Can Hearts and Minds Be Bought?
The Economics of Counterinsurgency in Iraq

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Abstract

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. Yet little empirical research has evaluated these efforts to see where, when, and how improving material conditions in conflict zones can enhance social and economic order. We address this lacuna by developing and testing a theory of insurgency. Following our reading of 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 or not to share information about insurgents with government forces. We test the model using new data from the war in Iraq. 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 initial results support the theory's implications—improved government service provision reduces insurgency in recent data, and the value of service provision varies predictably across communities. We suggest policy-relevant directions for future research.

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Introduction

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—mean that future conflicts are less likely to involve conventional force-on-force conflicts than the various forms of insurgency and irregular warfare observed in Iraq, Afghanistan, and elsewhere.[2] The consensus among scholars and practitioners for how to most effectively solve such conflicts is reflected in the United States Army's irregular warfare doctrine (FM 3-24).[3] This doctrine places a heavy emphasis on influencing 'human factors', e.g. the population's tolerance for insurgent activities, by combining benign measures such as economic reconstruction with carefully targeted strikes against violent actors.

While this approach makes clear 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 tentative 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, which we confront with a new dataset covering Iraq, including 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.

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[2] 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.

[3] 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.

Since March 2003, the United States government has 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 have been made in Iraq and the great variance in outcomes, studies of the Iraqi civil war can provide evidence about the relationship between reconstruction and social order. Because problems of graft render the data on large-scale reconstruction projects deeply suspect (SIGIR 2006a, 2006b, 2007a, 2007b, 2008), we focus our analysis on the $2.6 billion in American reconstruction funds allocated through the Commander's Emergency Response Program (CERP).

CERP has two major advantages for this study. First, CERP funds are allocated in small amounts without the layers of sub-contractors that make the relationship between dollars spent and work done so 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 behind CERP is that such projects will help Coalition and Iraqi Security Forces better combat insurgent activity and thereby enhance social order. This focus means that assessing how the relationship between CERP spending and violence varies over time and space in Iraq can both test our theory and help answer deeply 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 I reviews existing arguments about the links between governance, service provision, and insurgency. Section II develops a model of insurgency that focuses tightly on how the population's willingness to share information determines the success or failure of counterinsurgent success. Section III introduces new data on the provision of government services and conflict in Iraq. Section IV presents our initial efforts to 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 V concludes by discussing future research and offering some initial policy implications.

1 Literature

COMING SOON.

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.''[4]

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 the one in Iraqi where two conditions obtain. First, the population, or at least portions of it, know 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.''[5] Second, counterinsurgents can apply direct and indirect fire anywhere in the country at any time of day or night. This means the situation is somewhat different from those in which counterinsurgents' capacity for violence is weaker (e.g. rural African insurgencies).

Taken together, the peculiar conditions of Iraq suggest that the silence of the population, or at least of a substantial portion thereof, is a necessary but not sufficient condition for insurgent success. Conversely, the willingness of the population to share information with counterinsurgents is a sufficient but not necessary condition 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 start sharing information with the counterinsurgents.[6] After a short spike in June and July, the level of violence in Anbar began a steady downward trend through December 2007. While information-sharing was a sufficient condition for insurgent failure in Anbar, it is not 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,

[4] FM 3-24, 1-23.
[5] Quoted in Packer (2006).
[6] The exact timing of this decision varies across different accounts.

that intelligence began to flow, making more precise combat operations possible (Packer 2006).

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? This section develops a model of counterinsurgency to answer that question. It takes as a starting point the notion that rebels rely on a community of noncombatants not to share information with government counterinsurgency forces. We've chosen a variant on a model of criminal street gangs proposed by Nobel Prize winning economist George Akerlof and Janet Yellen (1994), which emphasizes the same logic, though in a different context.

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're developing 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 which 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 strong clubs are not the only rebels or violent organization that the authorities have in mind. The distinction between the models has important implications for understanding insurgency and terrorism, including domestic 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, there is a rebel group, R, which seeks to do violence against targets belonging to a government, G. A third actor, in this case the community, can decide the issue by sharing information with government. Violence might include terrorism directed against civilians but more generally includes all types of insurgency and rebellion. The government seeks to limit or eliminate violence.

The exact benefit of the violence for rebels is not modeled. Presumably the 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. What is important is that violence, rather than just the threat of violence, occurs, since we will observe violence in the data. We note that violence is inefficient, in a Coasian sense; for it to occur there must be incomplete contracting ability between rebels and government (Fearon 2004; Powell 2006). 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 necessarily involve some activities that are visible to noncombatants, who may choose to share that information with the government.[7] Let $0 \leq i \leq 1$ be the amount of information shared with the government by a representative member of the community C.

R, G and C are then players in a three way game: R will choose a level of violence, G will provide public goods and choose a level of enforcement, and C will decide how much information to share with G about activities of combatants. The government will move first, followed by the rebels, and then the community members, with the first two anticipating the responses of the players following.

The model is best explained by starting with the last mover, C, who takes G and R moves as given and then backing up to decisions of R and G. Community members make a rational decision when deciding whether or not to share information, maximizing a utility function

$$(1) \qquad U_c(i,c,g,v,r,n) = u[c + gi + s(1-i)] - v(1-i) - ri - ni\ ,\ \ u'>0,\ u''<0.$$

Here $c \geq 0$ is the community's level of local public good provision, which depends neither on outside funding or outside assistance. It may be provided through informal networks. In contrast $g \geq 0$ is the level of government provided local public goods, such as public safety, education, health care, welfare services, water, electricity or garbage collection. Unlike c, these public goods are available to community members only to the extent that the government controls territory. We further assume that control is proportional to the amount of information government obtains, i, which makes public good provision and information complements. Symmetrically, the rebels can provide the same set of services, $s \geq 0$, and make them available to the extent that they control territory $(1-i)$.[8] Community members have diminishing returns to local public goods.

Community members suffer from rebel violence, $v \geq 0$, which is possible for rebels to carry out to the extent that information is not shared, $(1-i)$. 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.[9] 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.

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

[8] One could also think of these assumptions in terms of each side conditioning public goods provision getting (withholding) information.

[9] The treatment of arrested gang members has a central role in Akerlof and Yellen's analysis.

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 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. (Retaliation by government is assumed away for simplicity, but could be added without changing our results substantively.)

[Insert Figure 1 About Here.]

Figure 1 illustrates how the 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, with slope

$$u'[c+gi+s(1-i)](g-s) + v - r - n.$$

The upper (green) curve illustrates the case where the slope is positive, and all information is shared with government. The lower (blue) line shows the case where the slope is negative, and no information is shared.

To summarize,

$$(2) \qquad i = 0 \text{ if } su'[.] + r + n \geq gu'[.] + v \text{ and } i = 1 \text{ otherwise.}$$

(We assume that at zero slope the community sides with the rebels.) Following Akerlof and Yellen, we term this the *noncooperation constraint*.

Rebels maximize

$$(3) \qquad U_r(v,m,i) = b_r v - a_r miv$$

Where v is the level of violence they choose, m is enforcement effort by the government in attempting to reduce rebel violence (counterterrorism and counterinsurgency, including apprehension, interdiction, incarceration, punishment, etc.). Enforcement is more effective if more information is shared. b_r and a_r are positive constants, reflecting the value of violence for rebels and their disutility from successful enforcement. Rebels must weight the benefit of violence against the cost, taking into account the effect of violence on information shared by the community with government.

It's helpful to first analyze (3) separately for cooperative and noncooperative communities. Consider the community that cooperates with government. If $b_r - a_r m > 0$ when i=1, then R chooses infinite violence. In equilibrium we will see that the government will not allow this to happen, by choosing m appropriately (If not, G is overthrown and the model is irrelevant).

If $b_r - a_r m \leq 0$ when $i = 1$ then utility of rebels decreases in violence when communities cooperate but increases in violence when they do not (i=0). That case is illustrated in Figure 2. In that case, the rebels will choose v*, the optimal level of violence, so that the noncooperation constraint just binds, if possible. That is to say, if $v^* = u'[c+gi+s(1-i)](s-g) + r + n$ if $u'[c+gi+s(1-i)](s-g) + r + n \geq 0$, so that the slope in figure 1 can be made negative. If that optimal v^* is positive then no information is shared ($i = 0$), so the expression simplifies to $v^* = r + n + u'[c+s](s - g)$.

