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ABSTRACT

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. Little empirical research has evaluated where, when, and how improving material conditions in conflict zones enhances social and economic order. We address this lacuna, developing and testing a theory of insurgency. Following the informal literature and US military doctrine, we model insurgency as a three-way contest between rebels seeking political change through violence, a government seeking to minimize violence through some combination of service provision and hard counterinsurgency, and civilians deciding whether to share information about insurgents with government forces. We test the model using new data from the Iraq war. We combine a geo-spatial indicator of violence against Coalition and Iraqi forces (SIGACTs), reconstruction spending, and community characteristics including measures of social cohesion, sectarian status, socio-economic grievances, and natural resource endowments. Our results support the theory's predictions: counterinsurgents are most generous with government services in locations where they expect violence; improved service provision has reduced insurgent violence since the summer of 2007; and the violence-reducing effect of service provision varies predictably across communities.

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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]

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, thereby 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 most conflicts is 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.[3] The consensus among scholars and practitioners for how to most effectively conduct such conflicts is reflected in the United States Army's irregular warfare doctrine (FM 3-24).[4] This doctrine places a heavy emphasis on influencing 'human factors', e.g. the population's tolerance for insurgent

[2] We thank Lindsay Heger for pointing this quote out to us.

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

[4] U.S. Army and Marine Corps jointly authored the "Counterinsurgency Field Manual," (Chicago: U. of Chicago Press, 2007). The same idea is expressed in the Department of Defense Irregular Warfare Joint Operating Concept (2007), which states "Irregular warfare depends not just on our military prowess, but also on our understanding of such social dynamics as tribal politics, social networks, religious influences, and cultural mores. People, not platforms of advanced technology, will be the key to IW success." (p. 1) See Fridovich and Krawchuk (2007) for an application of these ideas to insurgency in the southern Philippines.

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. We address this lacuna by developing a theory of insurgency as a three-way contest between rebels seeking political change through violence, a government seeking to minimize violence through some combination of service provision and hard counterinsurgency, and civilians deciding whether or not to share information on the insurgents with government forces. The model has testable implications; we test them on a new dataset covering Iraq that includes geo-spatial data on violence against US forces and civilians, reconstruction spending, and community characteristics, including measures of social cohesion, sectarian status, and natural resource endowments.

From March 2003 through December 2007, the United States government spent at least $29 billion on various reconstruction programs in Iraq (CRS 2008). This money has had little obvious impact; the correlation between reconstruction spending and violence varies dramatically over time and space, and is often positive. Given the huge investments made in Iraq and the great variance in outcomes, data from the Iraqi civil war can provide evidence on the relationship between reconstruction and social order. Problems of graft render the data on large-scale reconstruction projects deeply suspect (SIGIR 2006a, 2006b, 2007a, 2007b, 2008), so we focus on the $2.6 billion in American reconstruction funds allocated through the Commander's Emergency Response Program (CERP).

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. 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 can test our theory and help answer deep, 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 about the links between governance, service provision, and insurgency. In Section 2 we develop a model of insurgency that focuses on how the population's willingness to share information determines the success or

failure of counterinsurgent actions. Section 3 introduces new data on the provision of government services and conflict in Iraq. In Section 4 we test the theory. First we predict where Coalition forces concentrate spending. We then answer a practical question with clear theoretical implications: when and where have Coalition efforts to provide public goods reduced the level of insurgent violence. Section 5 concludes, discussing future research and offering policy implications.

1 Literature

The primary objective of any counterinsurgent is to foster the development of effective governance by a legitimate government.

FM 3-24 Counterinsurgency Manual

In *conventional* warfare between states, military commanders strive to generate superior relative combat power at decisive points on the battlefield in an effort to achieve tangible and measurable objectives, such as seizing their adversary's territory or the attrition of its army in the field. [5] States struggling to combat internal threats in the largely *unconventional* environment of insurgency, however, must achieve relatively more complex and nuanced objectives. According to the prevailing theories in the literature on insurgency and counterinsurgency, states must successfully compete with insurgents to gain the support of the population, and ultimately establish themselves as the legitimate authority --in the eyes of that population. The importance of popular support is echoed by classic 20th century counterinsurgency theorists (Mao 1937, Trinquier 1961, Taber 1965, Kitson 1971, Clutterbuck 1966, Thompson 1966). David Galula , in his seminal text, declares as his first "law" that there is a symmetry: "the support of the population is as necessary for the counterinsurgency as it is for the insurgent." (Galula, 1966, p.74)

Twenty-first century scholarship by experienced practitioners of counterinsurgency acknowledges the enduring relevance of this imperative in the context of ongoing insurgencies in Iraq and Afghanistan (Sepp 2005, Nagl 2002, Petraeus 2006, Cassidy 2006, McMaster 2008). Indeed, scholars and practitioners alike have acknowledged that prescriptions for gaining and maintaining this critical popular support elude simple calculation and generalization and must include both attractive and coercive measures to

[5] This maxim was the thrust of the US Army's Air Land Battle Doctrine introduced in 1982 in an effort to counter the Warsaw Pact's superior numbers of conventional forces. See US Army (1993) which describes the Airland Battle doctrine. For a more tactical application of this doctrine see US Army (1984) Ch. 1-2 "Fundamentals of the Air Land Battle" and Ch. 1-3 "Combat Power."

succeed (Leites and Wolf 1970, Birtle 2008). Combating insurgency is frequently assessed in the literature as a multifaceted political-military challenge for states that requires dynamic integration and synchronization of nonviolent efforts and coercion.

Gaining popular support is critical—this is undisputed in the literature. But why? The most prevalent explanation is that parties to insurgent conflicts leverage the popular support they generate and the collaborative relationships cultivated in the near term to gain access to critical information and intelligence. Kalyvas (2006) demonstrates that this information is necessary to interdict and stymie the violence intended for them by their adversaries as well as to increase the effectiveness of their own operations.[6]

Prescriptions for gaining popular support, and the access to information and intelligence that flow from them, vary considerably. Three distinct literatures address this issue. The first is the political science oriented literature that directly studies civil war and insurgency. The second is the criminology literature that studies how communities and police forces interact to prevent, or fail to prevent, crime. A third literature studies the organizational aspects of producing violence and focuses on how internal group processes affect the extent to which groups leak information that could be shared with the government.

The political science of insurgency and civil war

Broadly speaking, the political scientists divide potential measures for gaining information into coercive and attractive measures, and then debate which approach is most efficacious. Gurr (1971) argues that perceived relative deprivation of the populace drives rebellion. Horowitz (1985) emphasizes that addressing ethnic, religious and other identity based grievances, and the economic marginalization and disenfranchisement that accompany them, is critical to reducing incentives for rebellion. Proponents of these theories believe that in as much as the government can address popularly held grievances, local beneficiaries of these efforts will reciprocate and reward it with their support.

The limitations of attractive measures, or "hearts and minds," approaches to gaining support of the population are also compellingly argued. Leites and

[6] The Commanding General of the US Army's 1st Armored Division, then Major General Martin Dempsey summed up this imperative succinctly in November 2003 acknowledging that, "Fundamentally, here in Baghdad we do two things: We're either fighting for intelligence or we are fighting based on that intelligence." Quote carried originally by Matt Kelly, "U.S. Intelligence Efforts Lacking in Specialists," *San DiegoUnion-Tribune*, 22 November 2003, p.1.

Wolf (1970) argue that "hearts and minds" prescriptions for addressing insurgency are often overrated. Using a cost–benefit approach to analyzing the propensity of individuals to support insurgency, they emphasize the importance for the counterinsurgent of reducing the supply of insurgency – not just the demand for it. Jeffrey Race (1972) shows that government-initiated aid disbursement intended to sway the population's hearts and minds is ineffective absent some hope for ultimate *redistribution* of wealth in a population that anticipates remaining marginalized under the current government. Fearon and Latin (2003) find that socio-economic as well as identity based grievances are ubiquitous, yet note that civil wars are not. They infer that the precursors and conditions that spawn insurgent violence are not grievances that can be addressed with economic assistance, but instead stem largely from weak state capacity and low competence of its police and security forces.

Underlying motives and conditions of the insurgent conflict locale may drive the expected effectiveness of economic aid and development assistance as a tool for gaining popular support to combat the insurgency. Thompson (1966) studies insurgencies in Malaya and Vietnam, and asserts that aspirations to material wellbeing will generally trump powerful nationalist or religious forces.[7] However, Biddle (2006) uses the Iraq case to argue that in communal civil wars- unlike the insurgent conflicts Thompson discusses- external efforts to provide aid and economic assistance to win hearts, minds, and cooperation from the local populace may be doomed from the start because they don't address core communal grievances regarding their own representation within government.[8]

For quasi-criminal rebels profiting from participation in the insurgency, the appeal of illegal appropriation over production can prevail over nearly any reasonable effort by the government to provide a more attractive alternative within the fold of the government (Collier and Hoeffler 2001, Sambanis 2002, Mueller 2003, Ross 2004). Insurgency is profitable for many rebels, and the appeal of economic assistance conditional on cooperation with the government

[7] According to Thompson, "However powerful nationalist or religious forces may be, that of material well being is as strong if not stronger, especially in peasant communities where the family tradition is venerated and the instinctive loyalties are to the advancement of closest relatives." See Robert Thompson,(1966) p. 65.

[8] Stephen Biddle,(2006) , distinguishes between the efficacy of hearts and minds efforts in a more traditional Maoist "peoples war" versus the communal civil war he assesses the conflict in Iraq to more closely resemble. Biddle admonishes that "Economic aid or reconstruction assistance cannot fix the problem: would Sunnis really get over their fear of Shiite domination if only the sewers were fixed and the electricity kept working?"

may be less profitable than opportunities outside the law. This may be the case for the FARC in Columbia, for example.

A comprehensive assessment of the literature on insurgency and irregular warfare suggests that coercive and constructive methods may be complementary, and that it is the *mix* of activities making up an effective counterinsurgency strategy that is critical. For instance, Mao Tse- Tung (1937) espouses the critical importance of cultivating a cooperative relationship with the local population- the sea in which rebels must swim- yet at the same time acknowledges that "political power grows out of the barrel of a gun." One reading of his view is that employing an effective and efficient combination of attractive -i.e. hearts and minds activities- and coercive policies e.g. those that raise the costs of aiding the insurgency is needed to garner support and cooperation. When this combination of initiatives is tailored to unique local conditions it can be greater than the sum of its parts. Lake (2008) critiques the literature on legitimacy, arguing that establishing security is necessary for legitimacy and should therefore be sequenced first.

Kalyvas (2006) provides a wealth of both anecdotal and empirical evidence that links popular support to control and shows that this is one of the most powerful predictors of the patterns of violence seen in insurgent conflict. Popular support for both the government and rebels can shift based on both attractive and coercive measures employed in a particular locale (Kalyvas 2006, Petersen 1991).[9] For example, in the wake of the US conflict in Vietnam, a 1970 National Security Council study concluded that "public support tends to follow rather than lead control. Most rural people have no strong commitment to either side, and they accept the governance of whichever side appears to be winning."[10] When the government can make even modest gains in the perceptions of effective governance at local levels the resulting increase in cooperation and information flow can lead to a reduction in support for the insurgency. This in turn leads to more cooperation and the expected reduction in insurgent violence.

[9] See Roger Petersen,(1991). Petersen uses evidence from the resistance movements in the Baltic states circa World War II. He develops a seven point scale measuring support for rebellion ranging from -3 to +3 and includes possible activities of individuals at each point on the scale. Based on Petersen's logic, "winning hearts and minds" can be fleeting and shift at the individual level.

[10] See Andrew Birtle (2008) citation of *Vietnam Special Studies Group*, 13 May 1970, "The Situation in the Countryside," 27, Historians files, Center for Military History.

The literature suggests that the division between coercive and attractive measures to combat insurgency, however, is misconceived. These are more accurately viewed as strategic complements- the more provision of security the greater the efficacy of benign activities becomes. Signaling both capacity and commitment to providing security and order is critical to increasing support from the population. Economic aid and service provision by government – even in discrete cases- can contribute to the popular perception that the state is capable of maintaining order and enforcing security and other conditions needed to protect the local populace.

Communities and Crime

Complementarity between high quality governance and the ability of the government to control violence suggests a parallel to the domestic "community policing" literature, especially as it relates to policing gangs. Gangs and rebel groups have three strong similarities. They both often enjoy community support, either because they provide services or because they represent an alternative to hostile policing or governance (Jankowski 1991, chapter 6). In a region with poor security, support for gangs or rebels might be due to a community preferring a strong, "stationary bandit" who has an interest in long term stability because he can tax it, to a weak sequence of "roving bandits," --to borrow the terms of Olsen (1991). Another similarity between rebels and gangs is that they are extremely vulnerable to leaks and defection, if their control over territory is weak enough that police or rival organizations can use that information to arrest, capture, or kill members. Thus it shouldn't be surprising to observe analogous initiation rites among criminal gangs and rebels, as members signal commitment (not to leak or defect) to the organization through acts of crime, violence or self-humiliation (Jankowski, Ch. 6, Berman 2009). Finally, both gangs and rebels work hard to maintain the support of communities, by protecting community members from violence, obeying rules about drug dealing to minors, sometimes providing welfare services to families or using violence to further the interests of community members (by threatening landlords, for example, in the case of gangs). Building on the sociological literature on crime, Akerlof and Yellen (1994) interpret gangs' efforts to maintain the support of communities as self-interested –they are attempting to prevent community members from sharing information with the police. That insight will be critical to the approach we take to modeling insurgency in this paper.

