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Can Supply Restrictions Lower Price? Violence, Drug Dealing and Positional Advantage

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Can Supply Restrictions Lower Price? Violence, Drug Dealing and Positional Advantage*

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Abstract

The standard model of markets for illicit drugs predicts that tougher enforcement against sellers will raise prices; yet cocaine and heroin prices have fallen substantially during a period of massive increases in enforcement. We present a model in which the basic mechanisms at work in the textbook model may be substantially altered by an important feature of illegal markets—violence that creates inheritable heterogeneity along a dimension that both determines relevant production cost and imposes externalities on other suppliers. Dealers frequently make use of violence and threat of violence in the normal course of trade. A seller who is particularly effective in the use of violence may face lower enforcement costs than other dealers and generate an external cost borne by those sellers. Together these features generate a number of counter-intuitive policy implications. For example the arrest of a particularly violent dealer reduces external costs borne by other dealers. The net effect is a possible reduction in costs for the marginal dealer and hence a reduction in price.

KEYWORDS: drug markets, illegal drugs, positional advantage in markets

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1. Introduction

Application of the standard competitive model to markets for illegal drugs has by now become common enough that it is featured in introductory economics texts (e.g., Frank and Bernanke, 2004). Where this model is a sufficiently realistic abstraction of real-world illegal drug markets, it provides a helpful mechanism for evaluating the effects of policy. Consider, for instance, the effect of a policy that restricts supply by incarcerating a higher fraction of drug dealers. The supply curve shifts up and to the left, increasing the market price and reducing the quantity of drugs sold in the market. In the textbook analysis, the magnitude of the reduction in equilibrium quantity is shown to depend on the elasticity of demand, as is the effect on dealers' revenues, which justifies, in part, the considerable research effort devoted to estimating the price elasticity of demand for various illegal drugs (e.g., Chaloupka and Pacula, 2000; Grossman, 2004).

Of course, understanding how enforcement against sellers affects these outcomes is important for actual policy, not just pedagogical examples. The bulk of US drug control spending goes to enforcement, as opposed to reducing demand through prevention and treatment (ONDCP, annual), and the vast majority of the incarceration stemming from that enforcement is focused on people involved in drug distribution, not those who merely use (Sevigny and Caulkins, 2004). The "risks and prices" framework developed by Reuter and Kleiman (1986), in which prices for illicit drugs are primarily accounted for by dealer risk compensation, is an exploration based on the standard competitive model.¹ As is typical of such treatments, this approach essentially assumes that there are no rents.

Our contribution here is to reexamine the standard competitive model when sellers make use of violence and the threat of violence in the normal course of trade, e.g., rely on violence as a means of enforcing contracts, resolving disputes, or protecting turf. There are two distinctive features of our model. First, we allow for heterogeneity in dealers' inclination or ability to use violence in support of their business. This endows the nastiest dealers with a permanent cost advantage; these dealers earn rents in the market for illegal drugs. Second, the effective use or threat of violence by one dealer increases the costs for other dealers; a nasty dealer's own competitive advantage comes at the expense of other dealers in the market. In particular, in our model drug dealers who are adept at the use of violence are able to secure advantageous physical locations from which to base their operations; these locations provide added protection from detection

¹ Though that framework emphasizes enforcement as a source of risk to drug dealers, it allows for compensation for risks of violence, theft or fraud by other participants in markets populated with unreliable transactors. This unreliability derives from many factors, such as the frequency with which they are incarcerated, the urgency of their desires, and the lack of recourse to courts for settlement of disputes.

from law enforcement and thus lower costs of operation. When a particularly violent dealer is removed from the market, an advantageous location opens up, reducing the costs incurred by other drug dealers.

Our model differs from the standard competitive model with respect to a number of predictions concerning policy interventions. Notably, a policy of arresting and incarcerating violent dealers may have the effect of *reducing* the equilibrium price of the drug and increasing drug consumption. This counter-intuitive outcome occurs because the arrest of a violent dealer reduces external costs borne by other dealers, with the net effect being a possible reduction in costs for the marginal dealer. This prediction is particularly interesting in light of recent trends in drug prices in the United States—over the past two decades the market prices of cocaine, heroin, and methamphetamine have declined markedly even while supply-oriented enforcement has increased so that the risk of incarceration, given participation in drug selling, may have tripled from 1980 to 2000 (Caulkins and Reuter, 1998; ONDCP, 2004; MacCoun and Reuter, 2001, Chapter 2; Caulkins and Chandler, 2005).

