Evaluating Economic Warfare: Lessons from Efforts to Suppress the Afghan Opium Trade

Clemens, Jeffrey

University of California at San Diego, National Bureau of Economic Research

January 2013

Evaluating Economic Warfare:

Lessons from Efforts to Suppress the Afghan Opium Trade

Jeffrey Clemens*

January 28, 2013

Abstract

In the mid-2000s, U.S. anti-opium policy intensified with a goal of reducing the resources available to Afghan insurgents. To achieve this objective, I show that opium suppression efforts must accurately distinguish between insurgent and non-insurgent suppliers. The required level of accuracy will be particularly high if demand for opium is inelastic and if the insurgents' initial market share is large. Empirically, I show that demand for Afghan opium is relatively inelastic, that the market share of Taliban-heavy areas is large, and that enforcement has primarily impacted non-Taliban territory. Consequently, anti-opium efforts have significantly increased the drug-trade resources flowing to the Taliban.

*Clemens: University of California at San Diego, Jeffrey Clemens, Economics Department, 9500 Gilman Drive #0508, La Jolla, CA 92093-0508, USA. Telephone: 1-509-570-2690. E-mail: *clemens.jeffrey@gmail.com*.
I thank John Shoven, Greg Rosston, Gopi Shah Goda, and the rest of the SIEPR team for their feedback during working-group meetings. I thank Emily Tian for assistance in assembling data on Afghan poppy cultivation and opium prices, Justin Levitt for assistance in producing this paper's maps, Melissa Dell, Jeff Friedman, David Mansfield, Jeff Miron, Nirupama Rao, Juan Carlos Suarez Serrato, and Stan Veuger for comments, and Eli Berman and and Erin Troland for help in obtaining and working with Afghan conflict data. I also thank Martin Feldstein for his mentorship during both undergraduate and graduate study and for sparking my interest in the economics of national security.

In times of conflict, an adversary's resources are a source of potential harm. Many geopolitical tactics are thus quite explicitly economic, as they seek either to deter an adversary's worst intentions or reduce their capacity to inflict damage (Richardson, 1960; Tullock, 1974). Relevant policies include trade-limiting sanctions (Galtung, 1967; Pape, 1997) and direct attacks on an adversary's military infrastructure or personnel.[1] This paper explores a third example, namely efforts to undermine an adversary's source of income. I focus on U.S. efforts to reduce the resources of Taliban-loyal insurgents by suppressing the Afghan opium trade.

When they controlled Afghanistan's central government, the Taliban levied a 10 percent, in-kind tax on opium production in addition to an Islamic tithe known as *zakat* (Blanchard, 2009). More recent linkages between the Taliban and drug-trade resources are less fully understood. In areas the Taliban effectively controls, they are believed to make similarly structured, though less generous, in-kind collections (Mansfield, 2012).[2] Such links between opium income and Taliban resources, coupled with concerns about a Narcotics-Insecurity Cycle, motivates the view that the United States should suppress the Afghan opium trade (Blanchard, 2009). Caution is warranted, however, as work by Miron (1999, 2001), Miron and Zwiebel (1995), and Dell (2011) shows that such efforts may increase violence involving industry participants.[3]

This paper's first section derives a condition under which anti-opium policies would achieve the objective of reducing Taliban resources. Anti-opium policies seek to suppress

[1]Also relevant, in particular in counter-insurgency contexts, are efforts to win hearts and minds through the provision of public goods and stable economic conditions (Berman, Shapiro and Felter, 2011; Berman et al., 2011).

[2]Through detailed survey work in central Hilmand province, Mansfield (2012) recently documents direct Taliban collections on the order of 2 percent. Village mullahs typically collect an *ushr* on the order of 5 to 10 percent. Mansfield writes that "It is currently unknown whether village mullahs make payments to those in the Taliban or to government officials."

[3]The Narcotics-Insecurity Cycle can be described as the view that the narcotics trade *per se* creates insecurity that, in turn, hinders the success of an anti-narcotics effort. The research just cited questions this view by emphasizing the extent to which insecurity results directly from counter narcotics efforts.

Taliban income by discouraging poppy cultivation and interdicting narcotics.[4] As such policies move forward, however, they shift the market up its demand curve and thus increase the value of remaining opiates. I show that the net effect on Taliban resources depends crucially on three factors. These factors are the extent to which enforcement distinguishes between insurgent and non-insurgent suppliers, the price-responsiveness of demand, and insurgents' initial market shares.

Section 2 empirically assesses the determinants of anti-opium policy's capacity to reduce Taliban resources.[5] After receiving little attention during the war's early years, funding for anti-opium efforts escalated substantially.[6] As shown in Figure 1's Panel A, heightened enforcement did not reduce total poppy cultivation. Furthermore, reductions occurred in government-controlled districts while increases occurred in Taliban-heavy territory (see Figure 1's Panel B).[7] To rule out the view that this correlation reflects an influence of poppy cultivation on Taliban control, I instrument for Taliban influence with pre-enforcement data on districts' ethnic composition. This instrumental variables strategy leaves the estimated relationship between Taliban influence and changes in poppy

[4]Clemens (2008) analyzes policies directed at Afghan farmers (e.g., crop eradication and efforts to develop alternative livelihoods) in detail, showing that they are unlikely to achieve much success at reducing flows of opiates. Such policies are encumbered by their limited capacity to shift the supply curve and by relatively inelastic demand for opium within Afghanistan. Additional work, including papers by Caulkins and Reuter (2006), Kennedy, Reuter and Riley (1993), Reyes (2010), and Andersson (2010), highlight additional complications associated with drug control policies targeted at farmers in drug-crop source countries. For recent advocacy of interdiction policies, see recommendations by Peters (2009, p.34), who suggests "establishing checkpoints manned by NATO troops and counternarcotics police to seize drug shipments on highways" and "destroying drug labs and targeting opium convoys."

[5]The link between this paper's theory and empirics is very much in the spirit of Chetty (2009). In an important sense, the current paper also owes much to Becker (1968).

[6]Appropriations data reported by Tarnoff (2011) show a spike in counternarcotics funding from near 0 in 2003 to $300 million in 2004 and to $950 million in 2005. Appropriations subsequently stabilized at around $600 million per year. Figure 1 shows two-year moving averages of these appropriations. In an alternative accounting, Blanchard (2009) reports that the United States appropriated a total of $2.9 billion towards counter narcotics efforts in Afghanistan from 2001 through 2009, of which $2.23 billion were appropriated from 2007 through 2009.

[7]Among districts that eliminated poppy cultivation, for example, only one-sixth were in Taliban-controlled areas.