That same approach forms the basis for the "community policing" approach to crime prevention. The basic ideas are that strengthening alternatives to gang provision of services reduces the dependence of communities on gangs

for services; and that maintaining strong relationships between government (police) and community members, by being present (i.e., patrolling on foot), attentive, and protective of witnesses, helps provide a strong flow of information about gangs to police. "Studies have found that the critical ingredient in solving crimes is whether the public –victims and witnesses—provide information to the police that helps identify the suspect." (Bayley 1994, p. 7). (The "broken windows" strand of this argument maintains that fixing even small problems sends a message to communities that the government has both the will and the capacity to improve quality of life.[11]) Though community policing has strong proponents, they also admit that the empirical literature on the effectiveness of community policing is inconclusive (Bayley, 1994, p. 9; Bayley and Shearing, 1996, p. 595). It is mired in endogeneity and measurement problems.[12]

Organizational Form and Information Leakage

Should the government apply intelligence pressure effectively and provide local public goods, how would terrorist organizations respond? One answer is provided by the "club" model (Berman 2005; Berman and Iannaccone, 2006; Berman and Laitin, 2008), which argues that religious radicals who provide social services are relatively robust to conventional counterinsurgency pressure because they can select members who signal commitment, making them unlikely defectors. These strong clubs are free to choose high damage tactics. Less robust organizations would find these tactics too dangerous because they make members likely to defect or leak information. Nevertheless, even strong clubs must withdraw from tactics which share information with noncombatants.

Our reading of the insurgency literature suggests that strong clubs are not the only rebels or violent organization that the authorities have in mind. In weaker organizations intelligence pressure creates a tradeoff between control of operatives and efficiency, on the one hand, and potential leaks, on the other

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[11] Wilson and Kelling describe the community policing experience in Newark, New Jersey. They point to an example of how one broken window in a neighborhood left unattended signals nobody cares and thus breaking more windows "costs nothing" leading to widespread destructive behavior and vandalism See "Broken Windows," *Atlantic Monthly* March 1982.

[12] For instance, Sampson and Groves (1989) finds that tight knit communities with high levels of civic participation and intact families suffer less crime, but cannot determine whether some third factor drives that correlation. Zhao et al (2002), show that police forces with larger community policing budgets have lower crime rates, but the predisposition of police forces to community policing methods is not controlled for.

(Shapiro, 2007). For instance, intelligence pressure forces terrorist organizations to replace traditional forms of hierarchical control with a combination of under-funding and tight fiscal control (Shapiro and Siegel, 2007).

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.''[13]

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 the context of an insurgency such as that in Iraq where two conditions obtain. First, the population, or at least portions of it, knows what insurgents are doing. In 2006 a Shi'ite sheik in Tal Afar irately summarized the situation during 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.''[14] Second, counterinsurgents can apply direct and indirect fire anywhere in the country at any time of day or night. That makes the situation somewhat different from those 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

[13] FM 3-24, 1-23.
[14] Quoted in Packer (2006).

counterinsurgents.[15] After a short spike in June and July, violence in Anbar began a steady downward trend through December 2007.[16]

If we acknowledge that counterinsurgency is fundamentally about information, then we are still left with a critical unanswered question: 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.[17] Building on a model of criminal street gangs proposed by Nobel Prize winning economist George Akerlof and Janet Yellen (1994), our model generates a set of hypotheses about how the outcome of this interaction depends on measurable community characteristics, the technology of counterinsurgency, and the costs of insurgent violence.

It makes sense at the outset to distinguish this model from the "club" model, which one of us has written about previously (Berman 2005; Berman and Iannaccone, 2006; Berman and Laitin, 2008). The club model shares the testable implications of the model we develop here: good governance—specifically public good provision—reduces the ability of rebels to do violence; governments may also want to focus their benign and violent counterinsurgency activity where rebels are strongest. Yet the club model has other implications for rebel group structure not shared by all rebels: strong clubs provide their own 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 do not share information with nonmembers. Our reading of the insurgency and gang literatures suggests that we need a model for rebels who are not strong clubs. The distinction between these models has important implications for understanding insurgency and terrorism. In future work we will attempt to distinguish between the models, but this paper focuses on the common testable implications.

As in the "club" model, a rebel group, R, seeks to attack targets belonging to or protected by a government, G. The community, C, can compromise rebels

[15] The exact timing of this decision varies across different accounts.

[16] While information-sharing was sufficient for insurgent failure in Anbar, it is not always a necessary condition. The consensus reading of the history of Tal Afar in 2006 is that the insurgents were essentially defeated before intelligence began to flow. It was only after the 3rd Armored Cavalry Regiment (ACR) established security for the population and physical control over the area, that intelligence began to flow, making more precise combat operations possible (Packer 2006).

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

by sharing information with government. Attacks might include terrorism directed against civilians but more generally includes all types of insurgency and rebellion. The government seeks to limit or eliminate violence.

We do not explore the benefit of violent attacks to rebels. Presumably rebels aim to gain some political rents or concessions, but it would make no difference in what follows if the violence was carried out for ideological reasons, for profit, or even for its own sake. It is critical that violence, rather than just the threat of violence, occurs, since we will observe violence in data. Violence, of course, is inefficient in a Coasian sense; for it to occur there must be incomplete contracting ability between rebels and government (Fearon 2004; Powell 2006). We don't think of this as a restrictive assumption, since neither governments nor rebels are generally capable of credibly committing to bargains.

We assume that violence by rebels inevitably reveals tactically useful (to government forces) information to the community. Setting a roadside bomb, ambushing a patrol, or attacking some target require activities that are visible to noncombatants, who may choose to share that information with the government.[18] Following Popkin (1979) we assume that community members make a rational decision when deciding whether or not to share information, i , choosing $0 \leq i \leq 1$.

R, G and C are then players in a sequential game of complete and perfect information. Play proceeds as follows:

- G provides public goods and chooses a level of counterinsurgent effort.
- R chooses a level of violence.
- C decides how much information, i , to share with G.
- Either R or G gain effective control of the territory, with the probability of G winning control given by i.

Equilibrium

The subgame perfect equilibrium of the model is best analyzed by starting with the last mover, C. The community chooses i to maximize expected utility,

$$(1) \qquad EU_C(i,l,e,g,s,v,r,n) = u(l+eg)i + u(l+s)(1-i) - v(1-i) - ri - ni - m \ , \quad u'>0,\ u''<0.$$

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 $e \in$

[18] Clearly certain tactics, suicide bombings for example, reveal less information than others. Berman and Laitin (2008) explore the implications of this fact.

(0,1]. For instance, 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 $(1-i)$.[19]

A third source of public goods is $l \geq 0$, which captures the community's level of local public good provision. It does not depend on outside funding or assistance. It may be provided, for example, through 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 $u(.)$. That subutility function is concave, so that g and s weigh less heavily in C's decision to the extent that C can provide for itself.

Community members suffer from rebel violence, $v \geq 0$, which they will suffer if rebels win, with probability $(1-i)$. The violence is not necessarily directed against the community, but nonetheless endangers them. Community members also suffer from retaliation, $r \geq 0$, to the extent that they share information. Finally, community members may form norms, n, about sharing information with government, which are influenced by whether the government is likely to torture or harshly punish captured rebels.[20] We will initially assume $n \geq 0$, and return below to a discussion of changing norms. We will 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.*

Here $m \geq 0$ captures how much enforcement the government carries out in reducing rebel violence (counterterrorism and counterinsurgency, including apprehension, interdiction, incarceration, punishment, etc.). To the extent that this enforcement causes damage to community members it generates disutility.[21]

We call this a "rational peasant" model, in the tradition of Popkin's (1979) description of Vietnamese peasants; noncombatants make a decision about sharing information based on a rational calculation of self-interest, rather than

[19] One could also think of these assumptions in terms of each side conditioning public goods provision getting (withholding) information.
[20] The treatment of arrested gang members has a central role in Akerlof and Yellen's analysis.
[21] In ongoing research we explore a richer specification in which m causes damage only to the extent that information is poor, so that $-m(1-i)$ appears in equation (1).

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.[22]

[Insert Figure I about here.]

Figure I illustrates how the expected utility of community members changes with information revelation. Equation (1) implies that the utility of the representative community member is a monotonic function of i. The upper (green) line illustrates the case where that slope is positive, and all information is optimally shared with government. The lower (blue) 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. That determines what Akerloff and Yellen term the *noncooperation constraint*, a set of conditions under which the community is unwilling to share information with the government. Stated as the maximal acceptable level of violence, v, it is,

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

Rebels must 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

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

Government enforcement, m, harms rebels to the extent that the community shares information, i, allowing the government to target rebels. b_r and a_r are positive constants, reflecting the value of violence for rebels and their disutility from successful enforcement. Violence is limited by the violent capacity of rebels, $0 \le v \le v^{max}$, where v^{max} is an exogenous upper bound on violence reflecting the expertise, motivation and resources available to rebels. Assume for now that v^{max} is infinite—we will analyze the case of capacity-constrained rebels below.

[22] Retaliation by government is assumed away for simplicity, but could be added without changing our results substantively. Gates (2002) and Kalyvas (2006) present models in which government retaliation is key.

This setup implies two types of rebels, *constrained* and *unconstrained*. Consider the case of full information-sharing, i=1. We call the rebels *unconstrained* if $dU_R(v,m,i)/dv = b_r - a_r m > 0$, meaning U_r monotonically increases in v regardless of the community's actions; so rebels optimally choose $v^* = v^{max}$.

Alternatively, we label the rebels *constrained* when $b_r - a_r m \leq 0$ so that their utility does not increase in violence when communities share information, but increases in violence when communities do not. Constrained rebels' best response is to choose a level of violence, v^*, so that (2) just binds, if possible. Figure IIa illustrates the utility of constrained rebels as a function of violence. Importantly, rebel violence is a function of rebel characteristics (s, r, n), community capacity, l, and government choices of m and g.

[Insert Figure IIa 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

$$(4) \qquad v^* = \begin{cases} v^{\max} & \text{if } b_r - a_r m > 0 \\ \max(u(l+s) - u(l+eg) + r + n, 0) & \text{if } b_r - a_r m \leq 0 \end{cases}.^{23}$$

Before turning to the optimal behavior of government, Proposition 1 summarizes our results on the effects of benign counterinsurgency (by which we mean government spending, g, designed to reduce violence). The key intuition is that constrained rebels' best response is to limit violence to the highest level that sustains noncooperation with government (i=0).

Proposition 1 (Benign Counterinsurgency): If rebels are unconstrained, government spending on local public goods, g, has no effect on violence. If rebels are constrained, rebel violence decreases in g if a violent equilibrium exists.

[23] We have assumed away the technical possibility that constrained rebels would optimally choose a $v^* > v^{max}$. We will continue to make that assumption in what follows.

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

In other words, 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 can permit themselves more violence.

If v^* is positive but less than v^{max}, so that government provided local public goods reduce violence, the size of that reduction depends on the existing level of local services in the community, *l*,

$$(5) \qquad \frac{\partial^2 v^*}{\partial g \partial l} = -eu''(l+eg) > 0.$$

This yields an important policy implication: the weaker the community's ability to provide for itself, the greater the violence-reducing effect of government provided services, *g*. Intuitively, service-poor communities are more desperate for services (since U_c is concave in services). Figure IIb illustrates this point.

[Insert Figure IIb about here.]

We close the model by looking at the government's choices. The government is not a social welfare maximizer. It seeks to minimize violence by a cost-effective mix of counterinsurgent enforcement, *m*, and government services, *g*. This is not a normative criticism. We're making 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 be particularly appropriate for an ally or occupying power that is more concerned about the externalities of violence than it is about the welfare of residents.

The government chooses *m* and *g* to minimize a weighted average of violence and the costs of governing.

$$(6) \qquad C_G(v,m,g) = A_G(v) + B_G(m) + D_G(g).$$

Here $A_G()$, $B_G()$ and $D_G()$ 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. Call the government *active* if it chooses to monitor at all, $m>0$. (As we will see, the government may be passive in equilibrium when facing rebels with a low capacity for violence.)