A second striking prediction concerns the broad market effect of a policy that *is* effective in increasing the price of the drug, e.g., an increase in the penalty faced by the marginal dealer. We show that the net effect might well be to increase the profitability of drug selling for relatively successful dealers. Many policy analyses of drug enforcement (e.g., Rydell and Everingham, 1994; Caulkins et al., 1997) have focused on outcomes related to price, quantity (e.g., quantity consumed and numbers of dependent users), and total spending, which is presumed to be related to economic-compulsive crime by users and systemic violence by sellers (Goldstein, 1985). Profits may also be of distinct interest because they can motivate violence. In particular, an intervention that reduces use (by increasing prices) but which increases rents earned by successful dealers may have the socially counter-productive effect of increasing incentives for drug-related violence and entry into the drug trade, which may have the characteristics of a tournament (Levitt and Venkatesh, 2000).

The logic we develop pertains in markets in which there is a ubiquitous presence of potential violence—violence in which sellers impose substantial externalities on each other. The markets for expensive illegal drugs such as cocaine, heroin, and methamphetamine, often fit the bill.² Caulkins and Reuter (1998) estimate that compensation for the risks and costs of violence accounts for one third of the industry cost structure for cocaine. Some of that violence comes from users (e.g., users robbing sellers for their cocaine) but much of it is “systemic” seller-on-seller violence (Goldstein, 1985), e.g., from disputes over

² Marijuana markets are different in multiple respects. For example, users are less violent, seller law enforcement risks are lower, and the distribution chain is shorter.

turf.³ Levitt and Venkatesh (2000) find that a Chicago drug selling gang was involved in violent conflict during about one quarter of the four year period for which records were available.

Before proceeding we have two additional observations concerning the structure of illegal drug markets and market-related violence. First, drug selling is predominantly an activity of individuals or loose confederations, not of large organizations. 86 percent of federal and 92 percent of state drug prisoners surveyed reported not being part of any organized group (Sevigny and Caulkins, 2004). Hence, we model sellers as individual entrepreneurs, not employees of organizations. Second, ethnographic reports make clear that although the capacity to threaten violence is an essential asset to a seller (e.g., to collect debts), most of the time the threat is sufficient. Sometimes confrontations do escalate to actual violence, and those are the incidents of greatest concern to society generally, but they are a very small proportion of all potential violent confrontations. To give some sense of this, roughly two million drug sellers conduct more than two billion transactions per year in the US, but the number of drug-related homicides is measured in the thousands (Caulkins and Chandler, 2005; Sevigny and Caulkins, 2004).⁴

On the other hand, maintaining a reputation for violence is itself costly, even if dealers manage to minimize dealer-on-dealer violence due to “turf fights.” The most obvious cost is acquiring weapons, not so much because of the dollar purchase price but rather because the (mostly illegal) weapons expose sellers to arrest risk (when in possession of the weapon but not the drugs) and longer sentences from weapons-related sentencing enhancements. Sellers may also use violence against more vulnerable targets (e.g., users who owe the dealer money) to burnish their reputation in the eyes of other sellers.

Thus while the focus of our theoretical set-up is the use of violence and the threat of violence as a means of securing cost advantage in the market, we do not explicitly concern ourselves with the welfare costs (or other consequences) of the violence *per se* but instead examine the impact on the market equilibrium and on implications for policy intervention.

³ In the Caulkins and Reuter (1998) calculations, enforcement risk (including arrest, imprisonment and seizure of drugs) accounts for the bulk of costs for retail dealers.

⁴ Of course there are markets in which the actual use of violence has escalated to high levels. Reuter, et al. (1990) found that in 1988, when drug related violence was near or at its peak, the annual probability of a Washington, D.C. dealer being killed was 1.4 percent. Nevertheless, for many markets of illegal drugs we believe it is appropriate to model capacity for violence as determining the outcomes of confrontations without explicitly modeling attrition due to mortality, while at the same time viewing outcomes that can be logically related to violence (such as the rents discussed above) as important outcomes for policy purposes.

