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An Analysis of Economic Warfare[†]

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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 its 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 US efforts to reduce the resources of Taliban-loyal insurgents by suppressing the Afghan opium trade, with additional applications to conflicts involving oil-producing nations.

The Taliban historically profited from the opium trade through a 10 percent tax on farmers, known locally as *ushr*, and by providing traffickers with protection services. This link 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.

In related work, Clemens (2008) shows that policies directed at Afghan farmers (e.g., crop eradication and efforts to develop alternative livelihoods) are unlikely to achieve much success at reducing flows of opiates. Such policies are encumbered by relatively inelastic demand and by their limited capacity to shift the supply curve. Other proposals include interdiction strategies targeted at traffickers and other figures less sympathy inspiring than the typical Afghan farmer.[2] A recent set of policy recommendations by Peters (2009, p. 34), for example, suggests "establishing checkpoints manned by NATO troops and counternarcotics police to seize drug shipments on highways" and "destroying drug labs and targeting opium convoys." These interdiction efforts, crop eradication, and the ban on poppy cultivation all map into the policies modeled below.

Conflicts involving oil-producing nations also highlight many of the salient considerations surrounding economic warfare. The years following the US 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 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).

I. A Model of Economic Warfare

The following model contains a simple but informative framework for assessing the potential effectiveness of economic warfare. The

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[1] Also relevant, in particular in counterinsurgency 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] Recent work by Reyes (2010) and Andersson (2010) highlights additional complications associated with drug control policies targeted at farmers in drug-crop source countries.

policies under consideration involve the reduction of output in an industry in which at least one market participant is an adversary.

I characterize the industry as involving the output of a fixed number, N, of actors or regions (think, e.g., drug cartels, Afghanistan's administrative provinces, or oil-producing countries).[3] Due to alliances and adversarial relationships, US welfare, W, depends on the incomes, I_i, of each of these N regions. 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.[4]

I characterize the incomes of the regions as follows. Gross industrywide output is $Q_{\text{gross}} = \sum_{i=1}^{N} q_i$. The policy of interest is an "enforcement" level, E. In the Afghan context, 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 region i. This leaves net output of $Q_{\text{net}} = Q_{\text{gross}} - E$. Demand determines the market-clearing price, with $P = p(Q_{\text{net}})$. Region i's income is, thus, $I_i = [q_i - E_i] \times p(Q_{\text{net}})$.

The extent to which enforcement falls upon region i depends on a targeting parameter, ρ_i, with $E_i = \rho_i E$. The ability to target enforcement at regions with low λ_i is clearly crucial for the success of economic warfare. I treat the ρ_i as reflecting fixed limitations on the United States's ability to target.[5] Given these ρ_i, the expression for welfare can be written as

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

The analysis is simplest when enforcement is thought of as a surprise, postproduction move made in the context of a one-shot game. In subsequent periods one must account for strategic responses of production to expected enforcement.[6] 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 US welfare directly through domestic markets.[7] While these extensions add complexity to the analysis, the factors emphasized below remain central.

If there is a single adversarial region, with the United States expressing indifference to the incomes flowing to all others, then the effect of an incremental increase in enforcement on welfare is described by

$$(2)\quad \frac{dW}{dE} = -\lambda_1 p \rho_1 + \lambda_1 p \frac{1}{-\epsilon_D} \frac{[q_1 - E_1]}{Q_{\text{net}}},$$

where ϵ_D is the market's elasticity of demand. The first term describes the intended benefit of enforcement, namely the reduction in the adversary's income that comes from eliminating ρ_1 units of its output. The second term describes the unintended consequence, namely the increase in the value of the adversary's output that results from eliminating a full unit from the market. The expression highlights the importance of both the targeting parameter and the market's elasticity of demand. Incremental enforcement improves welfare if and only if

$$(3)\quad \rho_1 > \rho_1^* = \frac{1}{\epsilon_D} \frac{[q_1 - E_1]}{Q_{\text{net}}}.$$

[3] 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).

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

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

[6] 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.

[7] 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).

II. Real World Calibrations

In this section I calibrate the welfare effects of economic warfare in two real world scenarios.