If not, $v^* = 0$, the noncooperation constraint does not hold and information is shared. Anticipating a full solution, that would be a peaceful equilibrium. That 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.

[Insert Figure 2 About Here.]

To summarize,

$$(4) \qquad v^* = \max(r + n + u'[c+s](s - g) , 0).$$

We will concentrate on the positive violence case where the rebels can induce noncooperation with government (i=0). Note that in that case (2) and (4) imply that the optimal level of violence chosen by rebels declines in g,

$$(5) \qquad \frac{\partial v^*}{\partial g} = -u'[c+s] < 0 \ .$$

We've written that as a partial derivative to emphasize that community characteristics c, s, r and n are held constant. Violence increases in the ability of rebels to retaliate, and in the norm of noncooperation. The effect of rebel provided services on violence is $u'[c+s] + u''[c+s](s-g)$, which is positive in the usual case where $g \geq s$ (the government provides more services than rebels) but could in principle be negative (if rebel provided services were so dominant that diminishing returns in utility to those service dominated the effect on utility of providing more services).

The ability of government to reduce violence through provision of services depends on the existing level of services in the community, c,

$$(6) \qquad \frac{\partial^2 v^*}{\partial g \partial c} = -u''[c+s] > 0 \ ,$$

still in the $v^* > 0$ case. 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 (i.e., u is concave). Figure 2a provides the graphic intuition for this result.

We turn now to the choices of the government. This government is not a social welfare maximizer. It seeks to minimize violence by a cost-effective mix of counterinsurgency, m, and government services, g. This is not a normative statement, but a description of a government whose first priority is repressing violence. It may be particularly appropriate for an ally or occupying power which is more concerned about the externalities of violence than it is about the welfare of residents. (We return to these issues below.)

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

$$(7) \qquad C_g(m,v,g) = A_g(m) + B_g(v) + D_g(g).$$

Here $A_g()$, $B_g()$ and $D_g()$ are all convex functions reflecting increasing marginal costs of monitoring, violence, and service provision. $A_g(0) = B_g(0) = D_g(0) = 0$, and $B_g'(0) = D_g'(0) = 0$ so that low levels of violence and service provision are not particularly expensive.

Anticipating the behavior of rebels and noncombatants, the optimum will have the property that $b_r - a_r m \leq 0$, since otherwise violence would be infinite, and so would the cost of governing, C_g. That yields a corner solution for counterinsurgency activity $m^* = b_r / a_r$. The optimal level of counterinsurgency, m^*, must increase in the utility of rebels from violence and decline in their disutility from capture. Note that convexity of B_g results in $A_g(m^*) < B_g(\infty)$, the cost of infinite violence exceeds the cost of suppressing it. Should the opposite be true, then the rebels would overrun the government.

Having guaranteed that $b_r - a_r m \leq 0$ (finite violence), the government minimizes C_g by choosing the level of government services, g, as illustrated in Figure 3, which plots C_g against government services, g. Since government services and violence are both nonnegative, equilibrium service provision, g^*, is bounded between 0 and the value that would lead to zero violence, which simply $s + (r + n)/u'(c+s)$, from (4).

Having chosen a level of monitoring already, the government's remaining task is to choose a level of services to minimize

$$(8) \qquad C_g(m,v,g) = A_g(b_r/a_r) + B_g(v^*) + D_g(g),$$

$$\text{subject to (4), } v^* = \max(r + n + u'[c+s](s - g) , 0) .$$

In deciding on a level of government services, the government faces a tradeoff between the value of g in reducing violence and the cost of g. The first derivative is

$$(9) \quad \frac{\partial C_g}{\partial g} = -u'[c+s]B_g'(v^*) + D_g'(g) .$$

Note that neither g=0 nor setting g so that v^*=0 can be an optimal choice for the government. At g=0 equation (9) indicates that the government's cost curve is downward sloping, so increased spending on g is cost-reducing. At v^*=0 G's cost curve is upwards sloping. The optimal g^* is thus an interior solution, one in which the government will provide some services and will suffer some violence.[10] That solution is illustrated by the point A in Figure 3.

That violent equilibrium is an interior solution, for which the government minimizes C_g, the blue curve, at point A. That optimal choice is achieved by trading off the cost of violence against the cost of governance at the margin, i.e., by setting $-u'[c+s]B_g'(v^*) = D_g'(g^*)$, at point A. Note that at A, the level of violence chosen by rebels is positive from (4) and (2), which is to say that rebels have chosen a feasible level of violence for which information sharing has a negative effect on the utility of the community. In the interior solution, the lower the marginal cost of providing g, $D_g'(g)$, the higher will be g^*, and the less violence will occur in equilibrium, as the noncooperation constraint will limit rebel use of violence. 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 B_g'), the greater a g it will choose, and the less violence will occur.

How are violence and government services related when both are chosen optimally? To answer that question we solve the first order condition, setting (9) to zero,

$$0 = \frac{\partial C_g}{\partial g} = -u'B_g'(v^*) + D_g'(g^*) .$$

Using the implicit function theorem,

$$\frac{dg^*}{dv^*} = \frac{u'B_g''}{D_g''} > 0 .$$

This result must be interpreted carefully. When other conditions leading to violence were held constant, we saw that an increase in government spending on services would reduce violence, in equation (4) above. Yet when violence increases for exogenous reasons, the government will optimally respond by increasing spending in order to reduce violence. That optimal response would generate a positive correlation between violence and government spending.

To illustrate that idea, 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 "rebel strength." Intuitively, an increase in rebel strength will allow the rebels to conduct more violence, since they have more leverage over the community, as in (4). Government will react with an increase in the optimal level

[10] 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.

of government services, which can be calculated using the implicit function theorem as

$$\frac{dg^*}{d(r+n)} = \frac{u'B''_g}{(u')^2 + D''_g} > 0 .$$

In equilibrium, the government action will dampen, but not completely negate the increase in violence implied by (4),[11]

$$1 > \frac{dv^*}{d(r+n)} = \frac{D''_g}{(u')^2 + D''_g} > 0 .$$

The point of the illustration is that increases in rebel strength will create positively correlated increases in government services and violence, as the government moves optimally to reduce violence. To summarize, in comparative statics across communities with different rebel strength, *corr*(*g*,*v*) may be positive. To estimate the negative partial derivative in (5), the strength of the rebels and other rebel and community characteristics must be held constant, which we will attempt in the estimation section that follows.

Looking at the broader implications of the model, notice that even disenfranchised noncombatants will receive services. That theme is common to Popkin (1977), Akerlof and Yellen (1994), Kilkullen (2006), and the U.S. Army (2007). It results from the optimal behavior of government trying to motivate information sharing, even in the extreme case modeled here, in which their governments is indifferent to the welfare of noncombatants and seeks only to suppress rebellion. Of course a government which includes the welfare of residents in its objectives will provide even more services.[12]

In the longer run a government could seek to reduce violence by reducing the strength of rebel organizations (*r*+*n*). It might 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,

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[11] Note that $\frac{dv^*}{d(r+n)} = \frac{\partial v^*}{\partial (r+n)_{g^* cons\tan t}} + \frac{\partial v^*}{\partial (g^*)_{(r+n)\, cons\tan t}} \frac{dg^*}{d(r+n)}$, and that the left partial derivative must be zero, since v* cannot change with g* constant in (9) if the first order condition holds. The second and third terms are solved above.

[12] 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 just like g in the analysis, though it may induce stronger norms of noncooperation, *n*.

while roving rebels and short term occupying forces would not be expected to bother with prosecuting retaliators or improving norms of cooperation.[13]

3 Data

One striking feature of the Iraqi conflict is the tremendous variation in levels of violence across the country's 104 districts. Figure 4 dramatically illustrates the heterogeneity in per capita monthly violence since February 2004.

[Insert Figure 4 About Here.]