When rebel capacity is infinite, the government's first consideration must be avoiding v^{max}, since infinite violence 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 $i=1$).[24] This rules out the case of rebels unconstrained by the possibility that the community will share information, in (4). The government's optimal level of enforcement, m^*, increases in the utility of rebels from violence and declines in rebel disutility from capture.

The government's problem then simplifies to choosing a level of services, g, to minimize C_G, subject to the rebel's choice violence dictated by the noncooperation constraint of the community:

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

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

Figure IIIa 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

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

Since government services and violence are both nonnegative, equilibrium service provision, g^*, is bounded between 0 and the value that implies zero violence (from (4)),[25] leading to the following proposition.

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

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

Proposition 2 (Interior Solution for government services and violence): The equilibrium is violent and government provides services when rebel capacity is unbounded; i.e., infinite v^{max} implies $g^*>0$, $v^*>0$.

Proof: Rebels optimally choose violence, $v^* = r + n + u(l+s) - u(l+eg)$ by (4). $D_G'(0)=0$ in equation (7) 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 thus predicts that when rebel capacity is unbounded government will be active, both in service provision and in monitoring.[26]

This solution illustrates the idea of "hearts and minds" in the sense that government spending on services limits the level of violence which 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 greater a g it will choose, and the less violence it will suffer.

Note the broad implication of this model: even disenfranchised noncombatants receive services. That theme is common to Popkin (1977), Akerlof and Yellen (1994), Kilkullen (2006), and U.S. Army (2007). It results from the optimal behavior of a government trying to motivate information sharing, even in the extreme case modeled here, in which government is indifferent to the welfare of noncombatants and seeks only to suppress rebel violence. 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. [27]

[26] 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.

[27] Regarding the nature of governments, a straightforward extension would be to allow the government to extort noncombatants into sharing information by adding an extortion variable to (1) which multiplies i, like r, but with opposite sign. It would behave like g in the analysis, though it may induce stronger norms of noncooperation, n.

Benign Counterinsurgency and Violence

Turning to the question of benign counterinsurgency, our simple model yields a rich set of predictions about how violence and government services are related when both are chosen optimally. The first insight we've seen already; once v^{max} has been avoided, Proposition 1 predicts that g is violence-reducing when the optimal level of violence is non-zero, which it will be by Proposition 2.

A second insight is that, once once v^{max} has been avoided, 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, in each of which the government chooses an optimal active solution, government spending on local public goods, g^*, will increase with violence, v^*.

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

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

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.

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 which can be calculated using the implicit function theorem as

$$(10) \qquad \frac{dg^*}{d(r+n)} = \frac{eu'A_G''}{-e^2u''A_G' + [eu']^2 A_G'' + D_G''} > 0 .^{28}$$

[28] Substitute for v^* in (9) and apply the IFT.

This comparative static is illustrated in Figure IIIa 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 will invite more government spending; that increased spending will dampen, but not completely negate the increase in violence,

$$(11) \qquad 1 > \frac{dv^*}{d(r+n)} = \frac{-e^2u''A_G' + D_g''}{-e^2u''A_G' + [eu']^2 A_G'' + D''} > 0 \,.^{29}$$

Increases in rebel strength will thus create positively correlated increases in 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 predicted by Proposition 1, the strength of the rebels and other rebel and community characteristics must be held constant. We will estimate both the full and partial derivates below.

Limited Capacity Rebels and Counterinsurgent Effort

The previous section analyzed why local public goods provision and traditional coercive counterinsurgency are complementary tools in counterinsurgency. Yet some governments employ neither, remaining passive even in the face of moderately capable rebels.[30] The sequencing of monitoring and service provision is also subject to some debate (Lake 2008). Examining those questions will shed some light on the relationship between rebel entrenchment and the cost-effectiveness of counterinsurgent activity.

Until now we have assumed that rebels have infinite capacity. Consider instead rebels who have so little capacity for violence that repressing them might not be worth the cost of counterinsurgent activity. Relaxing the assumption of infinite capacity for violence, rebels have some capacity, $v^{max} > 0$. In this setting, the government has a meaningful choice to make about the level of enforcement.

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[29] Along the surface described by cost-minimization (8) we have $\frac{dv^*}{d(r+n)} = \frac{dv^*}{d(g^*)} \times \frac{dg^*}{d(r+n)}$.

[30] The logic for this pattern in our model is distinct from that in Felter (2005) which argues that the lure of outside military aid creates incentives for governments to underprovide counterinsurgency, effectively tolerating insurgent violence in order to gain valuable security assistance.

Proposition 4: The cost-minimizing choice of monitoring is either *active* ($m^* = b_r / a_r$, $g^* > 0$), or *passive* ($m^* = 0$, $g^* = 0$).

Proof: Any choice of m' in the range $(0 , b_r / a_r)$ will not reduce violence, since when i=1, $\frac{\partial U_R}{\partial v} = b_r - a_r m'i > 0$ if $m' < b_r / a_r$ from (3), and when i=0 monitoring is irrelevant; yet costs are monotonically increasing for $0 < m' < b_r / a_r$. If $m^* = b_r / a_r$, then $g^* > 0$ by Proposition 2. If $m = 0$ all rebels are unconstrained and by Proposition 1 providing g does not reduce violence, though it imposes costs on government; so $m^* = 0$ implies g^*=0.

Since there are only two options, the government's best response reduces to choosing the minimum of C_G between the passive and active local minima:

$$C_G(v^{max},0,0) = A_G(v^{max}) \qquad \text{or} \qquad C_G(v,m,g) = A_G(v^*) + B_G(b_r/a_r) + D_G(g^*).$$

Figure IIIb illustrates limited rebel capacity resulting in passive response. Consider first the case of high capacity rebels where the cost $A_g(v^{max})$ at point F exceeds $C_G(v^*,m^*,g^*)$ at point E. Here the *active* approach is cost-minimizing. If rebels have less violent capacity, so that the cost $A_G(v^{max})$ at point G is less than $C_G(v^*,m^*,g^*)$ at point E, then the *passive* approach is cost minimizing, and government optimally chooses m=g=0. Proposition 5 summarizes this result.

Proposition 5 (Threshold rebel capacity): When violent rebel capacity exceeds a *threshold* $\bar{v}^{\max} = C_G^{-1}(.,0,0)$ of $C_G(v^*,m^*,g^*)$, governments optimally shift from passive to active approaches.

Proof: The proof is the argument in the text.

[Insert Figure IIIb about here.]

Figure IIIb also illustrates how threshold rebel capacity for violence is affected by rebel entrenchment. When rebels are weakly entrenched, at equilibrium E_W, violence reduction is less costly in government spending. For that reason a cost-minimizing government will switch to an active posture at a lower threshold of violent rebel capacity, $\bar{v}_W^{\max}$, when rebel entrenchment in the community is weak, regardless of whether weak entrenchment is due to low service provision, weak norms of noncooperation or weak ability to retaliate for information sharing. Perhaps paradoxically, this result suggests that we are more likely to see active counterinsurgency (enforcement and local public good provision) against weakly entrenched rebels. The intuition is that the low cost of violence reduction makes even low (violent) capacity rebels worth opposing.

This framework can help account for the U.S. government policy towards counterinsurgency in Iraq in 2003 and early 2004. During the initial post-invasion period there were few sources of funding for reconstruction or local public good provision and Coalition forces in many areas adopted a distinctly passive attitude towards the (then) low-level violence (Ricks 2005, Gordon and Trainor 2006). As attacks against Coalition forces increased through the summer and fall of 2003, Coalition forces adopted a more aggressive posture. In November 2003, fully seven months after the invasion, the U.S. government allocated significant resources to reconstruction in the form of the $20B Iraq Relief and Reconstruction Fund (IRRF) and the U.S. military followed in January 2004 with the allocation of $140M in funds for commanders to support small-scale reconstruction projects.

In the context of our model, this shift to increased provision of public goods and increased military activity in late-2003 amounts to a switch from a passive to an active posture. The model provides two possible explanations for that switch which match events on the ground: (1) the government became more sensitive to violence (an increase in $A_G'(v)$); or (2) U.S. officials revised upwards their assessment of rebel violent capacity (an increase in v^{max}). We will not attempt to distinguish between these explanations, but note that our model of insurgency has the useful property of being able to explain discrete changes in government strategy with continuous changes in parameters.[31]

In the longer run a government could, of course, 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, 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 be expected to pursue these longer term strategies, while roving rebels and short term occupying forces might not bother to prosecute retaliators or improve norms of cooperation.[32] Governments expecting to remain in power for longer may also monitor and improve local governance in an effort to "learn by doing" even when a passive posture is (statically) optimal, driving down their costs of monitoring and governance until an active posture is lower cost than a passive.

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[31] The Philippine government undertook a similar switch from passive to active counterinsurgency in late-2001. As with U.S. forces in Iraq, the change involved both increased military activity and increased service provision, as the model would predict.

[32] Another possible extension would endogenize s, allowing the relative efficiency of rebels and governments in taxation and provision of public goods to influence the level of violence.

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 illustrates the dramatic heterogeneity in monthly violence per capita since February 2004.

[Insert Figure IV about here.]

This section offers a first look at new dataset on the provision of government services and conflict in Iraq. It includes precise geo-located U.S. government data on violence against Coalition and Iraqi security forces, NGO-generated data on civilian deaths at the district/day level, 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.

Our key dependent variable is the intensity of insurgent activity measured as the rate of attacks per capita against Coalition and Iraqi government forces. The attack data is based on '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."[33] Unclassified data drawn from the MNF-I SIGACTS III Database were provided to the Empirical Studies of Conflict (ESOC) project.[34] These data provide the location, date, and time of attack incidents between February 2004 and July 2008. The unclassified data do not include any information pertaining to the Coalition Force units involved, Coalition Force casualties or battle damage incurred as a result of the reported incidents. Moreover, the data do not include successful coalition-initiated events such as raids where no one returned fire, or coalition-initiated indirect fire attacks not triggered by an initiating insurgent attacks.

The SIGACT data have notable 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,

[33] GAO (2007), DOD (2008). The information provided in the Unclassified SIGACT data are limited to the fact of and type of terrorist/ insurgent attacks (including improvised explosive devices [IEDs]) and the estimated date and location they occurred.
[34] ESOC is a joint project between the US Military Academy, Princeton University, and Stanford Unversity that is collecting micro-data on a wide range of conflicts including Iraq, Afghanistan, and the Philippines. COL Felter and Shapiro are co-PIs for ESOC.

DOD 2007).[35] Second, several potentially useful variables in the data, type of attack and target of attack for example, are inconsistently coded over time. Third, these data almost certainly suffer from significant measurement error, though we have not yet determined if the error is non-random.[36]

The key independent variable in the following analysis is spending by Coalition forces on small-scale reconstruction projects through programs intended to provide local public goods.[37] Data were compiled by ESOC from the U.S. Army Corps of Engineers Gulf Region Division's Iraq Reconstruction Management System (IRMS). These data are unclassified. They include the start date, end date, project description, funding source, and amount spent for 17,794 reconstruction projects awarded through December 2007. They include over $17 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, the IRMS data we use account for approximately $17 billion of the $27 billion in reconstruction funds not spent directly on the Iraqi military through the Iraqi Security Forces Fund (ISFF).[38]

To generate a measure of reconstruction spending directed towards providing local public goods, what we call local spending, we combined

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[35] To address this weakness we have also collected geo-located data on civilian casualties recorded in the Iraq Body Count database. In 2006 the bivariate correlation between SIGACTs and incidents of civilian killings is approximately .855 at the governorate/month level. The correlation is lower at the district/month level, .541, because many incidents of civilian killings in Baghdad governorate cannot be precisely located. As we would expect, the rate of undercounting at the governorate level is statistically significantly greater in mixed and Shi'ite governorates than in Sunni governorates. In mixed governorates this is likely due to the high rate of sectarian violence. In Shi'ite governorates the Coalition presence is less dense. Since our theory makes predictions about violence against government forces, not about sectarian violence, we believe the undercounting of overall violence poses no inferential problems for this paper.

[36] 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 responsibility 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).

[37] Data on non-US spending is available through the Iraq Donor Assistance Database (DAD). Unfortunately, our interviews and initial analysis suggest that data quality of the Iraq DAD is quite low for projects completed before mid-2007. One aid official who worked on improving the DAD estimated that it captured less than 20% of non-US projects through mid-2006.

[38] The discrepancy arises from the fact that GRD bears direct responsibility only for reconstruction funds spent through its Project and Contracting Office (PCO). Reporting on projects spent by other authorities, such as USAID, is less complete. Reporting in IRMS by other military authorities, such as Multi-National Command Iraq (MNC-I) appears to be quite complete.

spending on three programs: CERP; the Commanders Humanitarian Relief and Reconstruction Program (CHRRP); and the Overseas Humanitarian, Disaster and Civic Aid Appropriation (OHDACA). Taken together these sources accounted for approximately $1.5 billion in spending on 9,949 individual projects.[39] The vast majority of this spending occurred through CERP. For each project we allocated 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.[40] These totals were then aggregated to generate district/month reconstruction spending totals. We followed the same procedure to aggregate levels of unconditional reconstruction spending. Table I provides various summary statistics for reconstruction spending.

