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Unintended Consequences of Enforcement in Illicit Markets

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Abstract

Legal enforcement of bans on goods can reduce the size of the black market but lead to greater violence by increasing revenue in the illicit market. However, the link between enforcement and violence is not as simple as is suggested by the textbook model, even for a competitive market. Nevertheless, under plausible assumptions more enforcement on trafficking in the illicit good leads to more violence.

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1. Introduction

The textbook model of markets for illicit drugs (as in Frank and Bernanke (2004), for example) predicts that stronger enforcement raises prices, revenue, and violence. The clear prediction depends on inelastic demand, the assumed competitiveness of the market, and enforcement that targets suppliers only. Models of noncompetitive black markets or markets in disequilibrium, on the other hand, find that the link between enforcement and violence can take other forms (Caulkins et al., 2003; Caulkins and Reuter, 2010; Rasmussen et al., 1993). This note shows that even in a competitive market in equilibrium, enforcement against trafficking in the illicit good can lead to less violence as long as it also includes buyers. Nevertheless, under plausible assumptions for illicit drug markets, enforcement will lead to more violence.

2. The Model

Consider a competitive market for a banned good. While in principle the market may be for any illicit good, demand for the good is assumed to be inelastic as in the markets for addictive substances. Effort expended in enforcement against trafficking in the good is proxied with a continuous variable, $e \geq 0$. The other assumptions and notation follow.

Supply

The quantity supplied in the absence of enforcement is q_S, a function of the net price sellers receive p_S. Function q_S derives as usual from marginal production and distribution costs. We assume q_S is a differentiable function with $q_S' > 0$, and denote the supply elasticity with $\eta_S = q_S'(p_S)\, p_S / q_S(p_S) > 0$. Enforcement of the ban raises the effective marginal cost of doing business by a fraction $\varphi(e)$. Following Reuter and Kleiman (1986), these additional costs include the monetization of the non-monetary perceived risks of arrest, sanction, fine, and incarceration, as well as any supply-disruptive activity following from enforcement, such as

product seizure. We assume that $\varphi(0) = 0$ and $d\varphi/de > 0$. Marginal production costs are $MC(Q_S)(1+\varphi)$ with a ban. Price p will refer to the monetary price exchanging hands in the market, excluding any risk adjustments. Defining $\psi = (1+\varphi)^{-1}$, the quantity supplied under enforcement is thus:[1]

$$Q_S(p,e) = q_S(\psi(e)p). \tag{1}$$

The properties of φ imply that $\psi(e) > 0$, $\psi(0) = 1$ and $d\psi/de < 0$.

Demand

The illicit quantity demanded under a ban, q_D, is a downward-sloping, differentiable function of the effective price consumers must pay, p_D. Demand elasticity is $\eta_D = -q_D'(p_D)\,p_D/q_D(p_D)$, and presumed to be inelastic: $0 \le \eta_D < 1$. If enforcement targets buyers, then the perceived inclusive expenditure on the product rises by multiple $\rho(e)$. This "risk tax" on buyers acts like a psychic expenditure tax of rate $\rho - 1$. We assume the risk tax satisfies $\rho(0) = 1$ and $d\rho/de > 0$. In this simple model there is only a single variable for enforcement, and any differential impact of enforcement on the two sides of the market caused by different allocations of enforcement effort is captured implicitly by the elasticities of the functions φ and ρ. The quantity demanded at black market price p, accounting for buyer risk from enforcement, is:

$$Q_D(p,e) = q_D(\rho(e)p). \tag{2}$$

Violence

Since the insights of Goldstein (1985), it is common in models of illicit markets to assume that violence V rises with illicit revenue R earned in the market: $V'(R) > 0$. V includes both demand-side crime committed to raise money for purchasing the good and crime

[1] The derivation follows from the fact that the supply function is the inverse of the marginal cost curve of the industry. Inversion of $p = MC(Q_S)(1+\varphi)$ yields $Q_S = MC^{-1}(p/[1+\varphi(e)])$ and thus equation (1).

perpetrated among suppliers (for example, to establish sales turf). We set aside any direct beneficial effect of enforcement effort on violence ($\partial V/\partial e = 0$), since (following the textbook model) we model enforcement against trafficking and not violence per se.