This section offers a first look at new dataset on the provision of government services and conflict in Iraq. Our data combine 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 per capita attacks 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."[14] Data from the MNF-I SIGACTS III Database were stripped of classified information and passed to the Empirical Studies of Conflict (ESOC) project housed at the United States Military Academy.[15] These data provide the location, date, and time of attack incidents between February 2004 and December 2007. The 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 returns fire, coalition-initiated indirect fire attacks not driven by an initiating insurgent attacks, or IEDs and mines found and cleared.

[13] 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.

[14] 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 IED's) and the estimated date and location they occurred. The complete SIGACT reports serve as a key piece of evidence in adjudicating claims for wrongful death compensation filed under the Foreign Claims Act in Iraq and Afghanistan (ACLU 2007).

[15] ESOC is a joint project between the USMA and Princeton University that is collecting micro-data on a wide range of conflicts including Iraq, Afghanistan, and the Philippines. Lt. Col. Felter and Shapiro are co-PI for ESOC.

The SIGACT data have some 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, DOD 2007).[16] 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.[17]

The key independent variable in the following analysis is spending by Coalition forces on small-scale reconstruction projects through program intended to provide local public goods.[18] The data were generated by ESOC from the U.S. Army Corps of Engineers Gulf Region Division's Iraq Reconstruction Management System (IRMS). The IRMS data are unclassified and include the start date, end data, project description, funding source, and amount spent for 17,794 reconstruction projects awarded through December 2007. The data 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).[19]

To generate a measure of reconstruction spending directed towards providing local public goods, what we call local spending, we combined spending on three programs: CERP; the Commanders Humanitarian Relief and Reconstruction Program (CHRRP); and the Overseas Humanitarian, Disaster and

[16] To address this weakness we have collected geo-located data on civilian casualties recorded in the Iraq Body Count database. For 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.

[17] 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 shop (S-2).

[18] Data on non-US spending is available through the Iraq Donor Assistance Database (DAD). Unfortunately, our interviews and initial analysis suggest the 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.

[19] The discrepancy arises from the fact that GRD bears direct responsibility only for reconstruction funds spent through its Project and Contracting Office (PCO). Reporting of 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.

Civic Aid Appropriation (OHDACA). Taken together these sources accounted for approximately $1.2 billion in spending on 9,197 individual projects.[20] The vast majority of this spending occurred through CERP. For each project we allocated the 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.[21] These totals were then aggregated up to generate district/month reconstruction spending totals. We followed the same procedure aggregate levels of unconditional reconstruction spending. Table 1 provides various summary statistics for reconstruction spending.

[Insert Table 1 About Here.]

4 Have US efforts to provide public goods helped?

We start our analysis 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'. But when we focus in on reconstruction spending explicitly intended to provide local public goods, the kind of spending our model suggests should matter, then a different picture emerges.

As before, the starting point for this analysis is the tremendous variation in the relationship between dollars spent and violence experienced. Figure 5 shows the bivariate correlations between violence and contemporaneous monthly spending on small-scale reconstruction projects for each of the 104 districts in Iraq. The results look almost identical if we substitute large-scale projects for local ones.

[Insert Figure 5 About Here.]

Before estimating the effect on violence of spending on local public goods it is useful to 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

[20] 523 projects were dropped due to data discrepancies or missing data.

[21] Since we do not know the spending patterns for individual projects, an alternative would be to generate a model of run-rates and use that to allocate funds over time. The model would 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.

part of its food security and vulnerability analysis (WFP 2004; WFP 2005).[22] The results are not sensitive to the figure used and so we use 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 2 describes the population distribution of districts. Because there are no systematic country-wide data on the ethno-sectarian mix of Iraq we classify districts by using governorate-level returns in the December 2005 election.[23] Where at least 66% of the population in a governorate voted for a clearly Sunni, Shia or Kurd party, we code the district in that governorate accordingly.[24] Using that system, 61% of Iraqis lived in governorates dominated by one group in 2004, while 39% lived in mixed governorates, 64% of whom lived in Baghdad. Population movement since 2005 have certainly increased geographic segregation, though we lack precise estimates.[25]

[Insert Table 2 About Here.]

Table 3 describes the units of observation we use for analysis. The 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 (1%) by the Iraq experts we consulted, or for tiny parties that never received more than 1% of the vote share in any governorate (5%). "CERP" spending per 1,000 residents (which includes a few other measures of local public good spending, as described in the previous section) averages $6.61,

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

[23] 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.

[24] 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.

[25] Official policy and individual incentives get in the way here. Both 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.

[27] 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.

though 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 3 About Here.]

Rates of attacks against Coalition or Iraqi forces 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 4, 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 6 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, one that predates any national-level change in Coalition strategy or operational patterns.[27] Overall, figure 6 suggests that time and ethnicity should explain much of the violence.

Table 4 reports on a preliminary econometric investigation. The single most important district characteristic is the Sunni vote share, which by itself accounts for 17% of the cross-sectional variation, as reported in column (1). A district which 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 0.2 incidents, a ratio of 16.5. 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 4 About Here.]

Year effects are also significant, reflecting the well-known escalation in the conflict. Violence increases by .25 incidents/1000 in 2005 over 2004, and further increases by .85 and .97 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 only a marginally significant increase in 2007, of .38 incidents/1000. Columns (4) and (5) report on an attempt to find a parsimonious specification, which includes only year

indicators, Sunni vote share and a Sunni vote share x trend interaction. Once the 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. The answer is no. The Shia vote share has a positive but insignificant coefficient, in column (6).

Extensive research 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 level though, it is not clear how these factors should impact violence.[28] In our model, for example, greater income might be associated with lower *r*—it is harder to retaliate against families which can afford guards—but higher *s*—rebels from economically successful areas may be able to afford higher levels of service provision. Table 5 reports the results of our efforts to assess the influence of natural resources endowments and economic grievances on violence in Iraq.

[Insert Table 5 About Here.]

Here we have added natural resource and economic grievance measures to the parsimonious specification from column (5) of table 4. We measure natural resources two ways; price-weighted oil reserves accessible from district; and the price weighted volume of oil pipelines passing through district.[29] The latter measure attempts to control for the accessibility of resource rents through either tapping pipelines or extorting payoffs from government officials by threatening 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 clearly shows, none of these variables are individually significant predictors of violence and when compared to the baseline model in column (1), none make a substantively meaningful contribution to model fit.

The government in our model will choose 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 6 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

[28] 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).

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

predictive power. Yet all these additions together increase predictive power by only three percentage points over that provided by the recent history of incidents in the district, indicating that this is the single most important predictor available.

[Insert Table 6 About Here.]

One testable implication of our model is that optimal government (in this case the U.S. government) spending on local public services is increasing in 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 7 reports the result of that test, using the same variables that predict violent incidents to predict CERP spending per capita. In the first column of results we see that a (hypothetical) entirely Sunni district would obtain $12.84 in CERP spending per 1000 residents per half year, over twice the national average. The difference is statistically significant. Year indicators show increases in spending over time (column 2), by $5.86 per capita in 2005 over 2004, and then $7.47and $9.23 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 4 is also an effect associated with voting for Shia parties, which might have to do with rewarding support for the government party. Nevertheless, all of this is consistent with the idea that CERP spending is aimed at districts where the potential for violence is high and tracked changes in violence over time, increasing and becoming increasingly concentrated in Sunni areas.

[Insert Table 7 About Here.]

Consistent with the results in Table 7, the strongest predictor of CERP spending is lagged violent incidents, which is highly significant and increases the predictive power of the model by nine percentage points, to 30% (column (5)). Each incident /1000 predicts an additional $3.36 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 high predicted violence should not be surprising, in the sense that the program is built to serve the needs of coalition forces. We see 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 illustrated in Figure 3 of the model: 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. The empirical challenge is to find a way to carry out the conditioning. Table 8 reports the

results of analyze 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 which do not change over time, year indicators and interactions of these.