[Insert Table I about here.]

4 Have US efforts to provide public goods helped?

We begin with some basic questions. Does the provision of public goods reduce insurgent activity as measured by attacks recorded by Coalition and Iraqi security forces? Have the billions of dollars the United States has spent on reconstruction spending, some portion of which went to providing public goods, had any effect on violence?

At first glance the answer is `no'. Figure V shows the bivariate correlations over time between violence and contemporaneous monthly spending on small-scale reconstruction projects for each of the 104 districts in Iraq. Correlations are positive more often than negative. The results are almost identical if we substitute large-scale projects for local ones (not shown).

[Insert Figure V about here.]

Yet when we focus on reconstruction spending explicitly intended to provide local public goods, the kind of spending our model suggests should matter, then a different picture will emerge.

[39] 523 projects were dropped due to data discrepancies or missing data.

[40] Since we do not know the spending patterns for individual projects, an alternative would be to generate a model of run-rates to allocate funds over time. That model could be estimated on uncompleted projects captured in snapshots of IRMS taken at different dates. Each snapshot would capture different projects in varying states of completion, allowing us to estimate run rates conditional on various covariates. We have the data to implement this approach in the future.

Before estimating the effect on violence of spending on local public goods it is useful to first examine other predictors of violence in Iraq. Because any analysis of the correlates of violence that did not control for population would suffer from significant omitted variable bias, we organize our analysis around the smallest geographic unit for which accurate population estimates are available, the district (*qada*). Iraq has 104 districts in 18 governorates. We use the World Food Program's well-documented population estimates generated in 2004 and 2005 as part of its food security and vulnerability analysis (WFP 2004; WFP 2005).[41] The results that follow are not sensitive to the figure used and so we report those using the 2004 figures which best match the sample frame used for the ILCS survey.

Since violence clearly varies along ethno-sectarian lines, a simple way to start explaining violence is to classify districts. Table II describes the population distribution of districts. There are no systematic country-wide data on the ethno-sectarian mix of Iraq, so we classify districts by using governorate-level returns in the December 2005 election.[42] Where 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.[43] 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.[44]

[Insert Table II about here.]

[41] The 2004 WFP population estimates used Iraqi government birth and death rates to update figures from the 1997 census. The 2005 estimates were adjusted based on 2004 survey results. Due to massive conflict-driven population movements—between 12 and 23 percent of Iraqis have been displaced since March 2003—these estimates become increasingly inaccurate over time (Brookings 2007; UNHCR 2008). These movements almost certainly lead to attenuation bias in Table IV below, as people flee areas of high violence.

[42] District-level returns have not been released by the Iraqi government and we have been unable to obtain them. It was official state policy under the secularist Ba'ath regime to prevent collection of sectarian data. The United States military does have limited time-series data on the neighborhood-level ethnic and sectarian mix in Baghdad. These data were used in MNF-I Commander David Petraeus' March 2008 testimony to the United States Congress.

[43] Turnout was high in the December 2005 election across all governorates. Average turnout in the Sunni governorates was higher (77%) than in Shi'ite (71%) or Mixed (75%) governorates according to official election returns.

[44] Both official policy and individual incentives interfere with migration estimates. The Iraqi government and surrounding states have prevented collection of accurate data on internal and external refugee flows for political reasons. Refugees, especially those in Syria and Jordan, are loath to draw attention by providing detailed information to enumerators.

Table III describes our variables for the sample we use for estimation: 832 district/half-years observations (104 districts x 8 half-years from January 2004 through December 2007). Weighted by population, we record 19% of Iraqis voting for clearly Sunni parties, 18% voting for clearly Kurdish parties and 48% 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 tiny parties that received less than 1% of the vote share in all governorates (5%). "CERP" spending per resident per half-year (which includes other measures of local public good spending, as described above) averages $6.76. It varies widely across district/periods: in the second half of 2007, twenty-two districts had no CERP spending, mostly in Shia and Kurdish regions.

[Insert Table III about here.]

Rates of attacks against Coalition or Iraqi forces also vary widely across districts and over time, averaging .83 attacks per 1000 residents per district/half-year. Most of Iraq is quiet, with incidents concentrated in a small number of districts. 149 district-years have no reported incidents over the sample period, spanning 39 districts. This pattern is illustrated in Figure IV, which demonstrates variation across regions in violence. Only seven districts average more than five incidents per 1000 residents: Al Daur (10), Handaniya (9), Muqdadiya (6), Balad (11), Mahmoudiya (7), Mosul (10), and Tarmia (6). The Figure also shows that among districts experiencing heavy violence there is great variation over both time and serial correlation.

Our model links characteristics of regions to levels of violence. So what characteristics of districts actually predict violence? Figure VI breaks the trends in per capita violence down by sectarian mix, providing some strong intuition. Two factors stand out. First, as is well known, 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 is largely driven by a fundamental change in violent trends in Sunni areas, which predates any national-level change in Coalition strategy or operational patterns.[45] Overall, Figure VI suggests that time and ethnicity should explain much of the violence.

[Insert Figure VI about here.]

[45] There is some evidence that Coalition units in Anbar governorate anticipated many of the operational changes—dispersal of forces, more frequent dismounted patrols, emphasis on political engagement with local leaders, and the like—which MNF-I implemented nationwide in early-2007.

Table IV reports a first econometric investigation. The most important district characteristic in predicting violence is Sunni vote share, which by itself accounts for 17% of the cross-sectional variation, as reported in column (1). A district that voted entirely Sunni is predicted to have 3.3 more incidents per 1000 than a district with no Sunni votes, which is predicted to have only 0.22 incidents, a ratio of 15. 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.

[Insert Table IV about here.]

Year effects are also significant, reflecting the well-known escalation in the conflict. Violence increased by .25 incidents/1000 in 2005 over 2004, and further by .87 and .99 incidents/1000 in 2006 and 2007 (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 .39 incidents per 1000.[46] Columns (4) and (5) report our attempts to find a parsimonious specification, which includes only year indicators, Sunni vote share and a Sunni vote share x trend interaction. Once a trend is included, the Sunni vote share x year indicators are only marginally jointly significant (p=.09), so we prefer the shorter specification in column (5). Finally, we check to see if the proportion Shia predicts violence once the proportion Sunni and the trend are accounted for. It does not; Shia vote share has an insignificant coefficient in column (6).[47]

The literature on civil wars suggests that competition for natural resource endowments and economic weakness are significant predictors of violence at the national level (Collier and Hoeffler 2004, Fearon and Laitin 2003). At the local

[46] This increase in 2007 likely reflects increasing efforts by Coalition forces to reduce sectarian violence over the course of 2007.

[47] 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--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 re-estimated this specification and those that follow using standard errors clustered at the governorate level to allow for cross-district spatial correlation within governorates. All core results that follow are robust to using those alternative standard errors.

level though, it is unclear how these factors should affect violence.[48] 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.

[Insert Table V about here.]

Table V reports the results of our efforts to assess the influence of natural resources endowments and economic grievances on violence in Iraq. Here we have added natural resource and economic grievance measures to the parsimonious specification from column (5) of Table IV. We measure natural resources two ways; price-weighted oil reserves accessible from district; and the price weighted volume of oil pipelines passing through district.[49] 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 as the average income change within a district, both in levels and in average movement between income quintiles. As the Table shows, none of these variables are individually significant predictors of violence and when compared to the baseline model in column (1), none make a substantial contribution to model fit.

The government in our model chooses public goods provision, g^*, based on rebel strength ($s+r+n$). In the Iraqi context rebel strength is predictable using not only the proportion Sunni, but also the district's history of violence against Coalition and Iraqi forces. Table VI reports the value of lagged incidents in the previous half-year for predicting current incidents. The first column of results demonstrates that lagged incidents are an excellent predictor, accounting for 78% of the variance in incidents by themselves. The coefficient on lagged incidents is statistically one, indicating that the best predictor of the number of incidents this period is the same as that last period. As in the previous table, the proportion Sunni predicts more incidents, and year effects and interactions provide extra predictive power. All these additions together increase predictive power by only three percentage points over that provided by the recent history of incidents in the district; it is the single most important predictor available.

[Insert Table VI about here.]

[48] Research into the reasons they predict violence at the national level leaves few reasons to expect subnational variation in resources and economic strength to correlate strongly with insurgent violence. For relevant research see Fearon (2005) and Dunning (2005).

[49] Sunni vote share is not correlated with oil reserves and is very weakly correlated with pipeline volume (ρ=.0663, p=.0569).

One testable implication of our model is that optimal government (in this case the U.S. government) spending on local public services increases with rebel strength. We can test that conjecture by seeing if variables that predict violent incidents also predict CERP spending (i.e., spending on local public goods). Table VII 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 $9.72 in CERP spending per resident per half year, almost twice the average in other areas. That difference is statistically significant. Year indicators show increases in spending over time (column 2), by $5.46 per capita in 2005 over 2004, and then $6.90 and $11.17 in the next two years (over 2004 levels). These spending increases are particularly accelerated in Sunni areas (column 3). The only major difference between these results and the predictors of violence in Table IV is that voting for Shia parties predicts violence, which might have to do with the Shia-dominated government rewarding governorates that strongly support it. Overall, this is consistent with the idea that CERP spending is aimed at districts where the potential for violence is high. It also tracks increases in violence over time and becoming increasingly concentrated in Sunni areas.

[Insert Table VII About here.]

Consistent with the results in Table VII, the strongest predictor of CERP spending is lagged violent incidents, which is highly significant and increases the predictive power of the model to 31% (column (5)). Each incident /1000 predicts an additional $2.89 in CERP spending in the subsequent half year (controlling for vote shares, year effects and trends). For instance, in the second half of 2007 thirteen districts had no violent incidents recorded, of which eleven received no CERP spending. CERP spending increasing with predicted violence should not be surprising, in the sense that 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.

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

We turn now to testing the main implication of the model, that conditional on rebel strength, CERP spending should reduce violence. Our empirical challenge is to find a way to carry out the conditioning. Table VIII reports the results of analyzing the effect of CERP spending on incidents by estimating equation

$$(8) \qquad v_{i,t} = \alpha v_{i,t-1} + \beta g_{i,t} + \mathbf{g}\mathbf{z}_{i,t} + \varepsilon_{i,t},$$

where $\mathbf{z}_{i,t}$ is the vector of control variables, including district characteristics that do not change over time, year indicators and interactions of these.

[Insert Table VIII About here.]

The first column of results reports the unconditional regression coefficient, which is positive. We interpret this as reflecting the endogenous relationship between spending on services and violence, which was reflected in Table VI. Since both variables are strongly serially correlated it shouldn't be surprising that high levels of CERP spending occur in district-periods with high levels of violence. The coefficient on CERP spending declines by about a quarter when we condition on the predictors of violence from Table III: proportion Sunni, proportion Shia, year indicators and their interactions. This is consistent with the idea that these other predictors somewhat reduce endogeneity bias in the CERP coefficient, which is positive. Column (3) reports the result of including the best predictor of violent incidents in the equation, lagged violent incidents. In that specification the coefficient on CERP is further reduced --to a statistical zero.

There are two factors to consider in interpreting this result. First, the combination of lagged violence and Sunni vote share provides an incomplete way to control for community capacity, thus our estimate of the negative partial derivative from proposition 1 is still confounded by the positive total derivative. Second, our estimate may still be subject to some positive bias, as officers allocating CERP may be better at predicting violence than our simple statistical model. At the very least, though, this specification reports the encouraging result that CERP spending did not seem to be *endangering* Coalition and Iraqi forces.

The right three columns of 8 repeat the same exercise for the most recent data available, the second half of 2007, during which the increase in troop strength (the "surge") and the associated operational changes implemented—increased dispersal of forces, more dismounted patrols, greater emphasis on engaging with local political leaders, and the like—were in full force. These operational changes were most dramatic in Baghdad where US combat forces moved from large bases outside the city in December 2006 to occupying over 60 "combat outposts" spread throughout the city in May 2007.[50] Replicated throughout the country, these kinds of changes provided officials allocating

[50] Coalition forces in Anbar governorate began following this operational model much earlier, in late-2005 in some areas.

CERP with better information about community needs and so amount to an improvement in the effectiveness of public goods provision, *e,* in our model.

Comparing the 2007 estimates to those for the entire four years of data, the correlation of CERP spending with violence is smaller in the later period across all specifications. The unconditional regression of incidents on CERP reveals a positive coefficient (0.036). As before, conditioning on sectarian proportions in the population reduces that coefficient slightly (to 0.025), which is consistent with an upward endogeneity bias.