3. The Impact of Enforcement on Violence

Consider how prices, revenue, and violence change as enforcement ramps up. Define excess demand as $G(p,e) = Q_D(p,e) - Q_S(p,e)$. Then applying the implicit function theorem to the equilibrium condition $G(p,e) = 0$ gives an expression for how the equilibrium price changes with enforcement:[2]

$$\frac{dp}{de} = -\frac{\partial G/\partial e}{\partial G/\partial p} = -\frac{\eta_D\,\rho'/\rho + \eta_S\,\psi'/\psi}{\eta_D + \eta_S}p \tag{3}$$

where the elasticities are understood to be evaluated at the effective prices ρp and ψp. The denominator of (3) is unambiguously positive, and so the sign of the expression depends only on the numerator. Thus market price will increase with marginal increases in enforcement if and only if

$$\eta_D \epsilon_\rho < -\eta_S \epsilon_\psi \tag{4}$$

where ϵ_f is the elasticity of function f with respect to enforcement. Both sides of inequality (4) are positive. The left side captures the demand-side price sensitivity to changes in enforcement, while the right side reflects the supply side. Whether the condition is satisfied depends on the relative magnitudes involved. This conclusion is in contrast to the simple textbook reasoning that more enforcement leads to higher prices by shifting the supply curve up. The price effect of increased enforcement is ambiguous in general because if demand is elastic enough or

[2] The derivation uses the facts that $-q_D'(\rho p)\cdot(\rho p/Q_D) = \eta_D(\rho p)$ and $q_S'(\psi p)\cdot(\psi p/Q_S) = \eta_S(\psi p)$.

consumers are highly sensitive to enforcement risk, the demand-side effects can cause the market price to fall. We analyze various cases below to draw additional insight from the model.

If the demand curve did not shift, and demand is inelastic as assumed, then knowing the direction of the price change also lets us know how revenue and violence change. However, when the demand curve shifts downward in response to enforcement, there is a countervailing effect on revenue. Equilibrium revenue can be written as $R = \hat{p}Q_D(\hat{p}, e)$, where $\hat{p}$ is the equilibrium price given enforcement level e. The total impact on violence of a marginal change in enforcement level is

$$\frac{dV}{de} = \frac{dV}{dR}\frac{dR}{de} = \frac{dV}{dR}\left[\frac{d\hat{p}}{de}Q + \hat{p}\left(\frac{\partial Q_D}{\partial p}\frac{d\hat{p}}{de} + \frac{\partial Q_D}{\partial e}\right)\right]$$

$$= \frac{dV}{dR}\left[\underbrace{\left(Q + \hat{p}\frac{\partial Q_D}{\partial p}\right)\frac{d\hat{p}}{de}}_{\text{price effect}} + \underbrace{\hat{p}\frac{\partial Q_D}{\partial e}}_{\substack{\text{demand-shifting} \\ \text{effect}}}\right] \tag{5}$$

We have $dV/dR > 0$ by assumption. The first term in the brackets is the price effect. When enforcement rises, the price changes in accord with equation (3), which has a marginal impact on revenue. The term in parentheses in the price effect is the usual marginal revenue term for an increase in price. For the assumed inelastic demand, this term is always positive:

$$Q + \hat{p}\frac{\partial Q_D}{\partial p} = Q(1 - \eta_D) > 0.$$

Thus, when the demand curve sits still, revenue change has the same sign as $d\hat{p}/de$. This is usually assumed in the textbook analysis of illicit markets and violence.[3] However, the second term in equation (5), the direct impact of enforcement on the demand curve (the "demand-shifting" effect, or DSE), is negative. From equation (2), we have:

[3] See, e.g., Caulkins et al. (2006): "A standard argument in the analysis of drug markets is that when enforcement drives up the price of the drug, it also increases the revenues flowing to drug dealers if demand is inelastic."

$$DSE = \hat{p}\frac{\partial Q_D}{\partial e} = -\eta_D R \epsilon_\rho / e < 0. \quad (6)$$