[Insert Table 8 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 we saw in Table 6. 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 3, proportion Sunni, proportion Shia, year indicators and interactions. This is consistent with the idea that these other predictors somewhat reduce the endogeneity bias in the CERP coefficient, which is a positive bias. Column (3) reports the result of including the best predictor of violent incidents in the equation, which is lagged violent incidents. In that specification the coefficient on CERP is further reduced, this time to a statistical zero. That 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 does 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 associated and the operational changes implemented as part of the "surge"—increased dispersal of forces, more unmounted patrols, greater emphasis on engaging with local political leaders, and the like—were in full force. The unconditional regression of incidents on CERP reveals a positive coefficient (0.049). As before, conditioning on sectarian proportions in the population reduces that coefficient slightly (to 0.037) and renders it statistically insignificant, which is consistent with the notion of an upward endogeneity bias.

What's more informative is that when we further attack endogeneity bias by conditioning on lagged violence, the coefficient on CERP spending becomes negative, at -0.023 incidents per thousand per dollar per capita. That negative estimate implies the same prediction that we had in the model, conditional on district characteristics, government spending on public goods should associated with less violence. The estimated coefficient is still subject to endogeneity bias, which is likely towards zero, so that it may well underestimate the salutary effect of CERP spending on violence in the latter half of 2007. (This in addition to attenuation biases due to mismeasurement of both CERP and incidents per capita.) To quantify the estimate, it implies that, conditional on district

characteristics, a dollar per capita of CERP spending predicts 2.3 less violent incidents per 100,000 population, both over the span of half a year.

Comparing the 2007 estimates to those for the entire four years of data, we see that the correlation of CERP spending with violence is smaller in the later period across all specifications. This result could be driven by improved allocation of CERP or by the increased use of CERP to reward communities where violence drops. Another interesting pattern is that lagged incidents are not as reliable a predictor of incidents in the second half of 2007 as they were in the previous four half-years.[30] One possible implication is that commanders themselves had more difficulty predicting the location of violent incidents in the second half of 2007. While this should reduce the efficacy of CERP spending in preventing violence—since it would be harder to allocate where the need is greatest—it also should reduce the endogeneity bias in our unconditional estimates. The reduction in endogeneity is consistent with the pattern reported in Table 8, which shows a sharp decline in the coefficient on CERP between the overall results and the second half of 2007.

In interpreting the above results it is important to keep in mind the measurement error issues 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.[31] We are exploring several approaches to 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.

With the data in hand these conditional estimates are as close as we can come to an estimate of dv^*/dg^* in the model, the effect of local public good spending on violence, conditional on local characteristics. We have identified several sources of exogenous variation in CERP spending and are currently collecting the data to use these to implement an instrumental variables approach to testing our predictions.

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. Intuitively, the more a community requires local public

[30] In unreported results, the R-squared in a univariate regression of incidents on lagged incidents falls from .86 to .74 and the coefficient of serial correlation declines significantly, from 1.15 to 0.67.
[31] 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 $ln(x/y) = ln(x)-ln(y)$.

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 to themselves.

We have several measures of the quality of local governance at the district level, which are included in the analysis in tables 9 and 10. 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 arguments about the differential effects of CERP across districts with better or worse governance predict a negative estimated coefficient for the interactions of CERP with measures of public "bads" (e.g., crime and distance from services) and a positive coefficient for interactions of CERP with measures of public goods (e.g., community coordination on garbage collection). Note that these coefficient on interaction terms with CERP-should suffer less 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 9 reports results for two public service indicators: victimization rates and our public service index. The coefficient on the public service index has the characteristic predicted: significant negative coefficient on the interaction term. The result is robust to the inclusion of lagged incidents as an indicator of rebel strength. Once lagged incidents are included, we also find the expected negative coefficient on the interaction of victimization and service provision. That finding is not yet conclusive evidence of a causal link between CERP and reduced violence, but it is consistent with that conjecture, suggesting that CERP is more effective in reducing violence in neighborhoods with relatively high crime victimization rates, poor access to services, and poor public garbage collection.

For completeness, table 10 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 ones 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.

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 near-certainty that rebuilding conflict and post-conflict states will remain a central security concern in coming years, we seek to identify the conditions under which providing local public goods can help rebuild social and economic order in future conflicts.

In order to do so we develop 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.

From this stark framework we generate a number of clear testable predictions about the relationship between service provision and violence. We then test the model using new data on the conflict in Iraq. Our data combine 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 other infrastructure measures such as road density.

While we have just begun to tap the potential of these data, a number of early results stand out. First, the conflict in Iraq is concentrated in a very few areas, but there is great variation in the timing and patterns of violence within these areas. While overall violence in Sunni governorates begins dropping precipitously in October 2006, for example, the drop in key areas such as Balad and Tikrit does 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, then in mixed areas where sectarian conflict appears to drive the process.

Our initial 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, we should expect commanders to 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 violence. Importantly though, once we condition on community characteristics, we find that greater service provision leads to less violence. In the second half of 2007, when operational changes meant that Coalition forces nation-wide had a better understanding of their communities' needs, every dollar per capita of CERP spending predicted 2.3 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.

These findings contain an important caution for policy makers: an observed positive relationship between service provision and violence does not imply service provision makes things worse. They also contain at least two important implications for future research. The first is that more attention needs to be paid, in our model 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 need 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. A second implication is that these 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 preliminary findings are a modest but hopeful beginning in our effort to address a central question in both development and counterinsurgency --how to effectively provide basic governance in conflict areas.

Tables

Table 1: U.S.-Funded Reconstruction Projects.

	Local Projects	Large-scale Projects	All Projects
Mean cost ($)	126,177	620,483	324,356
s.d.	320,823	1,335,551	925,711
Mean duration	104	356	205
s.d.	117	326	256
N	9197	6155	15352

Table 2: 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 3: 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	203,928,912	6.661653	12.55829	0	383.9158
Incidents per 1000 local population	832	203,928,912	0.830956	1.959917	0	24.21934
Lagged incidents per 1000	728	178,437,798	0.803249	1.901625	0	19.01101
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
Distance 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 4: Predictors of Violent Incidents against Coalition and Iraqi Forces

Dependent variable: Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)
Sunni share	3.314	3.314	1.071	-0.723	0.378	0.607
	(0.517)**	(0.518)**	(0.201)**	(0.240)**	(0.302)	(0.341)
2005		0.247	-0.087	-0.087	0.028	0.028
		(0.072)**	(0.047)	(0.047)	(0.066)	(0.066)
2006		0.846	0.102	0.102	0.408	0.408
		(0.195)**	(0.140)	(0.140)	(0.165)*	(0.165)*
2007		0.969	0.376	0.376	0.313	0.313
		(0.203)**	(0.154)*	(0.154)*	(0.148)*	(0.148)*
Sunni shr x 2005			1.794			
			(0.283)**			
Sunni shr x 2006			3.995	0.406		
			(0.838)**	(0.528)		
Sunni shr x 2007			3.182	-2.201		
			(0.755)**	(1.012)*		
Sunni shr x trend				1.794	1.175	1.175
				(0.283)**	(0.243)**	(0.243)**
Shia share						0.305
						(0.201)
Constant	0.213	-0.302	0.116	0.116	0.026	-0.164
	(0.102)*	(0.084)**	(0.037)**	(0.037)**	(0.055)	(0.117)
Observations	832	832	832	832	832	832
R-squared	0.17	0.21	0.25	0.25	0.24	0.24

Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population in 2004. Variables are described in notes to Table 3.
* significant at 5% level; ** significant at 1% level

Table 5: Natural Resources, Economic Grievances, and Violent Incidents

Dependent variable: Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)
Sunni share	0.378	0.377	0.389	0.350	0.219	0.222
	(0.302)	(0.305)	(0.306)	(0.334)	(0.349)	(0.353)
2005	0.028	0.035	0.039	0.022	0.022	0.021
	(0.066)	(0.073)	(0.070)	(0.066)	(0.066)	(0.076)
2006	0.408	0.420	0.428	0.406	0.406	0.403
	(0.165)*	(0.183)*	(0.172)*	(0.166)*	(0.166)*	(0.188)*
2007	0.313	0.327	0.337	0.310	0.310	0.305
	(0.148)*	(0.179)	(0.158)*	(0.148)*	(0.148)*	(0.182)
Sunni shr x trend	1.175	1.174	1.180	1.205	1.205	1.210
	(0.243)**	(0.243)**	(0.244)**	(0.253)**	(0.253)**	(0.254)**
Accessible oil, price weighted		-4.61e-13				8.42e-13
		(1.44e-12)				(1.92e-12)
Pipeline volume, price weighted			-4.11e-12			-3.76e-12
			(3.75e-12)			(4.05e-12)
Inc. change, 02-04 / 1M Iraqi dinar				-0.285		
				(0.250)		
Inc. quint. change, 02-04					-0.440	-0.460
					(0.351)	(0.417)
Constant	0.026	0.040	0.049	-0.072	0.060	0.057
	(0.055)	(0.083)	(0.061)	(0.112)	(0.066)	(0.083)
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. Regressions are weighted by estimated population in 2004. Variables are described in notes to Table 3 and in text.
* significant at 5% level; ** significant at 1% level