What's more informative is that when we further treat endogeneity bias by conditioning on lagged violence, the coefficient on CERP spending becomes *negative*, at -0.0197 incidents per thousand (per dollar per capita). That negative estimate is consistent with the prediction of Proposition #1; conditional on district characteristics, government spending on public goods *reduces* violence. The estimated coefficient is still subject to bias due to endogeneity and measurement error in CERP, so that it likely underestimates the salutary effect of CERP spending on violence in the latter half of 2007. To quantify the estimate, it implies that, conditional on district characteristics, each additional dollar of per capita CERP of spending predicts 1.9 less violent incidents per 100,000 residents, both over the span of half a year. Compared to an estimated effect that is statistically zero for the entire period, we interpret this transition to a negative coefficient as reflecting the negative partial derivative of violence on CERP that our model predicts from an increase in government effectiveness at providing public goods once the surge methods were in place.

One possible alternative explanation for these results is that violence of all types dropped quickly in 2007 while reconstruction spending adjusted relatively slowly. The mean length of the CERP projects in our data is 108 days, while the mean length of all other projects is 359 days. If the negative coefficient on CERP in the second half of 2007 were being driven by the fact that CERP was lagging the reduction in violence, we would expect to estimate a similar or stronger negative regression coefficient for non-CERP projects. Another alternative explanation is that CERP spending proxies for coercive violence-reducing activity in a region, since the summer of 2007. If that were true, then non CERP projects would just as plausibly serve as proxies. Table IX reports a test of these alternative possibilities.

[Insert Table IX about here.]

Columns (1) and (2) of Table IX repeats the exercise in Table IV, predicting non-CERP spending as a function of lagged violence and district characteristics, both for the entire period and for the second half of 2007, respectively. Non-

CERP reconstruction spending is clearly directed at areas of higher violence. Column (3) reports the relationship of non-CERP reconstruction spending with violence, while column (4) conditions this relationship on lagged violence. Conditioning on lagged violence does reduce the coefficient by an order of magnitude, indicating endogeneity of reconstruction to violence. Yet, unlike with CERP spending, treating endogeneity by conditioning on lagged violence does not render the coefficient insignificant, suggesting that the positive correlation of non-CERP spending with violence may be driven by more than just endogenous resource allocation. Column (5) repeats the full specification for the second half of 2007. While the coefficient on non-CERP spending loses significance, it does not become negative, as the coefficient on CERP does in column (6). Since the longer time frame of non-CERP projects implies that the alternative explanation should produce a stronger effect on non-CERP spending than on CERP spending, this result provides confidence that the change in the effectiveness of CERP, *e* in our model, is driving the results in Table VIII. Similarly, the table provides supportive evidence that CERP is not merely proxying for unobserved coercive activity, *m*.

In interpreting our analysis it is important to keep in mind the measurement error inherent in the SIGACT data. Our conversations with former battalion and brigade staff officers suggest the proportion of true incidents recorded as SIGACTs drops as the intensity of violence rises. A battalion with elements in contact 40 times over a three-day period might report only 30 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.[51] We are exploring several approaches of assessing whether the rate of undercounting is constant or is proportional to the number of true incidents. For the time being all we can say is that as imperfect as these data are, they remain the best quantitative measure of insurgent actions against Coalition and Iraqi government forces.

Another potential source of bias in these data is that SIGACTs capture criminal violence correlated with CERP spending. In central Baghdad in 2006, for example, one battalion used CERP funds to pay for local garbage services, exactly the kind of visible, small-scale public good we argue should reduce violence. The garbage trucks were soon attacked, and these attacks were entered into the SIGACT data. After some investigation, the battalion commander learned that the attackers were not insurgents, but were directed by the owner of

[51] With a logged dependent variable we would retain unbiased coefficient estimates if the log of measurement error is uncorrelated with the log of the true rate of attacks. This occurs if the rate of undercounting is independent of the number of incidents. Unfortunately, the interpretation of the coefficient on the log of population weighted violence is ambiguous as $ln(x/y) = ln(x)-ln(y)$.

a competing garbage collection firm vying for a piece of the lucrative CERP contract![52] To the extent that the provision of CERP incentivizes this kind of 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.

Another way to explore the hypothesis that CERP spending reduces violence is to include in the analysis variables that measure the quality of local public service provision, *c,* in our model. Intuitively, the more a community requires local public services, the more leverage a government obtains from provision of those services. Thus CERP spending should reduce violence more in districts in which governance is relatively weak. Taking into account the model's prediction that service provision is directed at areas of higher violence, this argument implies that the positive estimated relationship between CERP and violence should be attenuated in communities with a poor ability to provide local public services themselves.

We have several measures of the quality of local governance available, which are included in the analysis in Tables X and XI. Four of these measures directly capture provision of public goods in 2004: the violent crime victimization rate, the extent of community coordination on garbage collection, satisfaction with the safety of children, and whether victims of crime would seek redress from community leaders as opposed to other order-providers such as the police, Coalition forces, or militias. Three measures capture service provision under the previous regime: an index of the physical distance to a variety of enduring public services such as hospitals; road quality; and street light quality in December 2002. The logic behind including these measures is that communities poorly served in the past would have developed greater endogenous organizational capacity. Finally, we created a measure of the amount of refuse (sewage, garbage, and the like) present in an area, which is a function of both prior and current service provision.

Our argument for differential effects of CERP across districts with better or worse governance predicts a negative estimated coefficient for the interactions of CERP with measures of public "bads" (e.g., crime) and a positive coefficient for interactions of CERP with factors that would correlate with community capacity to produce public goods (e.g., lack of services under the prior regime). Note that these coefficients on interaction terms with CERP-should suffer less

[52] Private communication, COL Jeffrey Peterson, September 17, 2008.

endogeneity bias than the coefficient on CERP itself, since they should be less correlated with the error term (commanders allocating CERP can influence CERP more than they can the product of CERP and some local characteristic.)

Table X reports results for two public service indicators measured in Spring 2004: victimization rates and an index of the proximity of residents to enduring components of public service infrastructure such as police stations, hospitals, schools, and the like. The former measure captures communities' abilities to provide collective security during a period when the Iraqi state provided no real police services. The logic behind the second measure is that the density of these services in Spring 2004 captures the extent to which an area received public goods from the government under the previous regime. Poor service provision from the government typically leads to strong endogenous capacity for public goods provision (as the Hamas in Gaza and the Hezbollah in Lebanon have demonstrated). The coefficients on both have the characteristic predicted: a significant negative coefficient on the interaction term. The results are robust to the inclusion of lagged incidents as an indicator of rebel strength.

[Insert Table X about here.]

These findings provide additional evidence for the model; they are consistent with its prediction that CERP is more effective in reducing violence in neighborhoods with poor endogenous service provision—as measured by relatively high crime victimization rates and good access to services under the prior regime.[53] Importantly, we would expect demand for government services increase in those conditions—poor service provision—that give rise to communities with strong endogenous capacity. These results using our proximity index thus provide good initial evidence that community capacity plays a critical role in determining where reconstruction assistance can best reduce violence.

For completeness, Table XI reports the results of the same exercise for other community governance measures. These include satisfaction with the safety of children, road quality, streetlight quality in 2002, use of shared generators, whether one seeks out the help of the community when a relative is victimized (as opposed to police, militia or Coalition forces), the presence of refuse (including garbage and sewage) outside one's home, and whether a community coordinates garbage disposal. For these variables none of the interactions with CERP yield statistically significant coefficient estimates, providing no evidence for or against the model.

[53] The victimization results are robust when we restrict the sample to the second half of 2007. The public-service distance results become slightly weaker but remain in the expected direction and lose significance only with the inclusion of lagged violence.

[Insert Table XI about here.]

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 VI, 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 amount 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 2 and 4 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 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 use of violence to the level the community will tolerate. The community shares information only if the benefits of doing so outweigh the costs.

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

A number of results stand out. First, the conflict in Iraq is concentrated in a very few areas. Second, there is great variation in the timing and patterns of violence within these areas. While overall violence in Sunni governorates began dropping precipitously in October 2006, for example, the decline in key areas such as Balad and Tikrit did not begin until mid-2007. Second, the dynamics of conflict are fundamentally different in Sunni areas, where the conflict looks like a quasi-nationalist insurgency, while in mixed areas a sectarian conflict appears to drive the process.

Our results support the model in that spending on public goods is unconditionally correlated with greater violence. This of course, makes sense from both military and theoretical points of view. From a military perspective, commanders invest more resources where their soldiers are being hit hardest. From a theoretical perspective, our model predicts higher investments in public goods in areas where local conditions mean 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 appeared in the second half of 2007, when operational changes meant that Coalition forces nation-wide had a better understanding of their communities' needs. In that period every dollar per capita of CERP spending predicted 1.9 less violent incidents per 100,000 population. While this is a relatively small coefficient, two points should be kept in mind. First, it is likely an underestimate of the effect of CERP because of biases in estimation that we cannot (yet) treat. Second, that estimate represents an average predictor across regions and programs; our evidence on interactions suggests that CERP invested in districts with weak provision of public services has a higher return in violence reduction. The increased efficacy of government spending when accompanied by a more effective military strategy is evidence for our "rational peasant" model of insurgency, as opposed to a model based on individual grievances.

These findings contain an important caution for policy makers: an observed positive relationship between service provision and violence does not imply that service provision makes things worse. They also contain 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, efforts to understand the effects of nonviolent measures on conflict outcomes need to explicitly take into

account a classic problem in evaluating the effects of social programs: the endogeneity of treatment. These findings are the first in an effort to address a central question in both development and counterinsurgency --how to effectively provide basic governance to the residents of conflict areas.

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Table I: U.S.-Funded Reconstruction Projects.

	Local Projects	Large-scale Projects	All Projects
Mean cost ($)	154,386	742,177	389,982
s.d.	429,589	1,492,641	1,042,189
Mean duration	108	359	209
s.d.	120	324	257
N	9949	6651	16600

Notes: Data are from the U.S. Army Corps of Engineers Gulf Region Division's Iraq Reconstruction Management System (IRMS) database as of March 18, 2008. 1,194 projects were dropped from the data due to suspect coding in original data source.

Table II: Districts of Iraq

Ethnic / Sectarian Group	*Number*	*Population Share*
Sunni	14	8.42
Shiite	41	37.97
Kurdish	28	14.76
Mixed	20	38.85
Total	104	100

Note: Population figures are from World Food Program estimates, 2004. Ethnic/Sectarian classification is based on December 2005 governorate-level voting patterns in the governorate. Iraq has 18 governorates, two are classified Sunni (Anbar and Salah a-Din), nine Shia, three Kurdish, and four mixed (Baghdad, Diyala, Nineweh and Tameem).

Table III: Summary Statistics – districts

Variable	Observations	Weight	Mean	Std. Dev	Min	Max
Sunni vote share	18	25,491,114	0.186374	0.250241	0	0.916902
Shia vote share	18	25,491,114	0.484104	0.359953	0	0.902458
Kurdish vote share	18	25,491,114	0.183503	0.354798	0	0.992923
CERP spending per capita ($)	832	204,210,504	6.764191	11.42522	0	257.5827
Incidents per 1000 local population	832	204,210,504	0.8366955	1.975318	0	24.1273
Lagged incidents per 1000	728	178,684,191	0.810178	1.975318	0	19.60329
Crime victimization	100	25,284,788	0.012109	0.011496	0	0.061429
Public garbage	100	25,284,788	0.330332	0.2912601	0	0.9800867
Safety of children	100	25,284,788	3.062221	0.5961633	1.890181	4.954642
Proximity to public services	100	25,284,788	0.1578246	0.0246207	0.0731748	0.2107173
Road Quality	100	25,284,788	3.495114	0.7867081	1.956163	4.889529
Streetlight quality in December 02	100	25,284,788	1.37003	0.2871928	1	2.777587
Jamiyya index	100	25,284,788	1.042094	0.034613	1	1.151264
Seek help from community	100	25,284,788	0.0802823	0.0749265	0	0.3994516
Share generator	100	25,284,788	0.2230826	0.224184	0	0.792798
Refuse	100	25,284,788	3.733103	0.4872958	2.190962	4.8

Note: Means are weighted by district population estimates from the World Food Program for 2004. Vote shares are from the December 2005 voting patterns at the governorate level. The unit of observation for CERP and incident data is the district/half-year.

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

Dependent variable: Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)
Sunni share	3.325	3.325	1.072	-0.695	0.342	0.577
	(0.52)***	(0.52)***	(0.2)***	(0.24)***	(0.3)	(0.34)*
2005		0.250	-0.0799	-0.0799	0.0271	0.0271
		(0.071)***	(0.046)*	(0.046)*	(0.065)	(0.065)
2006		0.872	0.123	0.123	0.427	0.427
		(0.2)***	(0.14)	(0.14	(0.17)**	(0.17)**
2007		0.990	0.388	0.388	0.323	0.323**
		(0.2)***	(0.15)**	(0.15)**	(0.15)**	(0.15)**
Sunni shr x 2005			1.767			
			(0.28)***			
Sunni shr x 2006			4.018	0.485		
			(0.83)***	(0.52)		
Sunni shr x 2007			3.226	-2.075		
			(0.77)***	(1.02)**		
Sunni shr x trend				1.767	1.193	1.193
				(0.28)***	(0.25)***	(0.25)***
Shia share						0.312
						(0.2)
Constant	0.217	-0.311	0.109	0.109	0.0226	-0.172
	(0.1)**	(0.084)***	(0.036)***	(0.036)***	(0.054)	(0.12)
Observations	832	832	832	832	832	832
R-squared	0.17	0.21	0.25	0.25	0.24	0.24
MSPE (10-fold CV)	5.997	5.805	5.649	5.649	5.647	5.649

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III.