This term is the offsetting effect on revenue of the demand curve shifting down in response to enforcement risk. Thus, even when the sign on the price change is clear from inequality (5), the total effect on revenue and violence is unclear. If the DSE is large enough in magnitude, there is less revenue in response to a price increase even with inelastic demand. However, the DSE is smaller in magnitude when demand is more inelastic and when the effective price paid by consumers is less sensitive to enforcement. In the conclusion we discuss why these assumptions are likely to apply to illicit drug markets. Therefore we expect that the DSE will attenuate but not reverse the primary impact on revenue of the price change. We refer to this as "assumption DSE" below in the various types of markets now considered.

Case 1: No direct enforcement on consumers

If enforcement is focused entirely on suppliers and consumers are left alone, then $\epsilon_\rho = 0$, condition (4) is satisfied, and the price rises with enforcement effort. With no countervailing DSE in equation (5), there will be greater violence with stronger enforcement. This is the textbook analysis.

Case 2: The long run in a constant-cost industry

In the long run in a competitive constant-cost industry the supply curve is horizontal. With infinite η_S, inequality (4) is satisfied and greater enforcement of a ban leads to higher prices. Under assumption DSE there will be more revenue and therefore more violence.

Case 3: Completely inelastic demand

If there is no responsiveness to price at all on the demand side, perhaps because all but the hardest-core addicts have left the market,[4] then since $\eta_D = 0$, inequality (4) is satisfied and the price rises with more enforcement. Furthermore, from equation (6) there is no DSE, so violence also rises.

Case 4: The general case

Rearranging terms, condition (4) for the price change can be expressed as:

$$\frac{\eta_D}{\eta_S} < -\frac{\epsilon_\psi}{\epsilon_\rho}. \tag{7}$$

The price will rise with more enforcement in any market in which demand is less elastic than supply and more enforcement is targeted toward the supply side (as measured by the impacts on risk-adjusted prices given by the elasticity ratios on the right side). Under assumption DSE, violence also rises in such markets. Note that small η_D and ϵ_ρ make conditions (6) and (7) both easier to satisfy.

4. Conclusions

When a good is banned, enforcement aimed at supporting the ban indirectly affects violence occasioned by the market. Enforcement shifts the supply and demand curves, which change price, revenue, and violence. In contrast to the textbook model with supply-side enforcement only, when buyers are targeted as well, two additional nuances arise in the relationship between enforcement and revenue. First, the price increase is attenuated—or even reversed—by the increased risk borne by consumers. Second, the downward shift in demand decreases revenue. Thus, the link between enforcement and violence depends on more than the

[4] The argument assumes that users wish to consume a fixed number of hits per day. On the other hand, a referee pointed out that if hard-core addicts spend virtually all their disposable income on drugs, then their demand would be very price-elastic.

elasticity of demand. However, under plausible circumstances pertaining to markets for many illicit goods—supply more elastic than demand and enforcement targeted more toward suppliers—an increase in enforcement has the unintended consequence of more violence.

It is interesting to consider applying the model to menthol cigarettes, which the United States Food and Drug Administration is considering banning.[5] Numerous studies have shown that demand for cigarettes (in general, or for menthol cigarettes in particular) is highly inelastic (Chaloupka and Warner, 2000; Tauras et al., 2010). If enforcement of a ban follows the pattern set by other illicit drug markets, enforcement will fall primarily on suppliers. Under these conditions, the model shows that enforcement raises prices, the demand-shifting effect on revenue is small, revenue rises, and there is more violence. The result does not imply that the level of violence would be as large as that associated with other illicit drugs; clearly the violence function may differ by good, geography, and other factors. Nevertheless, minimizing total harm from menthol cigarettes means minimizing the sum of social harms from consumption of the banned good and the additional harms inadvertently caused by enforcement. Policymaking should therefore consider the indirect costs of enforcement when calculating the costs and benefits of a ban.

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[5] *New York Times*, "F.D.A. Closer to Decision About Menthol Cigarettes," July 23, 2013.

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