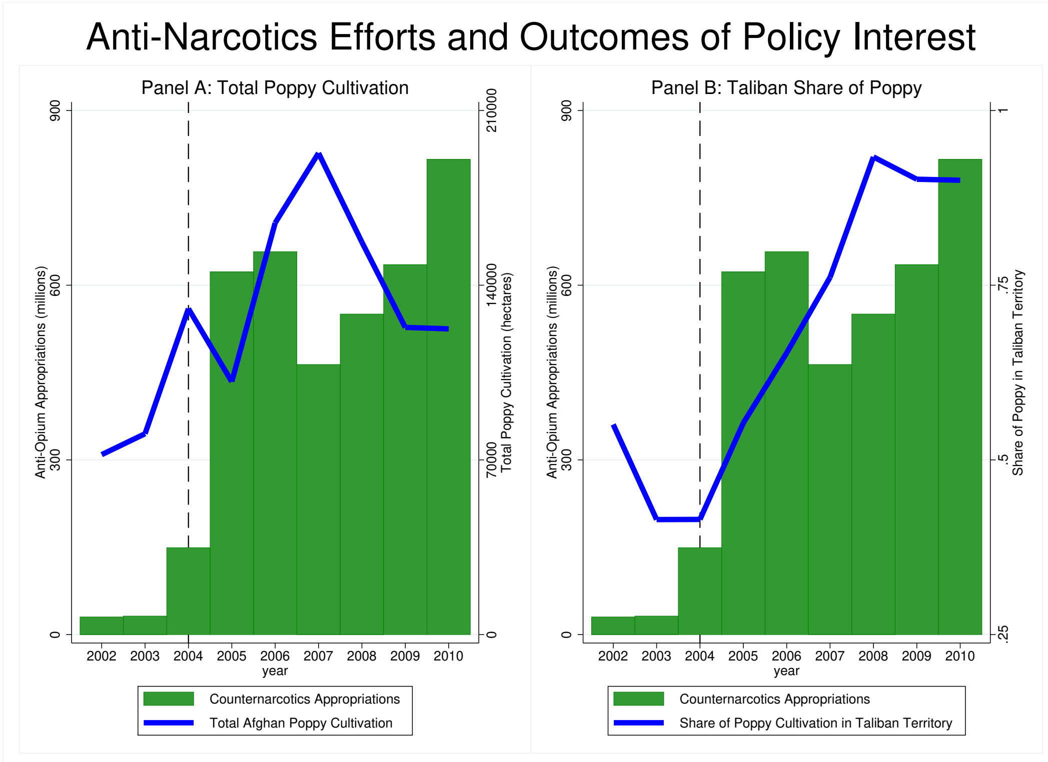

Figure 1: **Anti-Narcotics Efforts and Outcomes of Policy Interest:** The figure shows levels of U.S. counternarcotics appropriations for Afghanistan, total Afghan poppy cultivation (Panel A) and the share of poppy cultivation taking place in Taliban-heavy territory (Panel B). The counternarcotics appropriations are two-year moving averages of the sum of "Int'l Narcotics & Law Enorcement," "DOD - Counternarcotics," and "DEA Counternarcotics" as reported by Tarnoff (2011). The two-year moving average smooths out variation associated with the appropriations process. Most specifically, it smooths out a $950 million appropriation that occurred in 2005 (incidentally, this spike works in favor of the interpretation that counternarcotics efforts escalated after 2004). Total poppy cultivation data come from UNODC (2012). The division of poppy cultivation into Taliban and non-Taliban territory is guided by security-conditions data described in greater detail in the note to Figure 4

cultivation unaltered.

After assessing the capacity for anti-narcotics efforts to target Taliban-heavy areas, I estimate the elasticity of demand. In 2010, a poppy-specific blight dramatically reduced opium yields in southern Afghanistan. This large, unanticipated supply shock provides an opportunity to estimate the relevant elasticity. I find that demand for opium is relatively inelastic, with a range of estimates running from -0.33 to -0.44.

Taken together, the results imply that anti-opium efforts substantially increased the opiate-industry resources flowing to the Taliban. For each kilogram of opium removed from the market, the estimates imply that only one-sixth of a kilogram would have come from Taliban-heavy areas. Demand is sufficiently inelastic that, absent supply responses, the value of remaining opium would rise substantially, increasing the net income of farmers in Taliban-heavy areas by around $120. Supply responded quickly, and did so largely in Taliban-heavy districts. All told, the opium-source income of farmers in these districts rose from $240 million in 2004 to $580 million in 2010.

In section 3 I extend the application of section 1's framework to hypothetical scenarios involving oil-producing nations. A crucial feature of these settings is that an adversary's oil infrastructure should be readily distinguishable from allies' oil infrastructure, enabling relatively flawless targeting. Economic warfare is more likely to achieve its objectives in such scenarios than in the case of Afghan opiates. Nonetheless, the scenarios illustrate that even with perfect targeting it is possible for demand to be sufficiently inelastic, and adversaries' market shares sufficiently large, that economic warfare perversely increases their available resources. Viewing the oil market through the lens of economic warfare readily yields a broader set of geopolitical predictions. A nation's own position in the oil market is an important determinant of the costs and benefits it will realize from attempting economic warfare. Oil exporters, for example, may have strong interests in one another's instability.

I conclude with a discussion of how general the Afghanistan-specific impediments to economic warfare might be. Targeting is likely to pose significant difficulty across a wide range of prohibition-related settings. The Afghan context highlights a central problem of territorial control; it is difficult if not impossible for a government to enforce prohibitions in areas where it lacks dominion. More generally, to the extent that a government's primary adversaries are among those most capable of generating violence, they will naturally tend to pose the hardest targets.

1 A Model of Economic Warfare

The following model contains a simple but informative framework for assessing the potential effectiveness of economic warfare. The policies under consideration involve the reduction of output in an industry in which at least one market participant is an adversary. Afghanistan's opiate industry is this paper's primary application.

I characterize the industry as involving the output of a fixed number, N, of actors or regions (think, e.g., drug cartels or Afghanistan's administrative provinces).[8] Due to alliances and adversarial relationships, U.S. welfare, W, depends on the incomes, I_i, of each of these N actors. For simplicity, I assume that $W = \sum_{i=1}^{N} \lambda_i I_i$, with the λ_i being positive for allies and negative for adversaries.[9]

I characterize the incomes of industry participants as follows. Potential gross industry-wide output is $Q_{\text{gross}} = \sum_{i=1}^{N} q_i$. The policy of interest is an "enforcement" level, E. E is the total amount of opium eliminated from the market, either through interdiction, eradication, or by deterring farmers from cultivating poppy, with E_i eliminated from producer i. This leaves net output of $Q_{\text{net}} = Q_{\text{gross}} - E$. Demand determines the market-clearing price, with $P = p(Q_{\text{net}})$. Producer i's income is thus $I_i = [q_i - E_i] \times p(Q_{\text{net}})$.

The extent to which enforcement falls upon producer or region i depends on a targeting parameter, ρ_i, with $E_i = \rho_i E$. The ability to target enforcement at producers with low λ_i is clearly crucial for the success of economic warfare. I treat the ρ_i as reflecting fixed limitations on the U.S.'s ability to target.[10] Given these ρ_i, the expression for welfare can be written as:

[8] This should not be interpreted as applying at the level of, for example, individual Afghan farmers, who might be assumed to freely enter and exit into the production of opium. The relevant unit is some equivalent of a state actor (e.g., a country or a provincial warlord possessing the taxing authority relevant in the Afghan context).

[9] Of course this function need not be linear in the producer incomes.

[10] A natural extension would involving allowing these targeting weights to be improved at some cost.

$$W(E) = \sum_{i=1}^{N} [\lambda_i [q_i - \rho_i E] \times p(Q_{\text{gross}} - E)]. \tag{1}$$

The analysis is simplest when enforcement is thought of as a surprise, post-production move made in the context of a one-shot game. In subsequent periods one must account for strategic responses of production to expected enforcement.[11] In these later periods, enforcement may be more appropriately modeled as shifting the producers' cost curves. Additional natural extensions would account explicitly for the cost of enforcement and allow the price to affect U.S. welfare directly through domestic markets.[12] While these extensions add complexity to the analysis, the factors emphasized below remain central.

For a convenient set of λ_i, Proposition 1 describes the condition under which an incremental increase in enforcement improves U.S. welfare. Specifically, it addresses the case in which there is a single adversarial producer, with the United States expressing indifference to the incomes flowing to all other actors.

Proposition 1 *Let welfare be described by $W = \lambda_1 [q_1 - \rho_1 E] \times p(Q_{gross} - E)$, with $\lambda_1 < 0$, and let ϵ_D be the elasticity of demand. Then W increases in the level of enforcement if and only if the targeting parameter ρ_1 is greater a threshold ρ_1^* defined below:*

$$\rho_1^* = -\frac{1}{\epsilon_D} \frac{[q_1 - E_1]}{Q_{net}}. \tag{2}$$

This threshold ρ_1^* is declining in the magnitude of the relevant market's elasticity of demand and increasing in the adversary's initial market share.

[11] A slight variant on the condition derived below remains a central determinant of economic warfare's success when production responds by shifting along an upward sloping supply curve. The condition appears in the numerator of the extended model's expression for incremental enforcement's effect on welfare.

[12] For standard goods, increases in price will reduce welfare from domestic consumption. For goods with negative externalities, however, increases in domestic prices may increase welfare. As analyzed elsewhere, optimal policies for reducing the consumption of such goods with negative externalities may or may not involve quantity-oriented enforcement of the sort considered here (Becker, Murphy and Grossman, 2006; Glaeser and Shleifer, 2001).

The proposition's economic content can initially be illustrated by considering its implications for several cases:

1. Incremental enforcement necessarily reduces welfare when demand is sufficiently inelastic that $-\frac{1}{\epsilon_D}\frac{[q_1 - E_1]}{Q_{\text{net}}} > 1$.
2. To improve welfare, enforcement must be better-than-random (i.e., $\rho_1 > \frac{[q_1 - E_1]}{Q_{\text{net}}}$) when demand is inelastic, and increasingly so as demand becomes increasingly inelastic. Similarly, enforcement may be worse-than-random when demand is elastic, and may be increasingly so as demand becomes increasingly elastic.
3. When adversaries account for the entire market, either as a monopoly or as a cartel, and when disutility from their resources uniformly equals λ_1, enforcement improves (worsens) welfare if demand is elastic (inelastic).
4. Even when demand is elastic and adversaries account for the entire market, sufficiently poor targeting can reduce welfare when λ_i varies across adversaries.