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

Table V: Natural Resources, Economic Grievances, and Violent Incidents

Dependent variable: Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)
Sunni share	0.342	0.342	0.355	0.315	0.181	0.185
	(0.3)	(0.31)	(0.31)	(0.34)	(0.35)	(0.36)
2005	0.0271	0.0345	0.0383	0.0216	0.0216	0.0205
	(0.065)	(0.073)	(0.069)	(0.066)	(0.066)	(0.076)
2006	0.427	0.440	0.447	0.425	0.425	0.423
	(0.17)**	(0.18)**	(0.17)**	(0.17)**	(0.17)**	(0.19)**
2007	0.323	0.339	0.347	0.320	0.320	0.316
	(0.15)**	(0.18)*	(0.16)**	(0.15)**	(0.15)**	(0.18)*
Sunni shr x trend	1.193	1.192	1.199	1.223	1.223	1.228
	(0.25)***	(0.25)***	(0.25)***	(0.26)***	(0.26)***	(0.26)***
Accessible oil, price weighted		-0.000525				0.000781
		(0.0014)				(0.0019)
Pipeline volume, price weighted			-0.00418			-0.00373
			(0.0038)			(0.0041)
Inc. change, 02-04 / 1M Iraqi dinar				-0.294		
				(0.25)		
Inc. quint. change, 02-04					-0.45	-0.467
					(0.35)	(0.42)
Constant	0.0226	0.0386	0.0457	-0.0784	0.0574	0.0555
	(0.054)	(0.082)	(0.06)	(0.11)	(0.065)	(0.082)
Observations	832	832	832	800	800	800
R-squared	0.24	0.24	0.24	0.25	0.25	0.25

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III and in text.

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

Table VI: Serial Correlation in Violent Incidents

Incidents per 1000	*(1)*	*(2)*	*(3)*	*(4)*
Incidents/1000 Lagged ½ year	0.962 (0.041)***	0.986 (0.038)***	0.956 (0.044)***	0.987 (0.042)***
2005		-0.0922 (0.045)**	-0.0848 (0.045)*	0.0505 (0.077)
2006		0.270 (0.087)***	0.285 (0.090)***	0.555 (0.160)***
2007		-0.425 (0.110)***	-0.385 (0.100)***	0.0028 (0.100)
Shia vote share			0.00308 (0.056)	-0.0076 (0.053)
Sunni vote share			0.526 (0.150)***	2.496 (0.570)***
Sunni x trend				-0.766 (0.240)***
Constant	0.146 (0.040)***	0.198 (0.043)***	0.105 (0.054)*	-0.121 (0.076)
Observations	728	728	728	728
R-squared	0.78	0.80	0.80	0.81

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III.
*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table VII: Spending on Local Public Goods – ethnicity and lagged violence

CERP per capita	*(1)*	*(2)*	*(3)*	*(4)*
Sunni vote share	9.723	9.723	-3.324	0.313
	(2.57)***	(2.58)***	(5.57)	(7.67)
2005		5.464	4.313	3.797
		(0.83)***	(0.91)***	(0.90)***
2006		6.900	4.598	4.262
		(0.77)***	(1.38)***	(1.59)***
2007		11.17	7.712	5.928
		(2.12)***	(2.37)***	(2.29)**
Shia vote share			3.177	2.604
			(1.57)**	(1.58)
Sunni x trend			6.173	1.110
			(2.71)**	(3.40)
Incidents/1000				2.892
6 mo. lag				(0.53)***
Constant	4.951	-0.931	-1.186	-0.510
	(0.83)***	(0.55)*	(1.09)	(1.26)
Observations	832	832	832	728
R-squared	0.04	0.17	0.19	0.31

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III.

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

Table VIII: Violent Incidents and Spending on Local Public Goods

	------ *2004-2007* ------			--*2nd half of 2007* --		
Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)
CERP per capita	0.0750 (0.016)***	0.0556 (0.017)***	-0.00706 (0.0077)	0.0362 (0.011)***	0.0249 (0.013)*	-0.0197 (0.0091)**
2005		-0.228 (0.13)*	0.0773 (0.093)			
2006		0.197 (0.24)	0.585 (0.18)***			
2007		-0.0399 (0.20)	0.0447 (0.12)			
Sunni vote share		1.491 (0.73)**	2.498 (0.56)***		2.263 (1.04)**	-0.368 (0.57)
Shia vote share		0.136 (0.19)	0.0108 (0.066)		-0.205 (0.30)	-0.316 (0.18)*
Sunni x trend		0.631 (0.30)**	-0.758 (0.23)***			
Incidents/1000 6 mo. lag			1.007 (0.043)***			0.750 (0.13)***
Constant	0.348 (0.13)***	-0.145 (0.15)	-0.125 (0.075)	0.518 (0.14)***	0.354 (0.25)	0.336 (0.13)**
Observations	728	728	728	104	104	104
R-squared	0.18	0.32	0.81	0.09	0.15	0.76
MSPE (10-fold CV)	6.499	5.300	1.571	13.272	11.902	3.941

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III.

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

Table IX: Spending on Local vs. Large-Scale Public Goods

DV	*Non-CERP Reconstruction Spending*					*CERP*
	Non-CERP per Capita	*Non-CERP per Capita*	*Incidents per 1000*	*Incidents per 1000*	*Incidents per 1000 after 7/07*	*Incidents per 1000 after 7/07*
Model	(7.5)	(7.5)[1]	(8.2)	(8.3)	(8.6)[1]	(8.6)[1]
Non-CERP per capita			0.0235	0.00374	0.00284	
			(0.0048)**	(0.0016)**	(0.0054)	
CERP per capita						-0.0197
						(0.0091)**
2005	9.455		-0.236	0.0151		
	(2.82)***		(0.092)**	(0.074)		
2006	4.282		0.339	0.539		
	(3.63)		(0.20)*	(0.16)**		
2007	-5.709		0.411	0.0241		
	(4.27)		(0.19)**	(0.10)		
Sunni vote share	10.52	34.27	1.305	2.456	-0.944	-0.368
	(12.0)	(20.3)*	(0.58)**	(0.57)***	(0.79)	(0.57)
Shia vote share	8.043	7.150	0.0787	-0.0377	-0.502	-0.316
	(3.81)**	(4.39)	(0.19)	(0.049)	(0.22)**	(0.18)*
Sunni x trend	1.552		0.591	-0.772		
	(5.84)		(0.26)**	(0.24)***		
Incidents/1000 6 mo. lag	8.409	5.346		0.955	0.680	0.750
	(3.24)**	(2.15)**		(0.041)***	(0.14)***	(0.13)***
Constant	7.332	3.751	-0.344	-0.148	0.307	0.336
	(3.18)**	(2.98)	(0.16)**	(0.082)*	(0.15)**	(0.13)**
Observations	728	104	728	728	104	104
R-squared	0.26	0.35	0.37	0.81	0.74	0.76

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) Regressions are weighted by estimated population in 2004. Variables are described in notes to Table III. [1] results for second-half of 2007. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table X: Community governance quality, CERP, and Violence Reduction

Incidents per 1000	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Lagged incidents/1000	1.010	1.003		1.009	0.991	
	(0.044)***	(0.043)***		(0.044)***	(0.042)***	
CERP per Capita	-0.00734	0.0130	0.0803	-0.00735	0.0771	0.303
	(0.0078)	(0.0075)*	(0.023)	(0.0079)	(0.041)*	(0.074)***
Sunni vote Share	2.512	1.903	0.564	2.484	2.472	1.382
	(0.61)***	(0.30)***	(0.74)	(0.56)	(0.54)***	(0.64)**
Sunni share x Trend	-0.760	-0.527	0.930	-0.759	-0.732	0.649
	(0.24)***	(0.11)***	(0.41)**	(0.23)***	(0.22)***	(0.28)**
Victimization	-1.218	11.69	21.51			
	(3.39)	(4.24)***	(14.2)			
Victim x CERP		**-1.398**	**-1.744**			
		(0.26)***	(0.84)**			
Proximity to Pub. Services				-0.311	2.848	7.631
				(0.98)	(1.31)**	(3.69)**
Proximity x CERP					**-0.545**	**-1.615**
					(0.27)**	(0.46)***
Constant	0.0967	-0.0542	-0.317	0.136	-0.341	-1.209
	(0.060)	(0.048)	(0.16)*	(0.15)	(0.19)*	(0.60)**
Observations	700	700	700	700	700	700
R-squared	0.81	0.82	0.34	0.81	0.81	0.36
F-stat. for joint sig. test, local governance and interactions		14.81	2.22		2.46	6.50
Probability both have zero coefficients		0.0000	0.1144		0.0905	0.0022

Robust standard errors in parentheses, clustered by district. (Results are robust to clustering by governorate instead.) All specifications include a full set of year indicators. Regressions are weighted by estimated population in 2004.

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

Table XI: Community governance quality, CERP, and Violence Reduction

Incident per 1000 persons	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
CERP per capita	-0.0437	0.0583	0.148	0.0705	0.0531	0.0685	0.0437
	(0.072)	(0.070)	(0.12)	(0.022)***	(0.022)**	(0.13)	(0.027)
Children's safety	-0.320						
	(0.21)						
Safety x CERP	0.0319						
	(0.023)						
Road quality		0.0651					
		(0.15)					
Road quality x CERP		-0.000837					
		(0.018)					
Streetlights in 2002			0.266				
			(0.43)				
Streetlights x CERP			-0.0683				
			(0.084)				
Victims go to community				1.764			
				(1.04)*			
Community x CERP				-0.152			
				(0.16)			
Shared generator use					0.283		
					(0.69)		
Generator x CERP					0.00851		
					(0.079)		
Refuse index						0.456	
						(0.23)*	
Refuse x CERP						-0.00374	
						(0.033)	
Public garbage							-0.303
							(0.23)
Garbage x CERP							0.0450
							(0.060)
Sunni vote Share	1.382	1.381	1.330	1.110	1.315	1.209	1.320
	(0.75)*	(0.69)**	(0.76)*	(0.81)	(0.47)***	(0.59)**	(0.68)*
Sunni share x trend	0.662	0.651	0.681	0.784	0.623	0.673	0.659
	(0.32)**	(0.31)**	(0.32)**	(0.33)**	(0.26)**	(0.30)**	(0.30)**
Constant	0.932	-0.303	-0.427	-0.255	-0.114	-1.749	0.0153
	(0.70)	(0.46)	(0.55)	(0.13)*	(0.15)	(0.80)**	(0.14)
Observations	700	700	700	700	700	700	700
R-squared	0.33	0.32	0.33	0.33	0.32	0.33	0.32

Robust standard errors in parentheses, clustered by districts. (Results are robust to clustering by governorate instead.) All specifications include a full set of year indicators. All non-results on interaction of CERP and community variables in this Table are robust to the inclusion of lagged incidents. Regressions weighted by estimated population in 2004.