A. *Conflict Involving an Oil-Producing Country*

Conflicts involving oil-producing countries provide useful illustrations of equation (3)'s implications. Consider a hypothetical conflict involving Iran, which accounts for 5 percent of global oil output (USEIA 2012), so that $\frac{[q_1 - E_1]}{(Q_{\text{net}})} = 0.05$. 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 (3) yields $\rho_1^* = 0.5$. If oil infrastructure can be readily targeted, the targeting parameter will approach 1, implying that, absent any unmodeled consideration, incremental destruction of Iranian oil output and/or infrastructure could improve the reference nation's welfare.[8]

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 (3) yields $\rho_1^* = 1.2$. Since the targeting parameter is bounded from above by 1, it is impossible for incremental enforcement to improve welfare in this scenario. Demand for oil is sufficiently inelastic in the short run that attempts to suppress the income of a moderately sized market participant can have the opposite of the desired effect.

B. *The Case of Afghan Opiates*

I now move to this paper's primary application of economic warfare, which involves efforts to suppress the Afghan opiate industry. With the export value of opiates regularly amounting to one-sixth to one-third of Afghanistan's GDP (UNODC 2012, 2009), the potential for opium-source income to fuel the insurgency is a salient concern. Furthermore, historical concentrations of poppy cultivation in Taliban-controlled areas raise the possibility of a well-targeted anti-opium campaign. As shown below, reality has played out quite differently.

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 US welfare; this income undermines US security interests as well as its concerns associated with the war on drugs. US sentiment toward 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 a US 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.

A retrospective analysis of anti-opium policy in Afghanistan looks bleak for reasons related to each of the key parameters from equation (3). I begin with an assessment of the targeting parameter.

C. *The Targeting Problem*

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 traditions (including 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.

[8] A broader range of consequences, including escalation of existing conflicts and changes in the environment of international relations, are also of clear importance, but are well beyond this paper's scope.

By 2011, following an increase in emphasis on eliminating the opiate industry, 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 cultivation occurred in Taliban-heavy provinces. 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.

To a first approximation, shifts in poppy cultivation suggest a targeting parameter of $\rho_{Taliban} = 0$. Elsewhere, in a more detailed analysis, I estimate the targeting parameter to be roughly 0.15 (Clemens 2013).

D. *The Elasticity of Demand*

Elsewhere I also present details underlying an estimate of the elasticity of demand for Afghan opium (Clemens 2013). The estimate is based on the response of opium prices to a large, unexpected shock to supply. In 2010, a crop disease led southern Afghanistan to experience far lower opium yields than were initially expected (UNODC 2010). The response of prices to this unexpected supply shock suggests an elasticity on the order of -0.3.

E. *The Effect of Anti-Opium Efforts on Taliban Resources*

I use the parameter estimates discussed above to calibrate the implications of anti-opium enforcement for the resources available to the Taliban circa 2004 (the base year for which the targeting parameter was estimated). I take the targeting parameter to be 0.15, the demand elasticity to be -0.3, the market price to be \$100 per kg, and estimate the 2004 market share of Taliban-controlled areas to be 0.4. Placing these estimates into the formula for the welfare effect of incremental enforcement yields

$$\begin{aligned}\frac{dW}{dE} &= -\lambda_1 p\rho_1 \\ &\quad + \lambda_1 p \frac{1}{-\epsilon_D} \frac{[q_1 - E_1]}{Q_{\text{net}}} \\ &= \lambda_1 100 \times 0.15 + \lambda_1 100 \frac{1}{0.3} \cdot 4 \\ &= \lambda_1 118.\end{aligned}$$

The parameterization implies that seizing or deterring the production of one kilogram of opium channels roughly \$120 in income to farmers in Taliban-controlled areas.[9] The intended effect of reducing Taliban income by seizing 0.15 kilogram from areas they control is swamped by the unintended effect of increasing the value of their remaining opium stocks. This increase is large both because demand is relatively inelastic and because an additional 0.85 kilogram of opium in government-controlled territory has simultaneously been removed from the market.

III. Conclusion

The contrast between this paper's analysis of economic warfare in the contexts of oil-producing countries and Afghan opiates highlights the importance of targeting. When targeting faces few impediments, as with efforts to destroy a particular adversary's oil infrastructure, efforts to suppress adversaries' sources of income can achieve their objectives. When targeting is difficult, the prospects for success are unfavorable; poorly targeted enforcement can yield desirable results only 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.

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[9] Within an *ushr* of 10 percent, this would translate into \$12 for the Taliban itself.

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