Table 6: Serial Correlation in Violent Incidents

Incidents per 1000	*(1)*	*(2)*	*(3)*	*(4)*
Incidents/1000 Lagged ½ year	0.967 (0.042)**	0.989 (0.039)**	0.959 (0.044)**	0.990 (0.042)**
2005		-0.103 (0.046)*	-0.096 (0.046)*	0.040 (0.079)
2006		0.246 (0.086)**	0.261 (0.089)**	0.532 (0.158)**
2007		-0.421 (0.106)**	-0.382 (0.102)**	0.007 (0.103)
Shia vote share			0.0001 (0.056)	-0.010 (0.053)
Sunni vote share			0.513 (0.148)**	2.489 (0.581)**
Sunni x trend				-0.769 (0.243)**
Constant	0.143 (0.040)**	0.204 (0.043)**	0.115 (0.055)*	-0.112 (0.077)
Observations	721	721	721	721
R-squared	0.78	0.80	0.80	0.81

Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population in 2004. Variables are described in notes to Table 3.

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

Table 7: Spending on Local Public Goods – ethnicity and lagged violence

CERP per capita	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Sunni vote share	12.838	12.838	-2.437	-0.926	2.922
	(2.921)**	(2.927)**	(5.808)	(8.122)	(8.020)
2005		5.855	4.563	3.719	3.961
		(0.860)**	(0.954)**	(0.970)**	(0.932)**
2006		7.467	4.884	4.108	4.590
		(0.971)**	(1.286)**	(1.480)**	(1.494)**
2007		9.227	5.352	4.644	3.532
		(1.709)**	(1.948)**	(2.165)*	(2.004)
Shia vote share			2.734	3.119	1.970
			(1.386)	(1.583)	(1.382)
Sunni x trend			6.931	6.564	0.710
			(2.821)*	(3.407)	(3.448)
Incidents/1000 lagged ½ year					3.364
					(0.429)**
Constant	4.269	-1.368	-1.137	-0.624	-0.415
	(0.716)**	(0.663)*	(0.957)	(1.210)	(1.130)
Observations	832	832	832	728	728
R-squared	0.06	0.14	0.16	0.13	0.30

Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population in 2004. Variables are described in notes to Table 3.

Table 8: 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	0.079 (0.014)**	0.061 (0.015)**	0.006 (0.006)	0.049 (0.019)*	0.037 (0.021)	-0.023 (0.010)*
2005		-0.258 (0.126)*	0.017 (0.095)			
2006		0.140 (0.229)	0.505 (0.175)**			
2007		0.052 (0.181)	-0.013 (0.114)			
Sunni vote share		1.413 (0.794)	2.473 (0.607)**		1.925 (1.024)	-0.332 (0.609)
Shia vote share		0.138 (0.187)	-0.022 (0.056)		-0.289 (0.360)	-0.321 (0.218)
Sunni x trend		0.555 (0.317)	-0.773 (0.250)**			
Incidents/1000 6 mo. lag			0.971 (0.039)**			0.768 (0.128)**
Constant	0.321 (0.114)**	-0.135 (0.149)	-0.109 (0.080)	0.519 (0.147)**	0.430 (0.255)	0.295 (0.126)*
Observations	728	728	728	104	104	104
R-squared	0.25	0.36	0.81	0.13	0.17	0.76

Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population in 2004. Variables are described in notes to Table 3.

Table 9: Community governance quality, CERP, and Violence Reduction

Incidents per 1000	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Lagged incidents per 1000	0.971	0.971		0.970	0.954	
	(0.041)	(0.041)		(0.040)	(0.039)	
CERP per Capita	0.006	0.019	0.082	0.006	0.101	0.271
	(0.007)	(0.007)	(0.018)	(0.007)	(0.029)	(0.054)
Sunni vote Share	2.543	2.103	0.909	2.485	2.463	1.396
	(0.665)	(0.368)	(0.663)	(0.613)	(0.578)	(0.707)
Sunni share x Trend	-0.781	-0.599	0.685	-0.779	-0.736	0.536
	(0.257)	(0.136)	(0.360)	(0.254)	(0.231)	(0.281)
Victimization	-2.021	8.707	16.721			
	(2.973)	(4.024)	(13.602)			
Victim x CERP		**-1.055**	-1.113			
		(0.259)	(0.761)			
Distance to Pub. Services				-0.919	2.715	5.908
				(0.859)	(1.012)	(3.497)
Distance x CERP					**-0.630**	**-1.361**
					(0.197)	(0.372)
Public garbage Collection						
Garbage collection x CERP						
Constant	0.038	-0.080	-0.283	0.168	-0.370	-0.954
	(0.048)	(0.047)	(0.145)	(0.133)	(0.142)	(0.579)
Observations	700	700	700	700	700	700
R-squared	0.81	0.82	0.39	0.81	0.82	0.41
F-stat. for joint sig. test, local governance and interactions		9.46	1.14		5.19	6.85
Probability both have zero coefficients		.000	.326		.007	.002

Robust standard errors in parentheses, clustered by district. All specifications include a full set of year indicators. Regressions are weighted by estimated population in 2004.

Table 10: Community governance quality, CERP, and Violence Reduction

Incident per 1000 persons	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
CERP per capita	-0.026	0.049	0.141	0.075	0.059	0.080	0.058
	(0.098)	(0.076)	(0.103)	(0.020)**	(0.026)*	(0.133)	(0.026)
Children's safety	-0.297						
	(0.238)						
Safety x CERP	0.029						
	(0.028)						
Road quality		0.043					
		(0.144)					
Road quality x CERP		0.005					
		(0.021)					
Streetlights in 2002			0.289				
			(0.394)				
Streetlights x CERP			-0.055				
			(0.078)				
Victims go to community				0.799			
				(0.700)			
Community x CERP				-0.057			
				(0.164)			
Shared generator use					-0.092		
					(0.496)		
Generator x CERP					0.026		
					(0.059)		
Refuse index						0.480	
						(0.202)*	
Refuse x CERP						-0.003	
						(0.036)	
Public garbage	1.400	1.435	1.402	1.334	1.562	1.266	-0.183
	(0.804)	(0.799)	(0.799)	(0.844)	(0.636)*	(0.702)	(0.220)
Garbage x CERP	0.539	0.491	0.525	0.545	0.424	0.512	0.045
	(0.325)	(0.330)	(0.318)	(0.331)	(0.268)	(0.315)	(0.062)
Sunni vote Share	0.843	-0.261	-0.482	-0.188	-0.062	-1.869	1.377
	(0.784)	(0.449)	(0.491)	(0.107)	(0.131)	(0.698)**	(0.813)
Sunni share x trend	700	700	700	700	700	700	0.504
	0.38	0.38	0.38	0.38	0.38	0.39	(0.330)
Constant	-0.026	0.049	0.141	0.075	0.059	0.080	-0.057
	(0.098)	(0.076)	(0.103)	(0.020)**	(0.026)*	(0.133)	(0.134)
Observations	-0.297						700
R-squared	(0.238)						0.38

Seven hundred district x half-years, 04:II through 07:II. Robust standard errors in parentheses, clustered by districts. All specifications include a full set of year indicators. All results and non-results on interaction of CERP and community variables in this table are robust to the inclusion of lagged incidents. Regressions are weighted by estimated population in 2004.