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

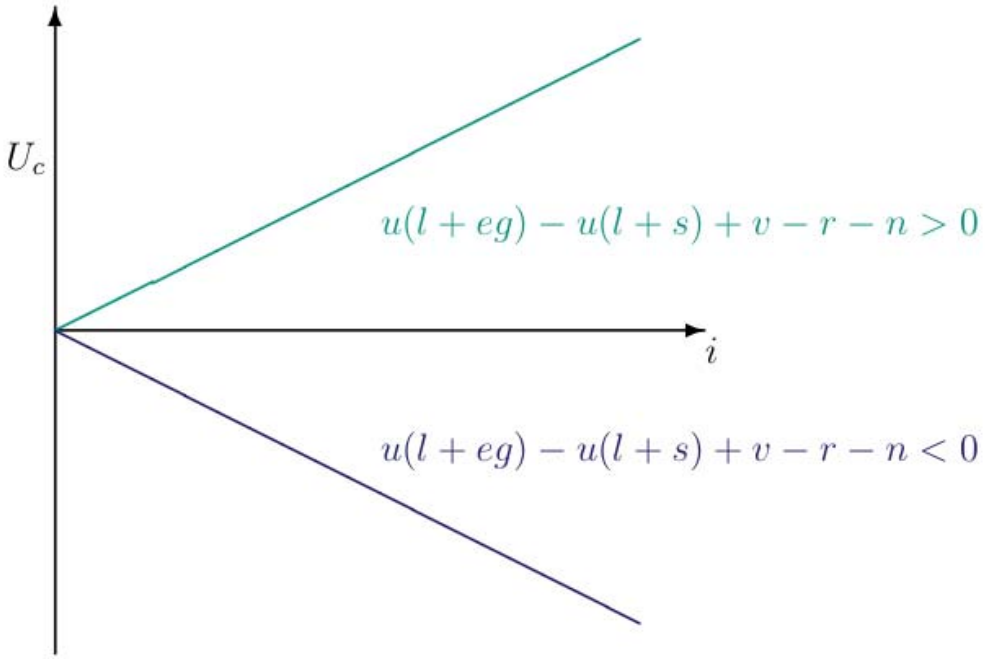


Figure IIa: The utility of rebels from violence

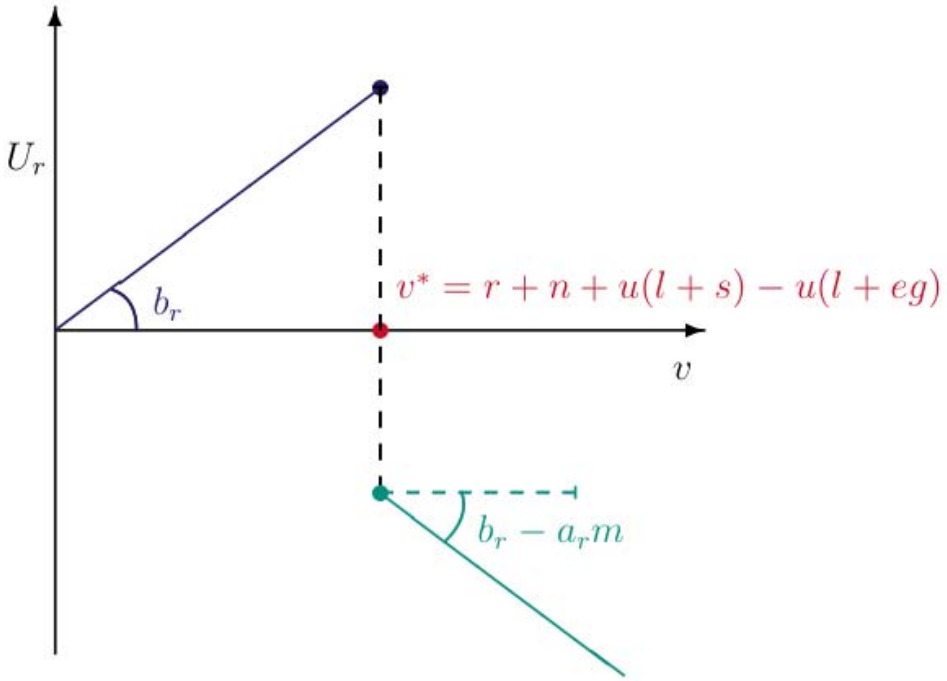


Figure IIb: Government services and violence by community capacity.

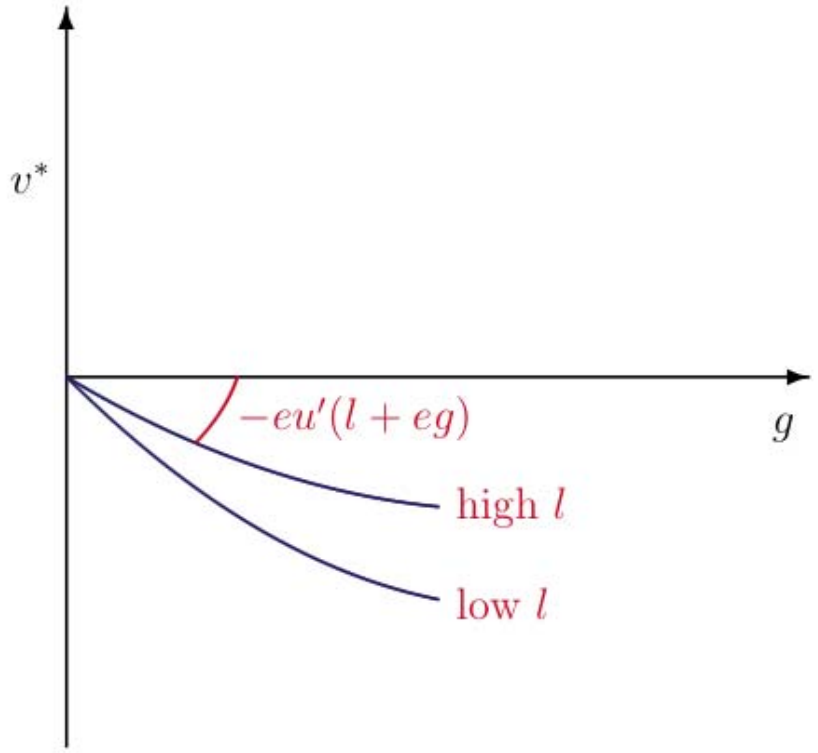


Figure IIIa: Government spending increases with rebel entrenchment.

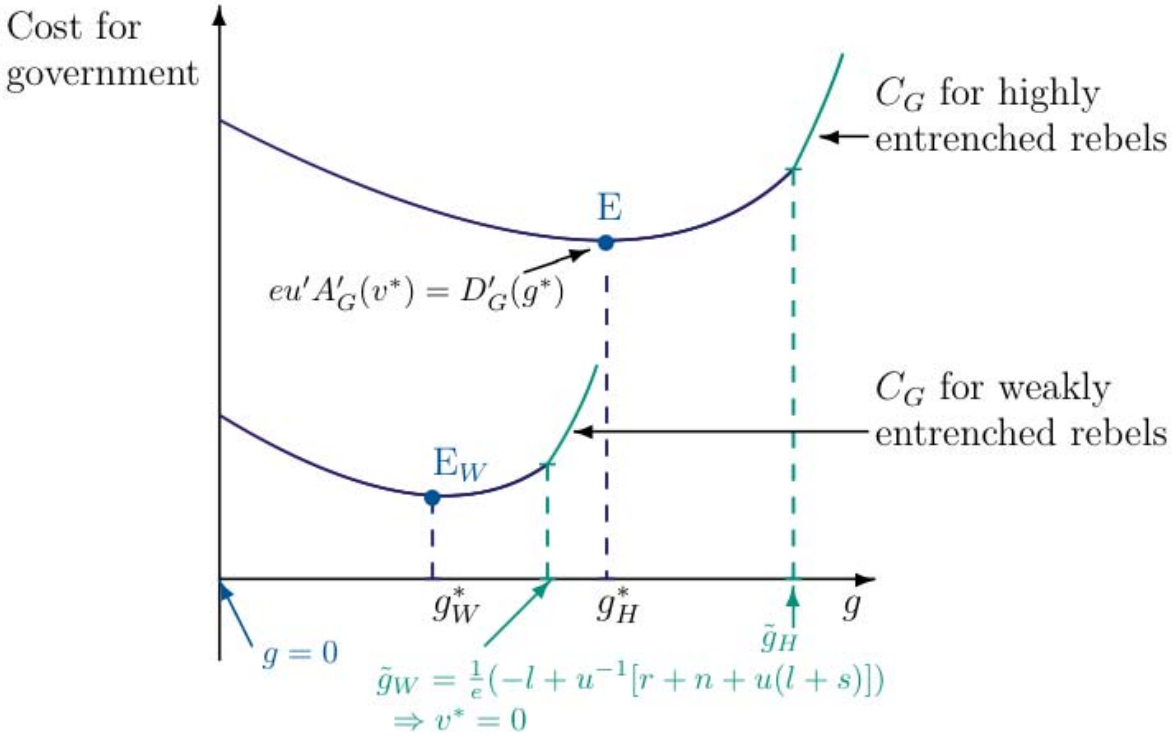


Figure IIIb: Low capacity rebels and passive government.

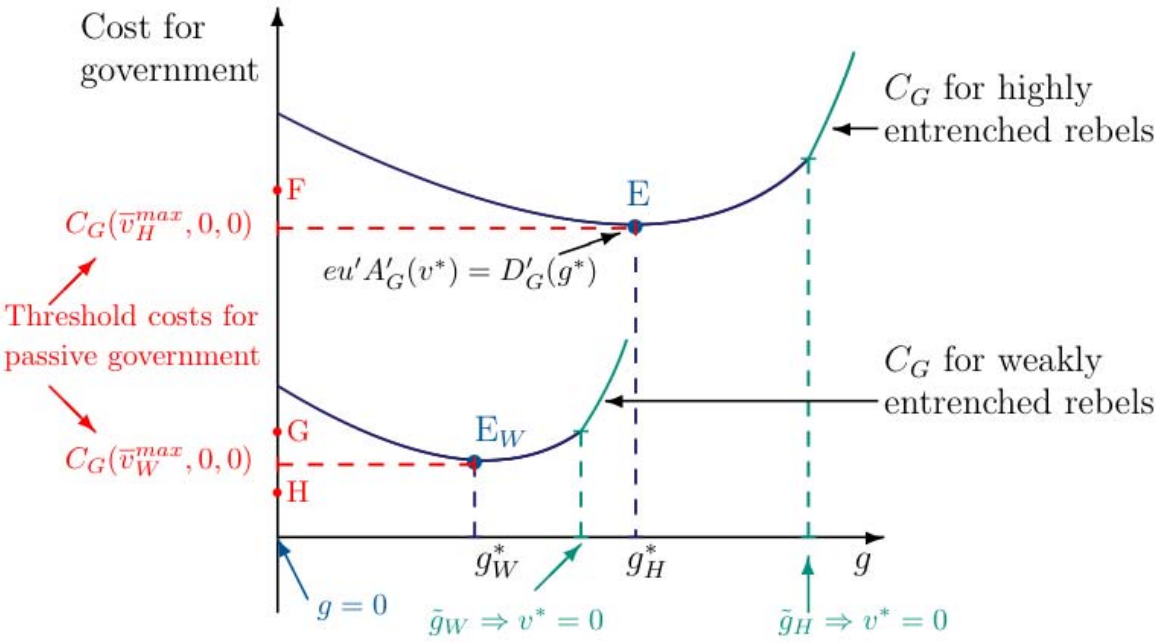


Figure IV.