2 The Case of Afghan Opiates

In this section I empirically assess the key determinants of economic warfare's impact in the context the Afghan opiate industry. With the export value of opiates regularly amounting to one sixth to one third of Afghanistan's GDP (UNODC, 2010, 2012), the potential for opium-source income to fuel the insurgency is a salient concern. Furthermore, historical concentrations of poppy cultivation in Taliban-oriented areas raise the possibility of a well-targeted anti-opium campaign. As shown below, recent experience has belied such optimism.

For simplicity, Afghanistan and its opiate industry can be divided into two producing regions: those influenced by the Taliban and those controlled by the national government. Flows of income from the opiate industry to Taliban-heavy territory have an unambiguously negative effect on U.S. welfare; this income undermines U.S. security interests as well as its concerns associated with the war on drugs. U.S. sentiment towards flows of opiate income to government-controlled territories is less clear. On the one hand, it is associated with the narcotics industry, with its implications for global public health and corruption within Afghanistan. On the other hand, it contributes to our ally's resource base and improves the livelihoods of low-income families on whose loyalty our ally's government relies. As a first approximation I consider the simplest case, namely the case in which the United States is, on net, indifferent to opiate-industry income outside of Taliban-heavy areas.

2.1 Data Describing Afghan Poppy Cultivation and Taliban Influence

A retrospective analysis of anti-opium policy in Afghanistan looks bleak for reasons related to each of the key parameters from equation (2). I begin with an assessment of the targeting parameter. The analysis focuses on poppy cultivation rather than post-production interdiction for two reasons. First, dissuasion of poppy cultivation, both through the threat of crop eradication and due to farmer respect for either secular or Islamic law, plays a central role in driving the distribution of opiate-industry income across the country (UNODC, 2012).[13] In contrast, post-production interdiction typically accounts for less than 5 percent of total opium output, and is in some years closer to 1 percent (UNODC, 2010, 2011, 2012). Second, data on the cross-district distribution of

[13]Among farmers who had previously cultivated poppy but ceased doing so in 2011, 23 percent reported doing so due to the existence of the government ban, 11 percent because poppy cultivation is (only recently, apparently) "against Islam," and an additional 5 percent due to a decision of local elders; 15 percent reported fear of the government and an additional 5 percent fear, specifically, of eradication; the remainder cited traditional production-related factors including input costs, yields, and market prices. Suggestively, the U.N.'s 2009 report (UNODC, 2010) provides a separate tabulation of responses by farmers in the South and West, which are under relatively heavy Taliban influence. These farmers were far less likely to cite reasons related to government or Islamic prohibitions and far more likely to cite reasons related to the profitability of production.

poppy cultivation are readily available while such data on interdiction are not.

Table 1 reports summary statistics describing poppy cultivation in 2004 and 2009, two district-level measures of security conditions, and a characterization of each district by its dominant ethnic group. The sample is restricted to the 233 of Afghanistan's 409 districts in which poppy was cultivated in 2004 and in which the measure of security conditions was available.[14] From 2004 to 2009, poppy cultivation was eliminated from some 153 of these districts while originating in 26 that are outside of the sample. The measure of the security threat is a categorical variable running from 1 to 4, with 4 indicating that a district was essentially controlled by the Taliban. The variable "High Security Threat" is simply an indicator equal to 1 for districts with security threats coded as 3 or 4. 44 percent of the districts described in Table 1 were dominated by the Pashtun ethnicity, which is prominent in Afghanistan's southern provinces and is predictive of relatively strong Taliban influence. 37 percent were Tajik dominated and 9 percent Uzbek dominated. In contrast with the Pashtun ethnicity, Tajiks and Uzbeks were the principal players in the Northern Alliance that worked with U.S. forces towards the Taliban's ouster in 2001.

2.2 Analysis of Targeting in the Context of Afghan Opium Poppy

2004 marked a high point for dispersion of poppy cultivation across Afghanistan. Anti-opium efforts were minimal during that and previous years, as stated policy objectives involved limited emphasis on the drug trade. In that year, the UNODC documented a then-record 131,000 hectares of land under opium poppy cultivation. This included 45,000 hectares in three Taliban-heavy provinces that have long poppy-cultivating

[14] I choose 2004 as the base year because it described the maximum extent of poppy cultivation across Afghanistan; the 233 poppy-cultivating districts encompassed 32 of Afghanistan's 34 provinces, as illustrated in Figure 2. It is also one of the final years preceding the U.S.'s increased emphasis on anti-opium enforcement (Blanchard, 2009).

Table 1: **Summary Statistics Describing Afghan Poppy Cultivation and Security**

	mean	sd	min	max
Opium Hectares (2004)	530.67	914.15	2	6486
Opium Hectares (2009)	466.09	1697.36	0	17063
Opium Poppy Eliminated	0.66	0.48	0	1
Opium Poppy Reduced	0.84	0.37	0	1
Pct Change in Opium Poppy	-1.45	1.08	-2	2
High Security Threat	0.35	0.48	0	1
Categorical Security Threat	1.87	0.97	1	4
Pashtun District	0.44	0.50	0	1
Tajik District	0.27	0.44	0	1
Uzbek District	0.09	0.29	0	1
Observations	233			

Note: The data describe the poppy cultivation, security, and dominant ethnic group associated with the 233 Afghan districts documented to have area under opium poppy cultivation in 2004. Poppy cultivation levels (and additional related variables generated by the author) come from the United Nations Office on Drugs and Crime (UNODC, 2010). The percent change in poppy cultivation from 2004 to 2009 was calculated using the mid-point formula (hence the minimum and maximum of -2 and 2, respectively). Data on the level of security and Taliban influence was obtained from a threat assessment map produced by the Afghan National Security Forces and obtained through a website associated with Radio Netherlands Worldwide: http://blogs.rnw.nl/vredeenveiligheid/files/2009/08/ansf-map-april-2009.jpg (last accessed November 4, 2012). Data on the dominant ethnic group in each district was obtained from a map available on the website of the Masawat Development Fund: http://masawatdevelopmentfund.org.au/wp-content/uploads/2011/11/ethnicgroupsmap.gif (last accessed November 4, 2012).

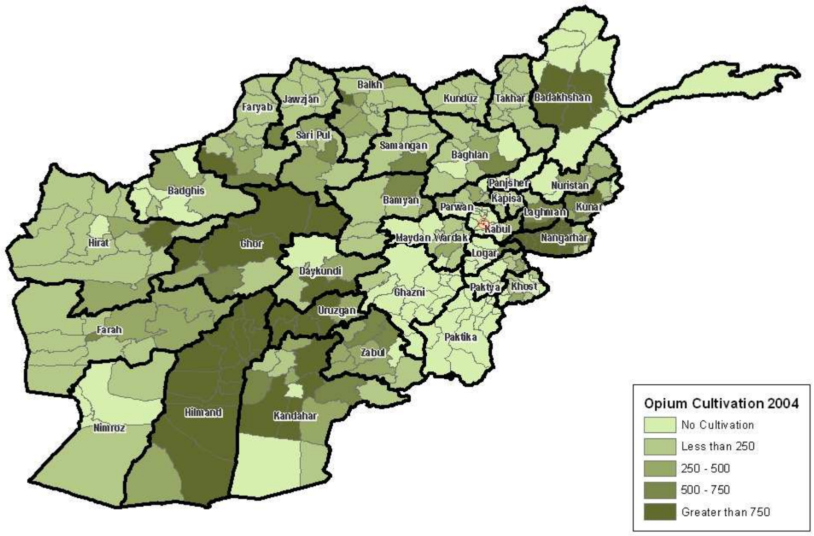

Figure 2: **Opium Poppy Cultivation across Afghanistan (2004):** The map shows levels of poppy cultivation (in hectares) across Afghanistan's districts in 2004. Source: UNODC (2012).

traditions (29,000 hectares in Hilmand, 11,000 in Uruzgan, and 5,000 in Kandahar). Nangarhar, a traditional poppy-cultivating province in the East, accounted for an additional 28,000 hectares while Badakshan, a traditional poppy-cultivating province in the North, accounted for 16,000. The remaining 42,000 hectares were scattered across a record 27 of Afghanistan's 29 remaining provinces.[15]

Anti-opium enforcement escalated substantially in 2005 and subsequent years, as illustrated previously in Figure 1. By 2009, the distribution of poppy cultivation had changed dramatically. Nearly half of Afghanistan's provinces (16) were documented to be poppy free. However, neither the elimination nor significant reduction of poppy culti-

[15]A 2004 realignment of Afghanistan's districts into provinces, increasing the total number of provinces from 32 to 34, creates some ambiguity on this point. The UNODC's Illicit Crop Monitoring Report from that year (UNODC, 2004) shows poppy cultivation in all 32 of the 32 administrative provinces in place at the beginning of the year. Subsequent reports, using the current division of districts into provinces (the division utilized in this paper's empirical analysis) show poppy cultivation as having occurred in 32 of the 34 current provinces (UNODC, 2012).