Figures

Figure 1: The utility of a noncombatant community from sharing information

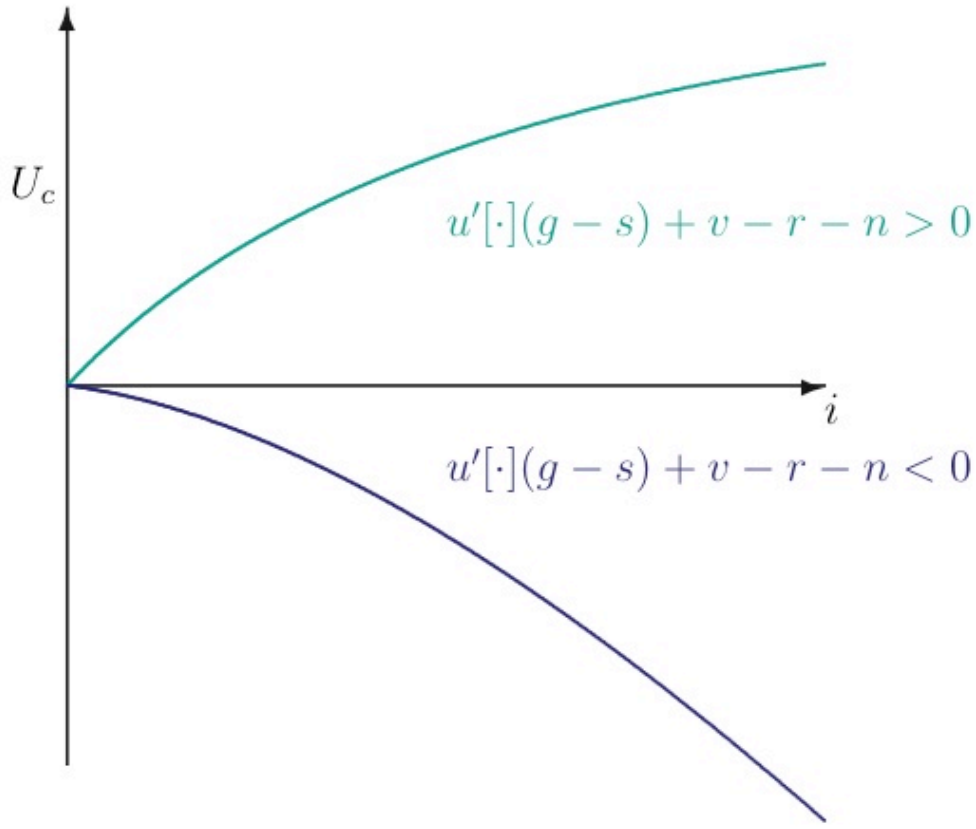


Figure 2: The utility of rebels from violence

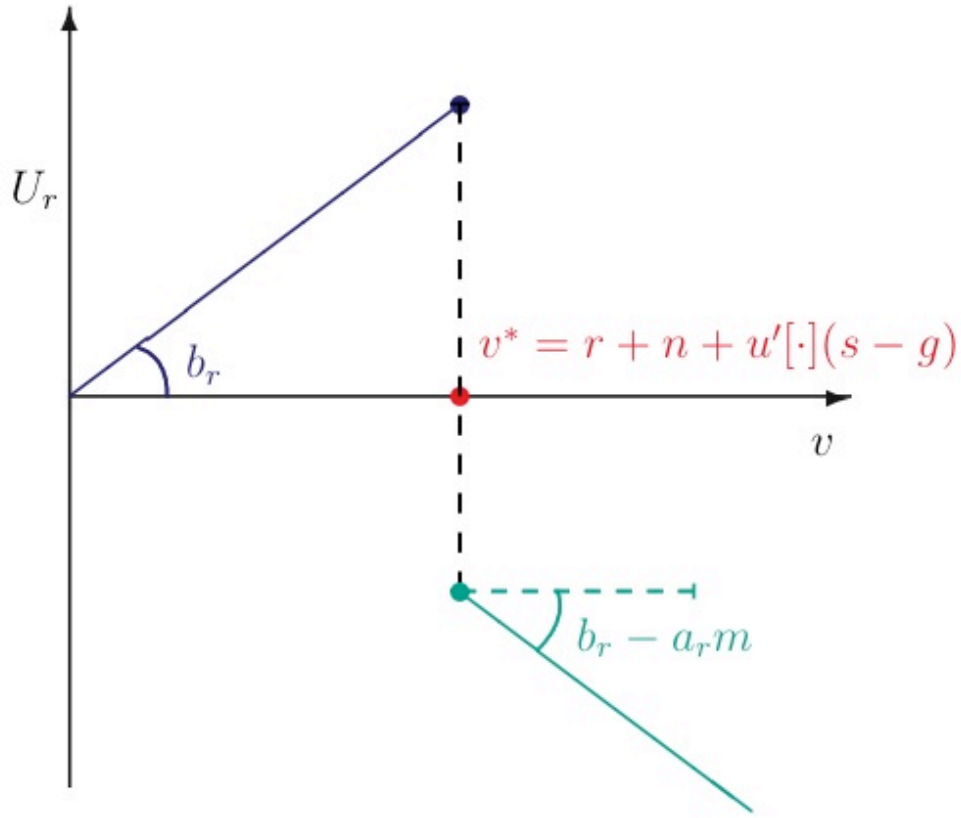


Figure 2a: Government services and violence by community capacity.

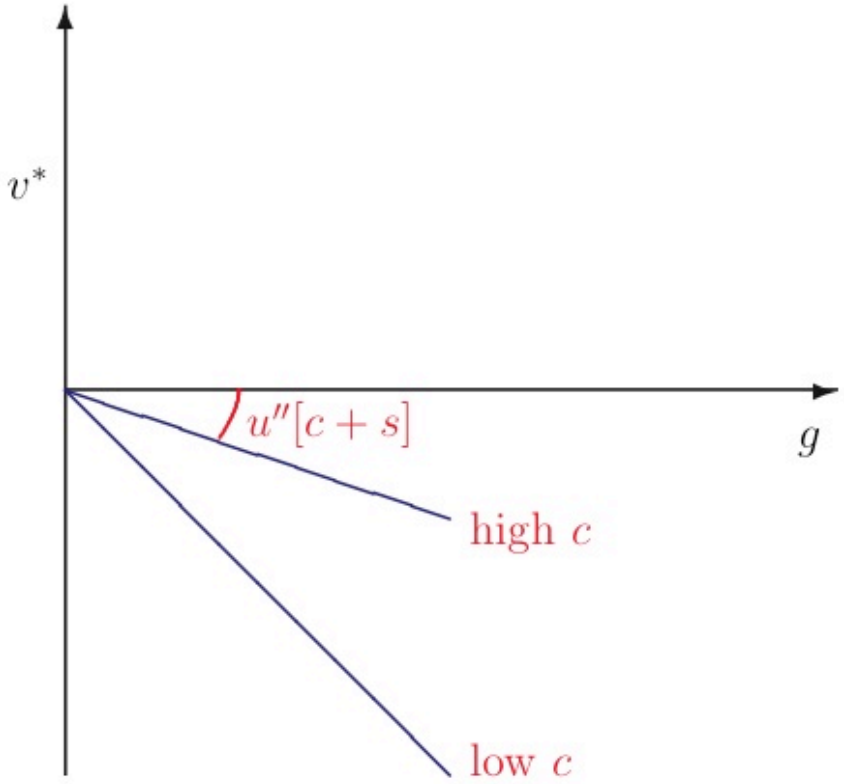


Figure 3: Optimal government services and violence.