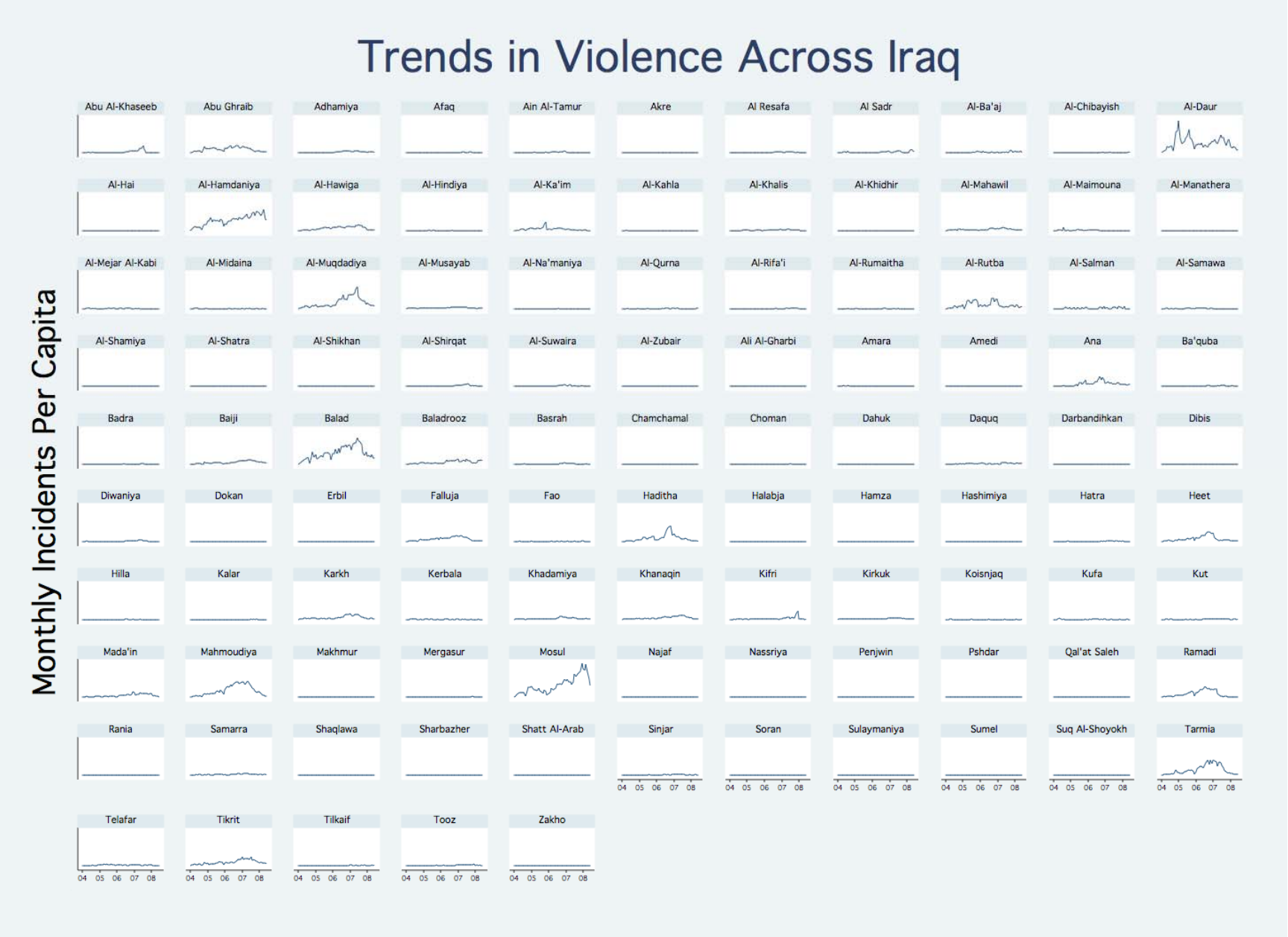

Trends in Violence Across Iraq
Monthly Incidents Per Capita
Abu Al-Khaseeb
Abu Ghraib
Adhamiya
Afaq
Ain Al-Tamur
Akre
Al Resafa
Al Sadr
Al-Ba'aj
Al-Chibayish
Al-Daur
Al-Hai
Al-Hamdaniya
Al-Hawiga
Al-Hindiya
Al-Ka'im
Al-Kahla
Al-Khalis
Al-Khidhir
Al-Mahawil
Al-Maimouna
Al-Manathera
Al-Mejar Al-Kabi
Al-Midaina
Al-Muqdadiya
Al-Musayab
Al-Na'maniya
Al-Qurna
Al-Rifa'i
Al-Rumaitha
Al-Rutba
Al-Salman
Al-Samawa
Al-Shamiya
Al-Shatra
Al-Shikhan
Al-Shirqat
Al-Suwaira
Al-Zubair
Ali Al-Gharbi
Amara
Amedi
Ana
Ba'quba
Badra
Baiji
Balad
Baladrooz
Basrah
Chamchamal
Choman
Dahuk
Daquq
Darbandihkan
Dibis
Diwaniya
Dokan
Erbil
Falluja
Fao
Haditha
Halabja
Hamza
Hashimiya
Hatra
Heet
Hilla
Kalar
Karkh
Kerbala
Khadamiya
Khanaqin
Kifri
Kirkuk
Koisnjaq
Kufa
Kut
Mada'in
Mahmoudiya
Makhmur
Mergasur
Mosul
Najaf
Nassriya
Penjwin
Pshdar
Qal'at Saleh
Ramadi
Rania
Samarra
Shaqlawa
Sharbazher
Shatt Al-Arab
Sinjar
Soran
Sulaymaniya
Sumel
Suq Al-Shoyokh
Tarmia
Telafar
Tikrit
Tilkaif
Tooz
Zakho
04 05 06 07 08

Figure V.

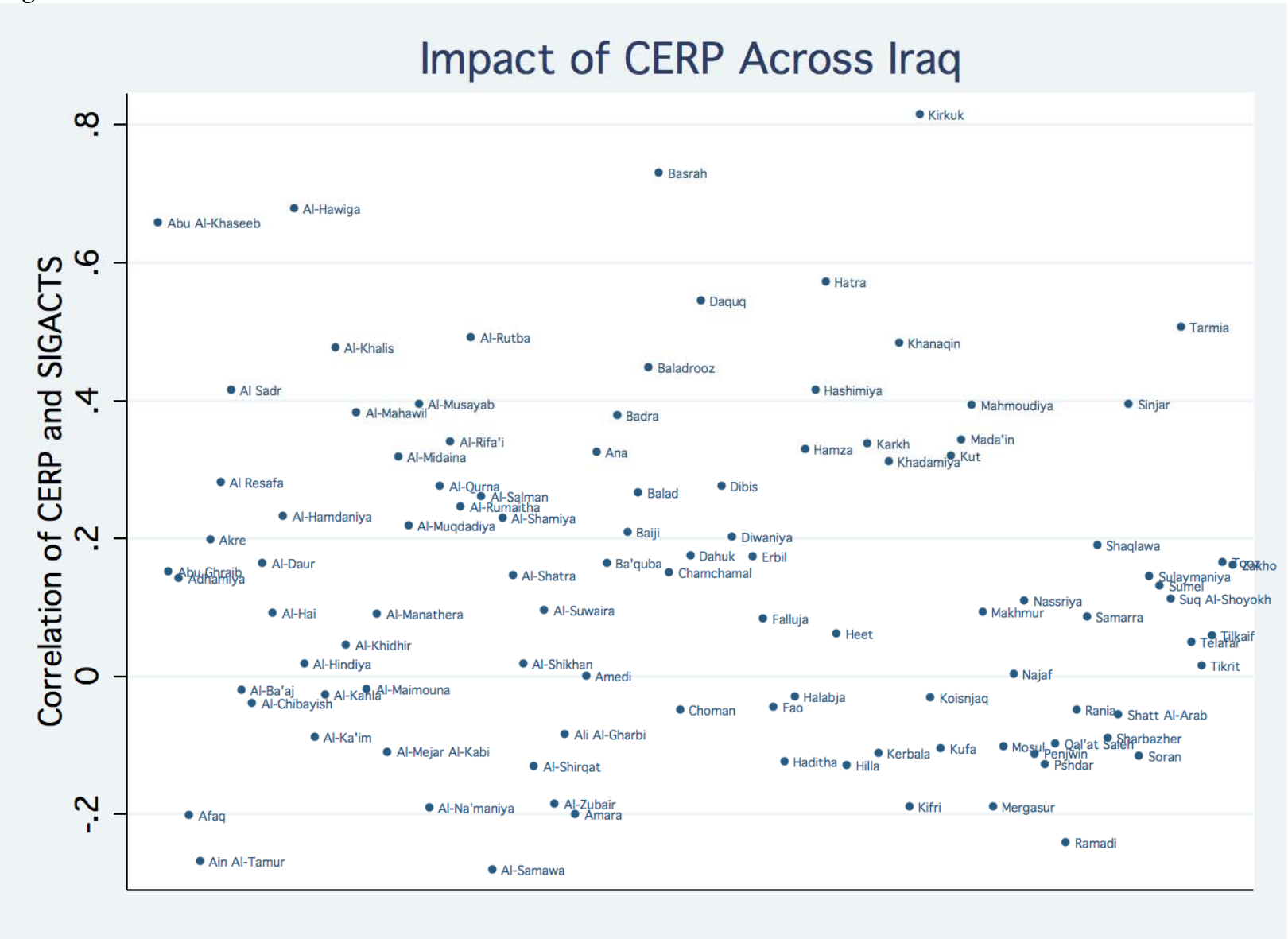
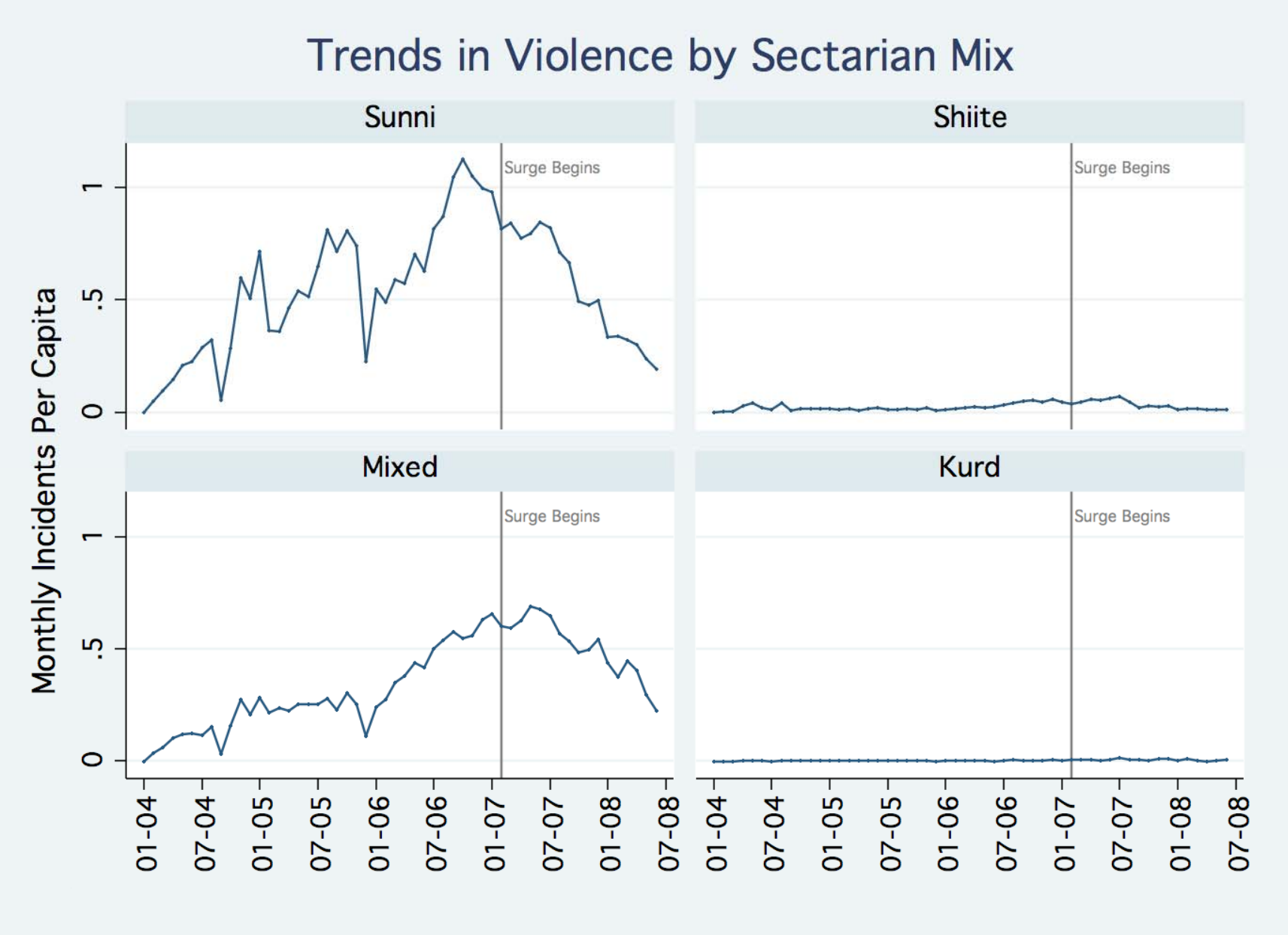

Impact of CERP Across Iraq
Correlation of CERP and SIGACTS
.8
.6
.4
.2
0
-.2
Kirkuk
Basrah
Al-Hawiga
Abu Al-Khaseeb
Hatra
Daquq
Tarmia
Al-Khalis
Al-Rutba
Khanaqin
Baladrooz
Al Sadr
Hashimiya
Mahmoudiya
Sinjar
Al-Musayab
Al-Mahawil
Badra
Al-Rifa'i
Hamza
Karkh
Mada'in
Al-Midaina
Ana
Khadamiya
Kut
Al Resafa
Al-Qurna
Balad
Dibis
Al-Salman
Al-Rumaitha
Al-Hamdaniya
Al-Shamiya
Al-Muqdadiya
Baiji
Diwaniya
Akre
Shaqlawa
Dahuk
Erbil
Ba'quba
Al-Daur
Chamchamal
Sulaymaniya
Sumel
Al-Shatra
Nassriya
Suq Al-Shoyokh
Al-Hai
Al-Manathera
Al-Suwaira
Falluja
Makhmur
Samarra
Heet
Tikrit
Al-Khidhir
Al-Hindiya
Al-Shikhan
Amedi
Najaf
Al-Ba'aj
Al-Kahla
Al-Maimouna
Halabja
Koisnjaq
Al-Chibayish
Choman
Fao
Rania
Shatt Al-Arab
Al-Ka'im
Ali Al-Gharbi
Sharbazher
Al-Mejar Al-Kabi
Kerbala
Kufa
Mosul
Qal'at Saleh
Peniwin
Soran
Haditha
Hilla
Pshdar
Al-Shirqat
Afaq
Al-Na'maniya
Al-Zubair
Amara
Kifri
Mergasur
Ramadi
Ain Al-Tamur
Al-Samawa

Figure VI.


Trends in Violence by Sectarian Mix
Sunni
Shiite
Mixed
Kurd
Surge Begins
Monthly Incidents Per Capita
0
.5
1
01-04
07-04
01-05
07-05
01-06
07-06
01-07
07-07
01-08
07-08