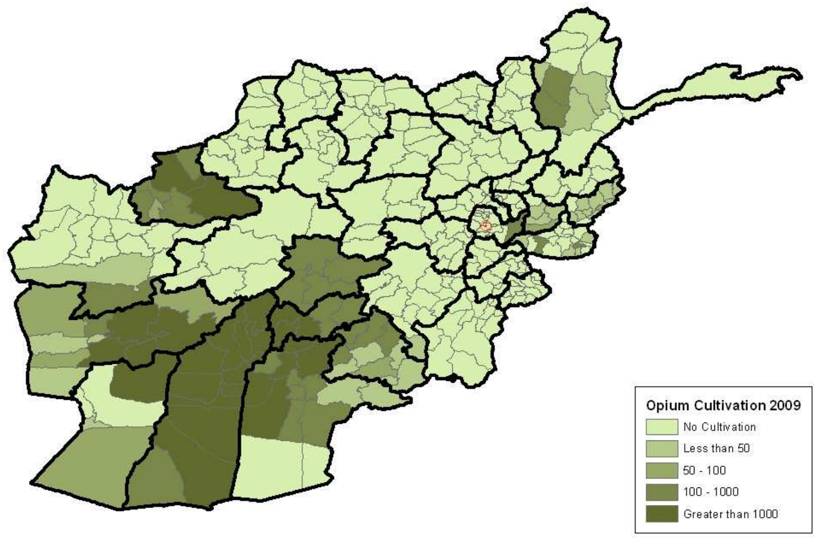

Figure 3: **Opium Poppy Cultivation across Afghanistan (2009):** The map shows levels of poppy cultivation (in hectares) across Afghanistan's districts in 2009. Source: UNODC (2012).

vation occurred in the Taliban-heavy provinces (see Figure 4, which shows a measure of Taliban influence across Afghanistan's districts as of 2007). In the government-controlled North, Badakshan had become a relatively minor player, as had Nangarhar, located near Kabul in the east. Meanwhile, production in Taliban-heavy provinces rose substantially, with 63,000 hectares under poppy cultivation in Hilmand, 11,000 in Uruzgan, and 27,000 in Kandahar. Taliban-controlled areas in Western Farah province accounted for an additional 17,000 hectares, with the remainder of the country accounting for only 13,000 hectares.

2.2.1 Ordinary Least Squares Estimates of the Relationship between Taliban Control and Reductions in Poppy Cultivation

I estimate the relationship between Taliban influence and changes in poppy cultivation using both an Ordinary Least Squares (OLS) estimator and an Instrumental Vari-

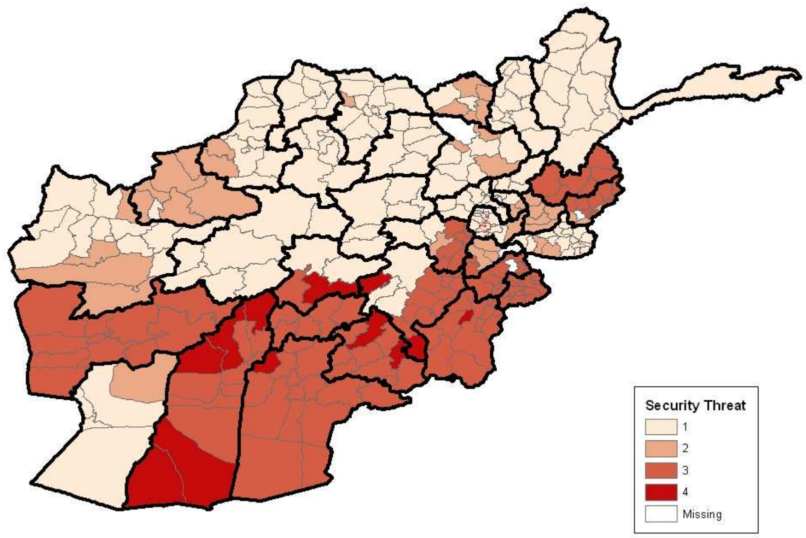

Figure 4: **Taliban Influence across Afghanistan:** The map shows district-level data on the level of security and Taliban influence. Source: Data obtained from a threat assessment map produced by the Afghan National Security Forces and obtained through a website associated with Radio Netherlands Worldwide: http://blogs.rnw.nl/vredeenveiligheid/files/2009/08/ansf-map-april-2009.jpg (last accessed November 4, 2012).

ables (IV) framework. The OLS estimator is below:

$$\triangle \text{Poppy Cultivation}_d = \alpha_0^{OLS} + \alpha_1^{OLS} \text{Security Threat}_d + \varepsilon_d. \tag{3}$$

In equation (3), α_1^{OLS} is an estimate of the relationship between security conditions and changes in poppy cultivation. The statistical analysis focuses exclusively on districts with non-zero poppy cultivation in 2004.[16]

Estimates of equation (3) are shown in Table 2. The estimate in column 1 shows

[16]The earlier discussion of Figure 1 highlighted that increases in poppy cultivation were concentrated in Taliban-heavy areas. While clearly true on a production-weighted basis, this is difficult to capture in an analysis of percent changes; in percent changes, shifts from 0 to any positive value are equivalent. When calculated using the mid-point formula they are uniformly equal to 2 and when calculated in terms of log points they are infinite. In analysis not shown I find that, despite being correlated with absolute production increases, security conditions are uncorrelated the *origination* of poppy cultivation across districts between 2004 and 2009.

that the binary indicator for a high level of Taliban threat predicts a 50 percentage point lower likelihood that poppy cultivation was eliminated from a district. This same variable predicts a 34 percentage point lower likelihood that a district's poppy cultivation was reduced (column 3), and predicts relative poppy cultivation increases on the order of 120 percent (column 5). Columns 2, 4, and 6 report a similar set of results where the independent variable is the 4-category indicator of the severity of the Taliban threat. The results are quite similar, suggesting that a 2-category movement up the scale predicts poppy-cultivation changes similar to those associated with the binary threat-level indicator.

In specifications 1, 3, and 5, where the measure of Taliban control is binary, it is straightforward to convert the results into estimates of the targeting parameter ρ_1 from the model in section 1. In specification 1, for example, α_0^{OLS} is the probability of poppy elimination in non-Taliban territory, while $\alpha_0^{OLS} + \alpha_1^{OLS}$ is the probability of poppy elimination in Taliban territory. Weighting these probabilities by the fraction of districts falling into each category yields an estimate of the fraction of affected districts that were under Taliban control. The resulting estimates, reported immediately beneath the estimates of α_0^{OLS} (the *Intercept* term in the table) range from 0.15 to 0.25. The relevant measures of the Taliban's initial market share exceed 30 percent when measured as a fraction of districts and 40 percent when measured as a fraction of all land under poppy cultivation; the results thus imply worse-than-random targeting.