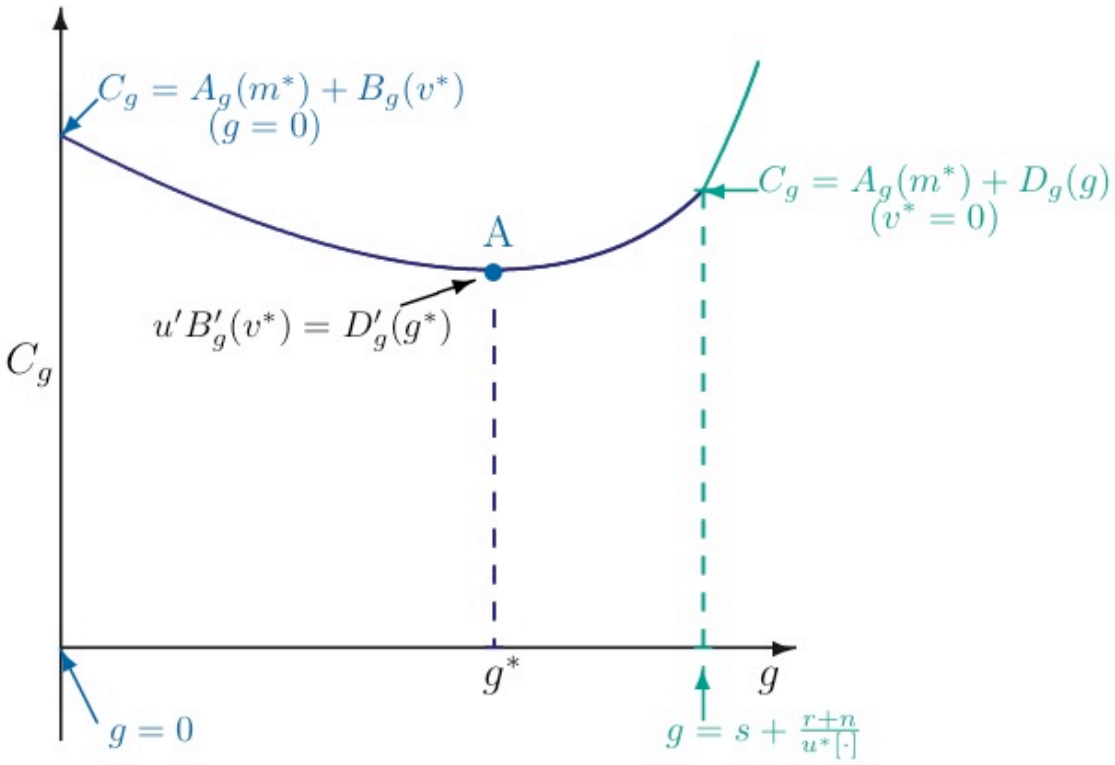


Figure 4.

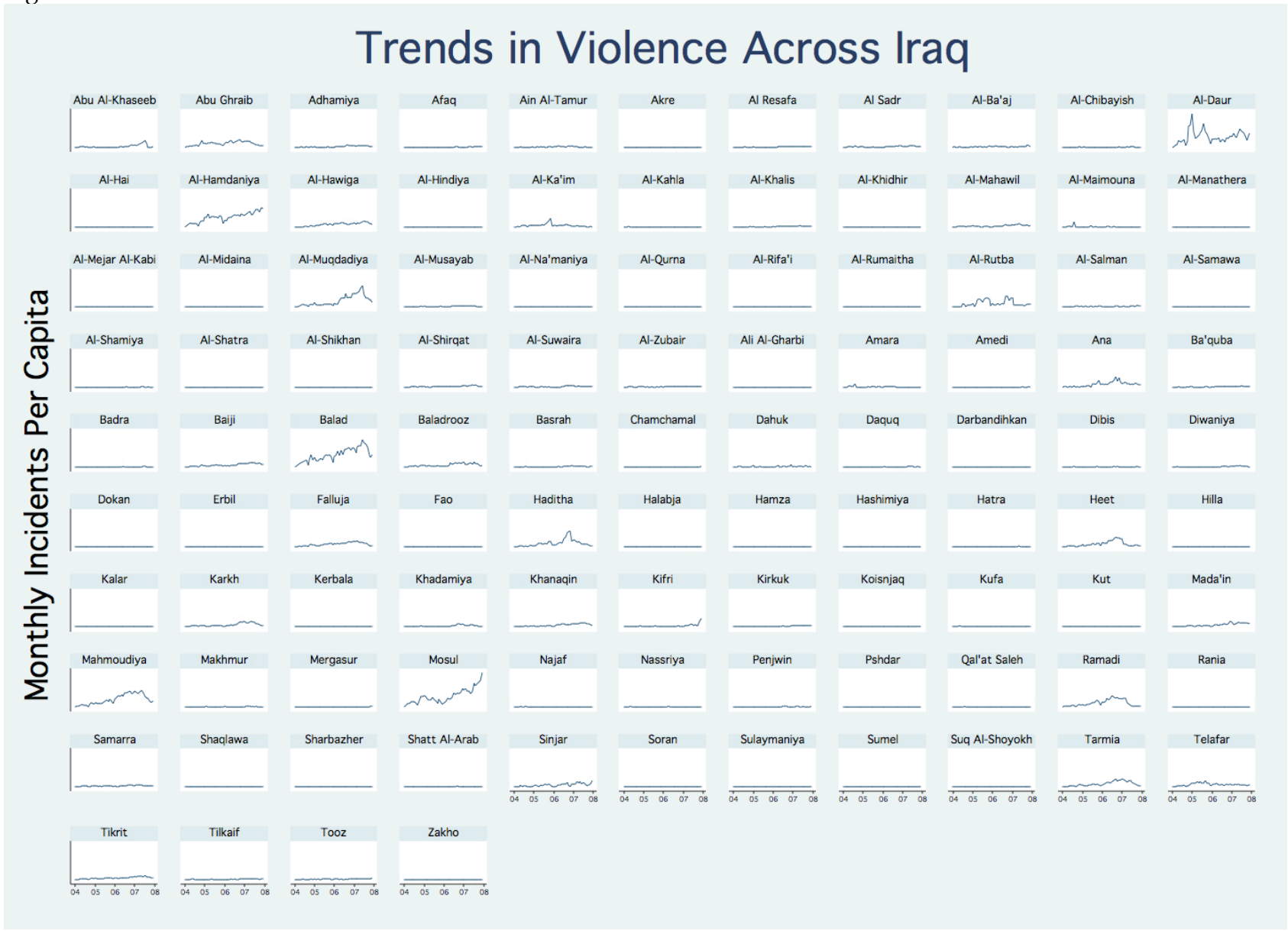

Trends in Violence Across Iraq
Monthly Incidents Per Capita
Abu Al-Khaseeb
Abu Ghraib
Adhamiya
Afaq
Ain Al-Tamur
Akre
Al Resafa
Al Sadr
Al-Ba'aj
Al-Chibayish
Al-Daur
Al-Hai
Al-Hamdaniya
Al-Hawiga
Al-Hindiya
Al-Ka'im
Al-Kahla
Al-Khalis
Al-Khidhir
Al-Mahawil
Al-Maimouna
Al-Manathera
Al-Mejar Al-Kabi
Al-Midaina
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
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 5.