It is important to keep in mind that the parameter of interest is not a causal estimate of the effect of Taliban control on the ease of targeting particular areas. The parameter of interest could be better described as an all-inclusive technological constraint on targeting. Suppose, for example, that anti-opium enforcement is difficult in mountainous regions and that mountainous regions are also controlled by the Taliban. In this hypothetical, Taliban control *per se* would not be a cause of difficulty in targeting enforcement at these

Table 2: **Taliban Influence and Changes in Poppy Cultivation**

	Eliminated Coeff./SE	Eliminated Coeff./SE	Reduced Coeff./SE	Reduced Coeff./SE	Pct Change Coeff./SE	Pct Change Coeff./SE
High Security Threat	-0.5335**		-0.3432*		1.1733**	
	(0.1338)		(0.1278)		(0.3625)	
Categorical Security Threat		-0.2830**		-0.1806**		0.6110**
		(0.0554)		(0.0585)		(0.1504)
Intercept	0.8421**	1.1862**	0.9605**	1.1792**	-1.8548**	-2.5903**
	(0.0521)	(0.0855)	(0.0253)	(0.0718)	(0.0794)	(0.1770)
Implied Targeting Parameter: ρ_1	0.157		0.245		0.187	
N	233	233	233	233	233	233
Number of Clusters	31	31	31	31	31	31
Estimator	OLS	OLS	OLS	OLS	OLS	OLS

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. Standard errors allow for the possibility that errors are correlated at the level of the 31 administrative provinces contained in the sample. The table reports coefficients from ordinary least squares estimates of equation (3). The sample consists of 233 Afghan districts with positive levels of opium poppy cultivation in 2004. The dependent variable in columns 1 and 2 is an indicator set equal to 1 if poppy cultivation was entirely eliminated from the district from 2004 to 2009. The dependent variable in columns 3 and 4 is an indicator set equal to 1 if poppy cultivation was reduced in the district from 2004 to 2009. The dependent variable in columns 5 and 6 is calculated as the percent change in poppy cultivation from 2004 to 2009; this percent change is calculated using the mid-point formula, and thus has a range from -2 to 2. The independent variables, which describe security conditions and the extent of Taliban control, are defined as descried in the note to Table 1.

regions. Nonetheless, the average difficulty of targeting Taliban-controlled regions is precisely what must be known to evaluate opium-suppression efforts.

There is, however, an important potential flaw with the coefficients in Table 2. Because the measure of security conditions comes from a period after the initial measure of poppy cultivation, reverse causality may be at work. A tendency for the continuation of poppy cultivation and opium production to increase Taliban influence may induce a negative correlation between poppy elimination and Taliban control. Importantly, the mechanism just described would tend to bolster the argument for attempting to eliminate poppy. This contrasts sharply with the "targeting" interpretation of α_1^{OLS}, under which a negative correlation suggests that anti-opium efforts may be ineffective at best and harmful at worst.

2.2.2 Instrumental Variables Estimates of the Relationship between Taliban Control and Reductions in Poppy Cultivation

I use an IV framework to rule out reverse causality by purging the measure of Taliban influence of developments associated with the ongoing conflict. Long-standing ethnic loyalties play a significant role in Afghanistan's extended internal conflict. I show the distribution of ethnic groups across Afghanistan in Figure 5. A comparison of Figures 4 and 5 reveals the relationships between ethnic groups and Taliban influence. Pashtun dominated areas are relatively likely to be influenced by the Taliban. The government firmly controls most areas associated with Tajiks and Uzbeks, who formed the core of the Northern Alliance that toppled the Taliban in 2001 with assistance from U.S. and other NATO forces. The IV estimation framework, which utilizes linkages between ethnic history and proclivity towards the Taliban, is presented below in equations (4) and (5). By using largely pre-conflict data on ethnicity, I ensure that the instrument is not driven by developments associated with the conflict itself.

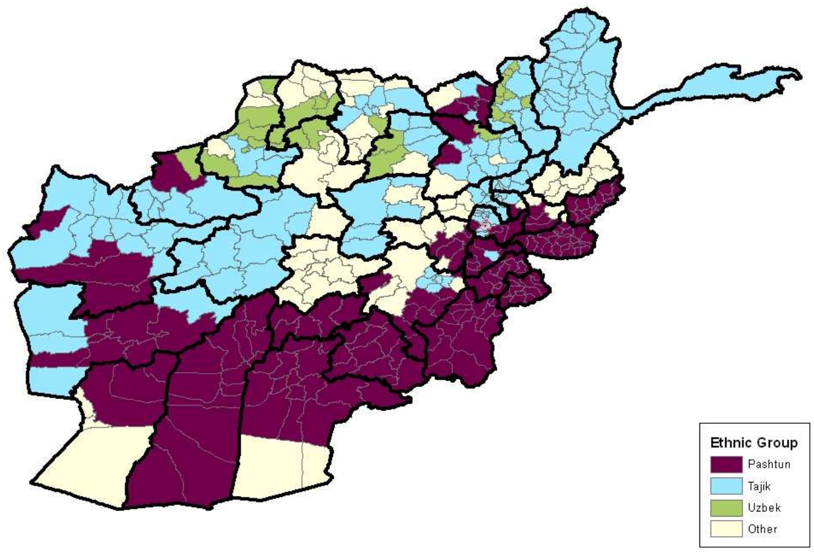

Figure 5: **Distribution of Ethnic Groups across Afghanistan:** The map displays the ethnic groups estimated to make up a majority of each district's population. Source: Data was obtained from a map available on the website of the Masawat Development Fund: http://masawatdevelopmentfund.org.au/wp-content/uploads/2011/11/ethnicgroupsmap.gif (last accessed December 1, 2012). The data collection associated with source map is described here: http://afghanistanelectiondata.org/election/2009/about/ethnic-data (last accessed December 1, 2012). The map "is based on data collected by the Office of the United Nations High Commissioner for Refugees (UNHCR) for AIMS in 2002 for approximately 200 districts and is supplemented with information from the Afghan Central Statistical Office published in 1985."

$$\triangle \text{Poppy Cultivation}_d = \alpha_0^{IV} + \alpha_1^{IV} \widehat{\text{Security Threat}}_d + \varepsilon_d \tag{4}$$

$$\widehat{\text{Security Threat}}_d = \beta_0 + \beta_1 \text{Ethnicity}_d \tag{5}$$

Table 3 reports the first stage relationship between ethnic groups and Taliban influence. In columns 1 and 2, Taliban influence is described by the High Threat indicator variable while in columns 3 and 4 it is described by the 4-category threat assessment variable. In columns 1 and 3, the indicator variables associated with the relevant ethnic groups are included separately. The estimates are consistent with what one would expect

Table 3: **First Stage Relationship between Ethnicity and Taliban Control**

	High Threat Coeff./SE	High Threat Coeff./SE	Cat. Threat Coeff./SE	Cat. Threat Coeff./SE
Pashtun	0.2855		0.6618+	
	(0.1711)		(0.3551)	
Tajik	-0.2480*		-0.4435+	
	(0.1124)		(0.2203)	
Uzbek	-0.2649*		-0.5595*	
	(0.1214)		(0.2638)	
Ethnicity		0.2693**		0.5693**
		(0.0715)		(0.1515)
R^2	0.252	0.252	0.273	0.270
N	233	233	233	233
Number of Clusters	31	31	31	31
Estimator	OLS	OLS	OLS	OLS

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. Standard errors allow for the possibility that errors are correlated at the level of the 31 administrative provinces contained in the sample. The table reports coefficients from ordinary least squares estimates of equation (5). The sample consists of 233 Afghan districts with positive levels of opium poppy cultivation in 2004. The dependent variable in columns 1 and 2 is an indicator set equal to 1 if the 4-category measure of security conditions is equal to 3 or 4, indicating relatively high degrees of Taliban influence. The dependent variable in columns 3 and 4 is the 4-category measure of security conditions. The independent variables in columns 1 and 3 are indicators for districts dominated by Pashtuns, Tajiks, and Uzbeks. The independent variable in columns 2 and 4 (*Ethnicity*) is an indicator set equal to 1 in Pashtun districts, -1 in Uzbek and Tajik districts, and 0 in districts associated with relatively neutral ethnicities.

given the history of the Afghan conflict as well as what one can see visually in Figures 4 and 5. Tajik and Uzbek districts are relatively unlikely to be Taliban dominated while Pashtun districts are more likely to be Taliban dominated. In columns 2 and 4 I summarize the relevant information on ethnicity in a single variable (*Ethnicity*) in order to maximize the statistical power associated with the first stage relationship. I set *Ethnicity* equal to 1 in Pashtun districts, -1 in Uzbek and Tajik districts, and 0 in districts associated with relatively neutral ethnicities. The coefficient on *Ethnicity* is estimated with sufficient precision to generate first-stage F-statistics in excess of 14 in both columns 2 and 4.

Table 4: **Taliban Influence and Changes in Poppy Cultivation**

	Eliminated Coeff./SE	Eliminated Coeff./SE	Reduced Coeff./SE	Reduced Coeff./SE	Pct Change Coeff./SE	Pct Change Coeff./SE
High Security Threat	-0.7790**		-0.3843*		1.2279**	
	(0.1894)		(0.1633)		(0.4242)	
Categorical Security Threat		-0.3684**		-0.1817*		0.5807**
		(0.0872)		(0.0762)		(0.1966)
Intercept	0.9274**	1.3460**	0.9748**	1.1813**	-1.8738**	-2.5335**
	(0.0540)	(0.1384)	(0.0310)	(0.1073)	(0.0953)	(0.2796)
Implied Targeting Parameter: ρ_1	0.075		0.235		0.177	
N	233	233	233	233	233	233
Number of Clusters	31	31	31	31	31	31
Estimator	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Instrument	Ethnicity	Ethnicity	Ethnicity	Ethnicity	Ethnicity	Ethnicity

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. Standard errors allow for the possibility that errors are correlated at the level of the 31 administrative provinces contained in the sample. The table reports coefficients from instrumental variables estimates of equation (4). The first stage regression associated with columns 1, 3, and 5 can be found in column 2 of Table 3, while the first stage associated with columns 2, 4, and 6 can be found in column 4 of Table 3. In both cases the instrument is an indicator set equal to 1 in Pashtun districts, -1 in Uzbek and Tajik districts, and 0 in districts associated with relatively neutral ethnicities. The sample consists of 233 Afghan districts with positive levels of opium poppy cultivation in 2004. The dependent variable in columns 1 and 2 is an indicator set equal to 1 if poppy cultivation was entirely eliminated from the district from 2004 to 2009. The dependent variable in columns 3 and 4 is an indicator set equal to 1 if poppy cultivation was reduced in the district from 2004 to 2009. The dependent variable in columns 5 and 6 is calculated as the percent change in poppy cultivation from 2004 to 2009; this percent change is calculated using the mid-point formula, and thus has a range from -2 to 2. The independent variables, which describe security conditions and the extent of Taliban control, are defined as descried in the note to Table 1.

Table 4 reports the IV estimates of the relationship between Taliban influence and changes in poppy cultivation. The 6 specifications reported in Table 4 are IV analogs of the 6 OLS specifications reported in Table 2. The coefficients are relatively little changed from the results in Table 2. The results describing the relationship between Taliban influence and the elimination of poppy cultivation are strengthened (columns 1 and 2), with the high-threat indicator predicting 78 percentage point lower likelihood of elimination. The point estimates in columns 3 through 6 are shifted by less than 15 percent from their OLS counterparts. The high threat level is associated with a 38 percent lower likelihood of poppy reduction and with relative poppy cultivation increases on the order of 120 percent. Like the point estimates, estimates of the targeting parameter ρ_1 are little changed from those in Table 2.

Improved estimates of the true targeting parameter could, in principal, be obtained by weighting the regressions by each district's share of total poppy cultivation in 2004. Specifications that apply such weights can be found in Appendix Table A.1. The results are suggestive of even worse targeting than was implied by the results in Table A.1. This reflects that fact that several of the most prominent poppy-cultivating districts in southern Afghanistan experienced significant increases in production over the relevant time period. On average, the estimates thus imply a targeting parameter of less than 0.1. Statistically, however, these results are less reliable than those reported in the main text. The strong right skew of the 2004 cultivation levels places a great deal of weight on a small number of districts. Most relevant to the validity of the IV estimation framework is that this weighting scheme significantly reduces the power of the first stage.

Finally, it is again worth emphasizing that the estimates correspond to changes in poppy cultivation in districts with non-zero production levels in 2004. In the language of the model from Section 1, the estimates relate to the targeting of the output of an initial, fixed set of producers. Accounting for subsequent differences in the origination of poppy production in Taliban and non-Taliban areas would tend to result in an increasingly pessimistic assessment of the targeting parameter (see Figure 1).

2.3 The Elasticity of Demand

I estimate the elasticity of demand for opium in Afghanistan by utilizing a convenient natural experiment. In 2010, a blight beset the poppy fields of southern Afghanistan, resulting in far lower yields than were initially expected (UNODC, 2011). Southern yields averaged roughly 30 kg per hectare, roughly half of their level from the previous year. With the south accounting for the majority of national (and with it global) opium production in recent years, nationwide supply was roughly 44 percent less than anticipated and global supply roughly 38 percent less than expected. Expected and realized quantities of opium production can be found in Panel A of Table 5.

Prices rose dramatically in response to these unexpected declines in the quantity of opium supplied during the 2010 harvest. Afghan opium traders reported that year-over-year prices rose by around 99 log points from the 2009 planting season through the 2010 planting season (from around \$84 per kilogram to around \$226 per kilogram). They similarly reported that year-over-year prices rose by around 115 log points from the lead-up to the 2010 harvest to the lead-up to the 2011 harvest (from around \$95 per kilogram to around \$300 per kilogram).[17] Various permutations of the price and quantity effects of the poppy blight can be found in Table 5's Panel C. As reported in column 3, they imply demand elasticities ranging from -0.33 to -0.44.

An alternative approach, taken by Clemens (2008), involves backing out the elasticity of demand for opiates within Afghanistan's borders by using estimates of demand

[17] Seasonality in opium prices makes year-over-year price changes a more appropriate means of estimating the demand-side response to the poppy blight than relatively high-frequency changes. High-frequency price changes are also difficulty to utilize in this setting due to uncertainty over both the timing of the blight and the pace at which news of the blight would have traveled to Afghanistan's various regions.

Table 5: **Estimates of the Elasticity of Demand for Opium within Afghanistan**

Panel A: Opiate Production in 2009 and 2010 (metric tonnes)			
	2009 Actual	2010 Expected	2010 Actual
Southern Afghanistan	6026	5878	2984
Rest of Afghanistan	865	616	616
Afghanistan Total	6891	6434	3580
Rest of Rest of World	853	1075	1075
World Total	7744	7505	4655
Panel B: Opium Prices in 2009-2011 (Dollars per kilogram)			
	2009	2010	2011
Pre-Planting Season	84	226	
Pre-Harvest Season		95	300
Panel C: Demand Elasticity Estimates			
	% $\triangle$ Quantity	% $\triangle$ Price	Elasticity
Estimate 1	-44%	99%	-0.44
Estimate 2	-38%	99%	-0.38
Estimate 3	-44%	115%	-0.38
Estimate 4	-38%	115%	-0.33

Note: Data on opium production and prices come from reports by the United Nations Office on Drugs and Crime (UNODC, 2010, 2011, 2012). In Panel B, the estimates of the percentage change in quantity refer to differences between expected and realized quantities. Realized quantities are taken directly from the UNODC's reports. The expected quantity in Afghanistan's southern region was calculated by multiplying the 2009 crop yield by the 2010 level of land under poppy cultivation. Realized yields were much lower due to an unusually destructive poppy-disease (UNODC, 2011). The quantity changes used for estimates 1 and 3 involve the production reductions as shares of Afghan production only. The quantity changes used for estimates 2 and 4 involve the production reductions as shares of global production. The price changes used for elasticity estimates 1 and 2 are year-over-year changes in prices reported during the September run-up to the planting season (UNODC, 2011) during the years surrounding the onset of the poppy disease. The price changes used for elasticity estimates 3 and 4 are year-over-year changes in prices reported during the March run-up to the harvest season (UNODC, 2012) during the years surrounding the onset of the poppy disease.

elasticities in retail markets. This exercise produces a range of relatively small demand elasticites, running from -0.02 to -0.16.[18] Such low elasticities have even more pessimistic implications for the effects of opium interdiction and poppy eradication efforts than the elasticities just estimated.

2.4 Estimating the Effect of Anti-Opium Efforts on Taliban Resources

I use the results above to estimate the implications of anti-opium enforcement circa 2004 (the base year from which the targeting parameter was estimated) on the resources available to the Taliban. I take my preferred estimate of the targeting parameter to be the estimate of 0.18 from column 5 of Table 4. I take the demand elasticity to be -0.4, the market price to be \$142 per kg (UNODC, 2004), and estimate the 2004 market share of Taliban-heavy areas to be 40 percent. Placing these estimates into the formula for the welfare effect of incremental enforcement yields:

$$\begin{aligned}\frac{dW}{dE} &= -\lambda_1 p \rho_1 + \lambda_1 p \frac{1}{-\epsilon_D} \frac{[q_1 - E_1]}{Q_{\text{net}}} \\ &= -\lambda_1 142 \times 0.18 + \lambda_1 142 \frac{1}{0.4} .4 \\ &= \lambda_1 116. \end{aligned} \tag{6}$$

The parameterization implies that seizing or deterring the production of one kilogram of opium channels roughly \$116 in income to farmers in Taliban-heavy areas.[19] The intended effect of reducing Taliban income by seizing 0.18 kilogram from areas they influence is swamped by the unintended effect of increasing the value of their remain-

[18]Relatively inelastic demand at the source-country level is driven by the fact that source-country prices are a very small fraction of retail prices. Source-country demand will be highly inelastic unless mark-ups from the source-country to retail markets are nearly purely multiplicative.