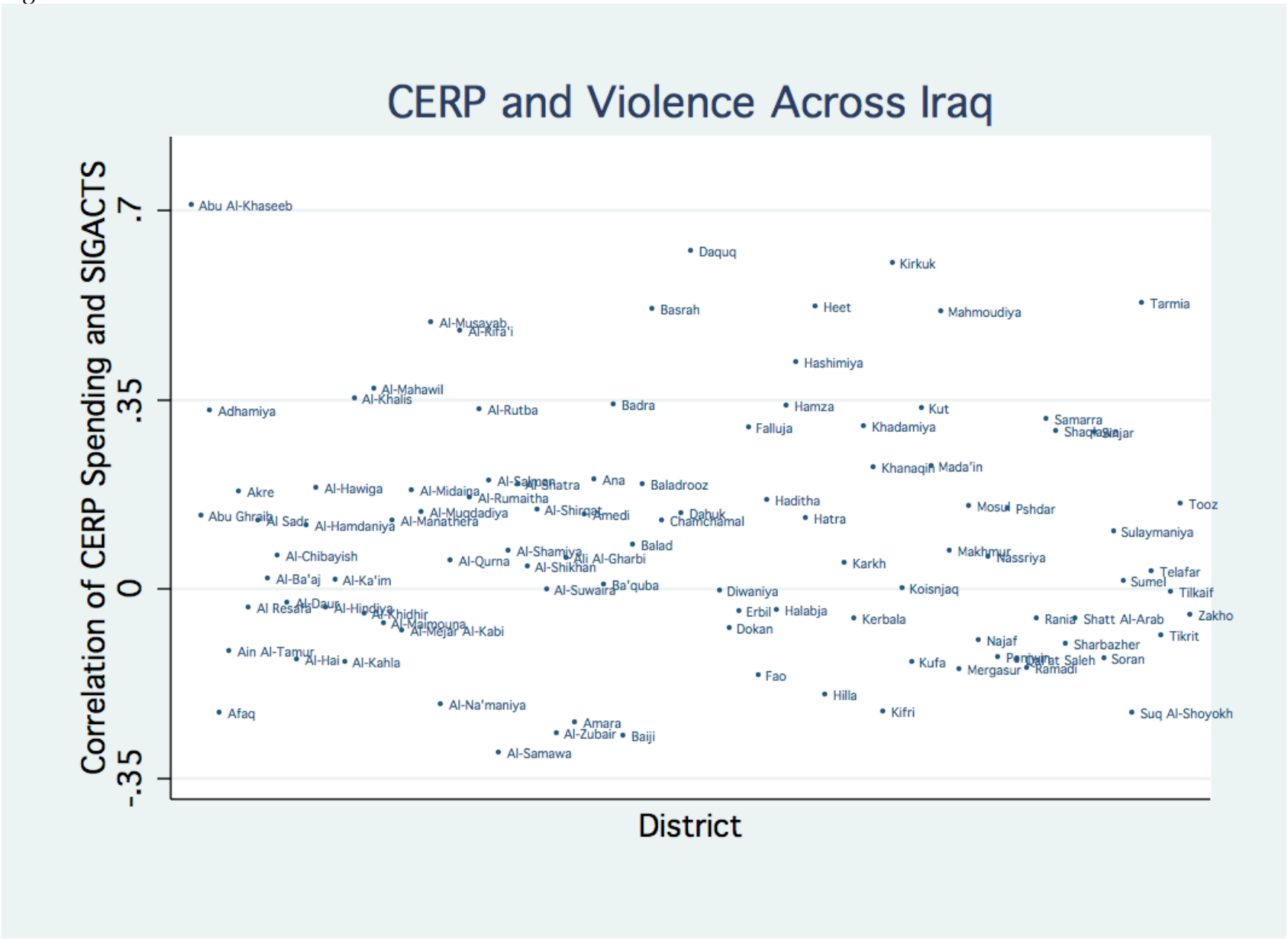
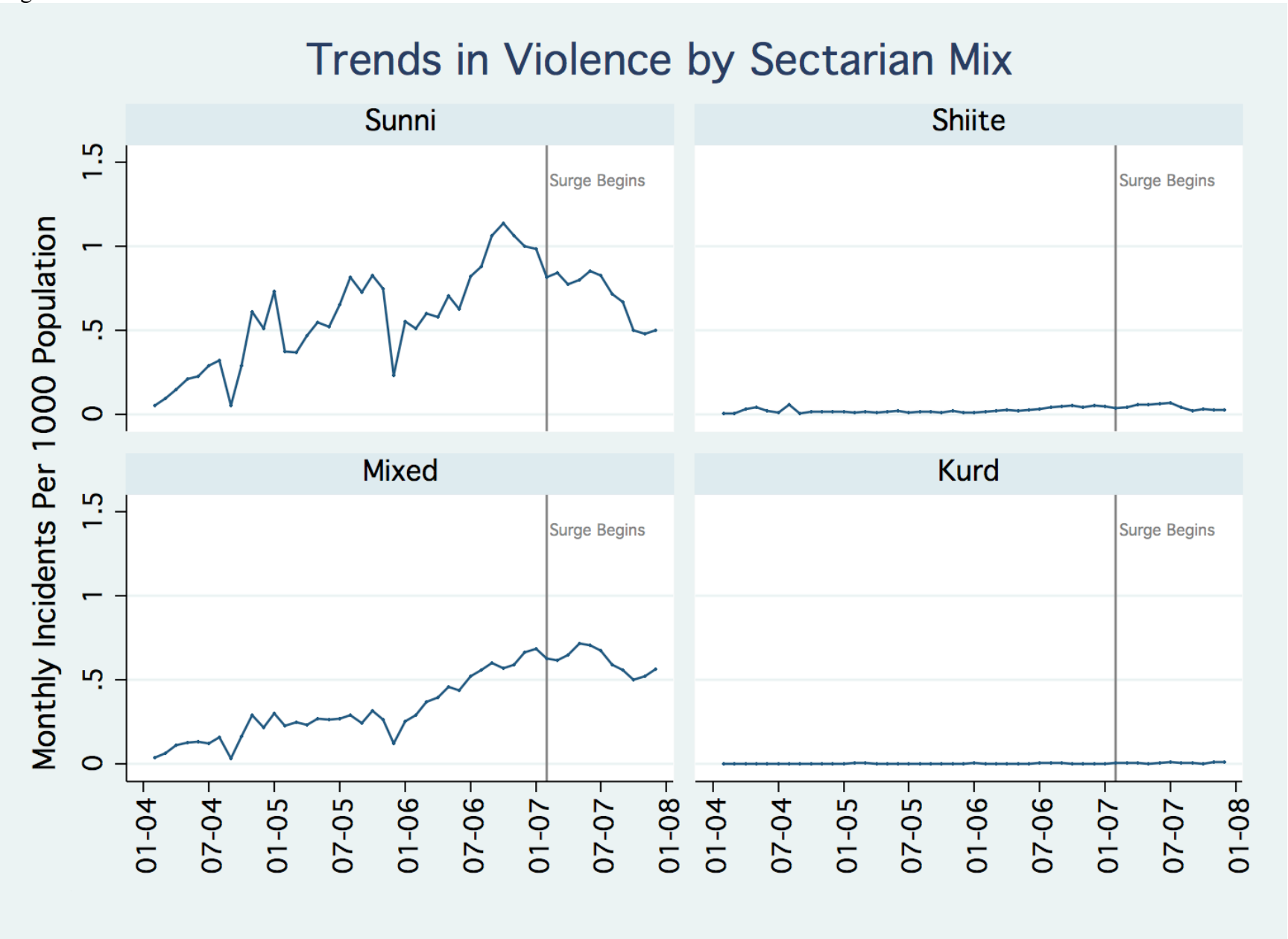

CERP and Violence Across Iraq
Correlation of CERP Spending and SIGACTS
-.35
0
.35
.7
District
Abu Al-Khaseeb
Daquq
Kirkuk
Basrah
Heet
Mahmoudiya
Tarmia
Al-Musayab
Al-Rifa'i
Hashimiya
Al-Mahawil
Al-Khalis
Adhamiya
Al-Rutba
Badra
Hamza
Kut
Falluja
Khadamiya
Samarra
Khanaqin
Mada'in
Akre
Al-Hawiga
Al-Midaina
Al-Rumaitha
Al-Shatra
Ana
Baladrooz
Haditha
Mosul
Pshdar
Tooz
Abu Ghraib
Al Sadr
Al-Hamdaniya
Al-Muqdadiya
Al-Shirqat
Amedi
Dahuk
Chamchamal
Hatra
Sulaymaniya
Al-Chibayish
Al-Qurna
Al-Shamiya
Al-Shikhan
Ali Al-Gharbi
Balad
Karkh
Makhmur
Nassriya
Telafar
Al-Ba'aj
Al-Ka'im
Al-Suwaira
Ba'quba
Diwaniya
Koisnjaq
Sumel
Tilkaif
Al Resafa
Al-Daur
Al-Hiddiya
Al-Khidhir
Al-Mairmouna
Al-Mejar Al-Kabi
Erbil
Halabja
Kerbala
Dokan
Rania
Shatt Al-Arab
Zakho
Najaf
Sharbazher
Tikrit
Ain Al-Tamur
Al-Hai
Al-Kahla
Kufa
Mergasur
Ramadi
Soran
Fao
Hilla
Afaq
Al-Na'maniya
Kifri
Suq Al-Shoyokh
Amara
Al-Zubair
Baiji
Al-Samawa

Figure 6.


Trends in Violence by Sectarian Mix
Sunni
Shiite
Mixed
Kurd
Surge Begins
Monthly Incidents Per 1000 Population
0
.5
1
1.5
01-04
07-04
01-05
07-05
01-06
07-06
01-07
07-07
01-08

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