[19]Given the standard *ushr* of 10 percent, this would translate into \$12 for the Taliban itself.

ing opium stocks. This increase is large both because demand is relatively inelastic and because an additional 0.82 kilogram of opium in government-controlled territory has simultaneously been removed from the market.

A direct comparison of 2004 and 2010 provides a suggestive estimate of the aggregate impact of anti-opium policy on the distribution of opium income between Taliban and non-Taliban territory. In 2004, there were 131,000 hectares of land under poppy cultivation, yielding an estimated 4,200 metric tonnes, of which roughly 40 percent was produced in Taliban-heavy districts. At an average price of $142 per kilogram of dry opium, the estimated opium-source income of farmers in Taliban-heavy districts was $240 million. In 2009, there were 123,000 hectares of land under poppy cultivation, yielding an estimated 3,600 metric tonnes, of which roughly 90 percent was produced in Taliban-heavy districts. At an average price of $169 per kilogram of dry opium, the estimated opium-source income of farmers in Taliban-heavy districts was $580 million. The opium-source income of Taliban-heavy territory had thus more than doubled, as had its share of the total.

3 Additional Model Calibrations Involving Conflict with an Oil-Producing Country

In this section I expand the application of section 1's model of economic warfare to the context of conflicts involving oil-producing nations. Historical conflicts involving oil-producing nations point to many of the salient considerations surrounding economic warfare. The years following the U.S. invasion of Iraq, for example, saw extensive insurgent efforts to derail Iraqi oil production and sabotage its pipelines (Fattouh, 2007). The Iran-Iraq War also featured several permutations of relevant strategies. These included the early destruction of Iraq's port facilities (Foote et al., 2004), Iraqi responses in kind

(Sterner, 1984), and Iranian threats, directed at the world as a whole, "to close the Gulf for 'everybody'" (Sterner, 1984, p.129). In contrast with the previous section's analysis of anti-opium policy, conflicts involving oil-producing countries provide illustrations of equation (2)'s implications in a setting where targeting should not be particularly difficult.

3.1 A Short-Run Conflict Involving Iran

Consider a hypothetical conflict involving Iran, which accounts for 5 percent of global oil output so that $\frac{[q_1 - E_1]}{Q_{\text{net}}} = 0.05$ (USEIA, 2012). Typical estimates of the short-run elasticity of demand for oil are on the order of -0.1 (Cooper, 2003; Hamilton, 2008). Substituting these numbers into equation (2) yields $\rho_1^* = 0.5$. If oil infrastructure can be readily targeted, the targeting parameter should approach 1. This implies that incremental destruction of Iranian oil output and/or infrastructure could improve the reference nation's welfare absent additional, unmodeled considerations.

The reference nation's own position in the oil market may radically alter the net benefit it realizes from attempting economic warfare with Iran. A net importer of oil will suffer losses from the increase in oil's price. For the United States, the benefit from reducing Iranian resources would thus be blunted, and possibly reversed, by domestic considerations. In contrast, a net exporter stands to gain from the resulting increase in the value of its own production. Beyond their obvious military value, attacks on one another's oil infrastructure may thus have served more explicitly economic ends in the case of the Iran-Iraq War. The same can be said for efforts to sabotage Iraqi oil production following the U.S.'s 2003 invasion. It is also apparent that a net exporter like modern-day Russia can benefit substantially from protracted Middle East instability. A broader range of consequences, including the potential escalation of existing conflicts and changes in the environment of international relations, are also of clear importance;

these considerations are well beyond this paper's scope.

3.2 A Short-Run Conflict Involving Russia

Next consider a hypothetical conflict involving Russia, which accounts for 12 percent of global oil output (USEIA, 2012), so that $\frac{[q_1 - E_1]}{Q_{\text{net}}} = 0.12$. With a short-run elasticity of demand for oil of -0.1, equation (2) yields $\rho_1^* = 1.2$. Since the targeting parameter is bounded from above by 1, it is impossible for incremental enforcement to improve the reference nation's welfare in this scenario. The short-run elasticity of demand for oil is sufficiently low that attempts to reduce the income of a moderately-sized market participant can have the opposite of the desired effect.

3.3 A Short-Run Conflict Involving Iran Supplemented by Additional Concerns about Russia

Consider next a hypothetical in which the reference nation is in active conflict with Iran (country 1) and also has misgivings about the resources available to Russia (country 2). Assuming perfect targeting of Iranian output, we can write:

$$\begin{aligned}\frac{dW}{dE} =& -\lambda_1 p[1 - \frac{1}{-\epsilon_D}\frac{[q_1 - E_1]}{Q_{\text{net}}}] \\ &+ \lambda_2 p \frac{1}{-\epsilon_D}\frac{[q_2 - E_2]}{Q_{\text{net}}}. \end{aligned} \tag{7}$$

Equation (7) implies that incremental enforcement improves the reference nation's welfare if $\rho_1 > \rho_1^*$ and the expression below holds:[20]

[20]The condition that $\rho_1 > \rho_1^*$ ensures the minimum requirement that incremental enforcement actually reduces the resources available to the targeted adversary. This is a necessary, but not sufficient, condition for enforcement to improve welfare in this scenario.

$$\frac{\lambda_1}{\lambda_2} > \frac{\frac{1}{-\epsilon_D}\frac{[q_2 - E_2]}{Q_{\text{net}}}}{1 - \frac{1}{-\epsilon_D}\frac{[q_1 - E_1]}{Q_{\text{net}}}}. \tag{8}$$

The denominator of (8)'s right hand side is positive when $\rho_1 > \rho_1^*$. Concern for Russian resources results in an additional cost from enforcement targeted at Iran, as the reduction in the total quantity supplied increases the value of Russia's output. This is captured by the numerator of (8)'s right hand side, which is positive unless demand is infinitely elastic, in which case the expression equals 0. For the increase in enforcement to improve welfare, the ratio of dollars given to Russia to dollars taken from Iran must be sufficiently small. Specifically, it must be smaller than the ratio describing the reference nation's relative disutility from resources flowing to these two countries.

Substituting into the expression, we have $\frac{\lambda_1}{\lambda_2} > \frac{\frac{1}{0.1}\times 0.12}{1-\frac{1}{0.1}\times 0.05} = \frac{1.2}{0.5}$. Thus incremental enforcement could improve the reference nation's welfare if disutility from Iranian resources is more than 2.4 times disutility from Russian resources.

3.4 A Long-Run Conflict Involving Iran Supplemented by Additional Concerns about Russia

Consider finally the case in which the conflict from the previous example is expected to last for quite some time. This variant is relevant because the long-run elasticity of demand for oil is much larger than the short-run elasticity. Typical estimates place it in the neighborhood of -0.5 (Hamilton, 2008). The required ratio of disutility from Iranian resources relative to Russian resources declines with this elasticity.[21] With a demand elasticity of -0.5, it declines by nearly 90 percent to just over 0.25.

[21]It also rises as either adversary's market share rises.

4 Discussion

The contrast between this paper's analysis of economic warfare in the contexts of the oil market and Afghan opiates highlights the importance of targeting. When targeting faces few impediments, as may be true in the case of oil infrastructure, successful economic warfare becomes plausible. When targeting is difficult, the prospects for success are highly unfavorable; poorly targeted enforcement can only yield the intended result when the relevant market's demand is highly elastic. The Afghan opiate industry emerges as a context in which the targeting problem has, for a number of years, appeared to be intractable. I conclude with some discussion of why this might be the case and how general the relevant issues might be.

The most obvious explanation for ineffective targeting of Taliban poppy is territorial control. Afghanistan's national government has the capacity to enforce the poppy ban in areas it controls, while enforcement elsewhere is difficult if not impossible. It follows quite directly that Taliban-loyal poppy farmers are less likely to be encountered by poppy-ban enforcers.

A second explanation relates to the government's persuasive influence. Conditional on the government's degree of territorial control, Taliban-oriented farmers are relatively un-persuadable for two reasons. Soft persuasion is relatively ineffective on Taliban-oriented farmers because they are, by definition, disinclined to respect the government's legal authority; they are thus unlikely to abstain from cultivating poppy out of respect for the ban itself. Similarly, persuasion through the threat of enforcement is made difficult by the Taliban's protective services.

A third potential explanation for the difficulty of targeting Taliban-loyal poppy farmers relates to contracting, specifically to the incentives laid out for those implementing enforcement on the ground. In this and other prohibition-related contexts, perfect targeting could, in principal, be achieved through a strategy of catch-and-release; enforcement agents could turn a blind eye when they encounter non-adversarial producers. Because catch-and-release incidents generate little tangible evidence, however, they are difficult to verify and reward. Instead, anti-drug enforcement agencies tend to be rewarded on the basis of interdiction statistics and the ability to show "drugs on the table."[22]

Difficulties with economic warfare may extend to a broad range of prohibition-related contexts. Reflecting on the cartels associated with modern drug trafficking, as in Mexico, policymakers' dislike of industry participants is driven in part by their capacity to generate violence. The ability to target market participants will thus quite naturally be negatively correlated with the extent to which they are viewed as adversaries. The tendency for enforcement to increase the market shares of those most capable of generating violence, and least inclined to respect legal authority, creates an important impediment to the effectiveness of income-suppression policies.

References

Andersson, C. 2010. "Counterproductive counternarcotic strategies? A study of the effects of opium eradication in the presence of imperfect capital markets and share-cropping arrangements." *Umeå Economic Studies*.

Becker, G.S. 1968. "Crime and Punishment: An Economic Approach." *The Journal of Political Economy*, 76(2): 169–217.

Becker, G.S., K.M. Murphy, and M. Grossman. 2006. "The market for illegal goods: the case of drugs." *Journal of Political Economy*, 114(1): 38–60.

Berman, E., J.N. Shapiro, and J.H. Felter. 2011. "Can Hearts and Minds Be Bought? The Economics of Counterinsurgency in Iraq." *Journal of Political Economy*, 119(4): 766–819.

[22] Also potentially relevant is that, on a purely operational level, there may be difficulty transmitting an order that policy has become selectively anti opium.

Berman, E., M. Callen, J.H. Felter, and J.N. Shapiro. 2011. "Do working men rebel? Insurgency and unemployment in Afghanistan, Iraq, and the Philippines." *Journal of Conflict Resolution*, 55(4): 496–528.

Blanchard, Christopher M. 2009. "Afghanistan: Narcotics and U.S. Policy." Congressional Research Service.

Caulkins, Jonathan P., and Peter Reuter. 2006. "Illicit drug markets and economic irregularities." *Socio-Economic Planning Sciences*, 40(1): 1 – 14.

Chetty, R. 2009. "Sufficient Statistics for Welfare Analysis: A Bridge Between Structural and Reduced-Form Methods." *Annu. Rev. Econ.*, 1(1): 451–488.

Clemens, J. 2008. "Opium in Afghanistan: Prospects for the Success of Source Country Drug Control Policies." *Journal of Law & Economics*, 51(3): 407–432.

Cooper, J.C.B. 2003. "Price elasticity of demand for crude oil: estimates for 23 countries." *OPEC review*, 27(1): 1–8.

Dell, M. 2011. "Trafficking Networks and the Mexican Drug War (Job Market Paper)."

Fattouh, B. 2007. *How secure are Middle East oil supplies?* Oxford Institute for Energy Studies.

Foote, C., W. Block, K. Crane, and S. Gray. 2004. "Economic policy and prospects in Iraq." *The Journal of Economic Perspectives*, 18(3): 47–70.

Galtung, J. 1967. "On the effects of international economic sanctions: With examples from the case of Rhodesia." *World Politics*, 19(3): 378–416.

Glaeser, Edward L., and Andrei Shleifer. 2001. "A Reason for Quantity Regulation." *American Economic Review*, 91(2): 431–435.

Hamilton, J.D. 2008. "Understanding crude oil prices." National Bureau of Economic Research.

Kennedy, M., P. Reuter, and K.J. Riley. 1993. "A simple economic model of cocaine production." *Mathematical and computer modelling*, 17(2): 19–36.

Mansfield, D. 2012. "'TAXATION' IN CENTRAL HELMAND." Afghanistan Research and Evaluation Unit.

Miron, J.A. 1999. "Violence and the US Prohibitions of Drugs and Alcohol." *American Law and Economics Review*, 1(1): 78–114.

Miron, J.A. 2001. "Violence, Guns, and Drugs: A Cross-Country Analysis*." *Journal of Law and Economics*, 44(S2): 615–633.

Miron, J.A., and J. Zwiebel. 1995. "The economic case against drug prohibition." *The Journal of Economic Perspectives*, 9(4): 175–192.

Pape, R.A. 1997. "Why economic sanctions do not work." *International Security*, 22(2): 90–136.

Peters, G. 2009. *How opium profits the Taliban.* United States Institute of Peace (USIP).

Reyes, L.C. 2010. "The Effect of Forced Eradication on Coca Production in Colombian Municipalities."

Richardson, L.F. 1960. *Arms and insecurity: A mathematical study of the causes and origins of war.* Boxwood Press.

Sterner, M. 1984. "The Iran-Iraq War." *Foreign Aff.*, 63: 128.

Tarnoff, C. 2011. "Afghanistan: US foreign assistance." Congressional Research Service.

Tullock, G. 1974. *The social dilemma: The economics of war and revolution.* University publications Blacksburg, VA.

UNODC. 2004. "Afghanistan Opium Survey 2004." United Nations Office on Drugs and Crime.

UNODC. 2010. "Afghanistan Opium Survey 2009." United Nations Office on Drugs and Crime.

UNODC. 2011. "Afghanistan Opium Survey 2010." United Nations Office on Drugs and Crime.

UNODC. 2012. "Afghanistan Opium Survey 2011." United Nations Office on Drugs and Crime.

USEIA. 2012. "International Energy Statistics." U.S. Energy Information Administration.

Appendix 1: Supplemental Figures and Tables

Table A.1: **Taliban Influence and Changes in Poppy Cultivation: Weighted Regressions**

	Eliminated Coeff./SE	Eliminated Coeff./SE	Reduced Coeff./SE	Reduced Coeff./SE	Pct Change Coeff./SE	Pct Change Coeff./SE
High Security Threat	-0.3348		-0.8064**		2.3289**	
	(0.5127)		(0.2131)		(0.4869)	
Categorical Security Threat		-0.1727		-0.4159**		1.2009**
		(0.2767)		(0.1413)		(0.3365)
Intercept	0.5377*	0.7431	1.0532**	1.5477**	-2.0825**	-3.5106**
	(0.2668)	(0.6022)	(0.0632)	(0.2529)	(0.1479)	(0.6262)
Implied Targeting Parameter: ρ_1	0.160		0.106		-0.080	
N	233	233	233	233	233	233
Number of Clusters	31	31	31	31	31	31
Estimator	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Instrument	Ethnicity	Ethnicity	Ethnicity	Ethnicity	Ethnicity	Ethnicity
Weight	2004 Poppy	2004 Poppy	2004 Poppy	2004 Poppy	2004 Poppy	2004 Poppy

Note: **, *, and + indicate statistical significance at the 0.01, 0.05, and 0.10 levels respectively. Standard errors allow for the possibility that errors are correlated at the level of the 31 administrative provinces contained in the sample. The table reports coefficients from instrumental variables estimates of equation (4). The first stage regression associated with columns 1, 3, and 5 can be found in column 2 of Table 3, while the first stage associated with columns 2, 4, and 6 can be found in column 4 of Table 3. In both cases the instrument is an indicator set equal to 1 in Pashtun districts, -1 in Uzbek and Tajik districts, and 0 in districts associated with relatively neutral ethnicities. The sample consists of 233 Afghan districts with positive levels of opium poppy cultivation in 2004. The dependent variable in columns 1 and 2 is an indicator set equal to 1 if poppy cultivation was entirely eliminated from the district from 2004 to 2009. The dependent variable in columns 3 and 4 is an indicator set equal to 1 if poppy cultivation was reduced in the district from 2004 to 2009. The dependent variable in columns 5 and 6 is calculated as the percent change in poppy cultivation from 2004 to 2009; this percent change is calculated using the mid-point formula, and thus has a range from -2 to 2. The independent variables, which describe security conditions and the extent of Taliban control, are defined as descried in the note to Table 1.