2. Twenty Five Years of Cocaine and Heroin Markets

An important motivation for our model is the behavior of the cocaine and heroin markets, the two most important illegal drug markets in terms of revenues and social harms, over the last twenty five years. Figure 1 provides the most basic series, showing that cocaine and heroin prices fell by about 80% from 1980 to 2000 during which time drug related incarcerations rose ten fold. We briefly summarize the basis for the claim that drug imprisonments rose not just in absolute numbers but in terms of the risks of incarceration for cocaine and heroin

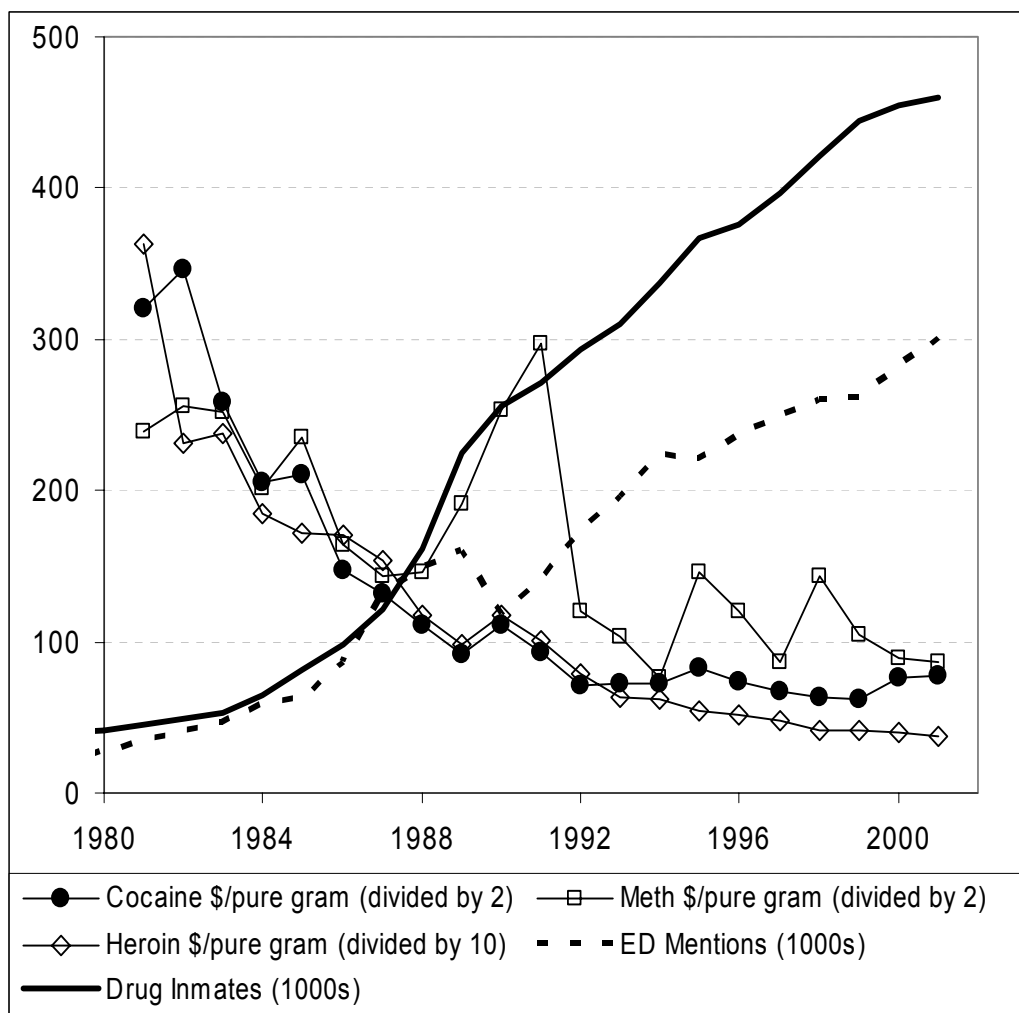


Figure 1. Drug Prices, Drug-Related Emergency Department Mentions and Total Drug-Related Incarceration, 1980-2000.

sellers⁵ and that declining demand is an implausible explanation for the drug price declines.

Converting drug incarcerations to a rate for cocaine and heroin markets requires considerable judgment with respect to both the numerator (number of cocaine and heroin dealers incarcerated) and denominator (number of active dealers). The available data on incarcerations is not drug specific. However Sevigny and Caulkins (2004) use self-report data from a large 1997 survey of federal and state prison inmates to show that over 60% are serving time for cocaine or crack offenses; heroin, marijuana, and methamphetamine each account for about 10% of drug prisoners. There are no analyses available for the 1980s, so we rely on the impressions of observers that the share for cocaine has risen and that for heroin may have fallen somewhat. The total drug incarcerations figure probably overstates the rise for heroin and understates that for cocaine but we are sure in both cases that the total has risen substantially.

For the denominator, the number of dealers, we rely on indicators from other studies, such as estimates of the population of frequent users. For the period 1988-2000, series are available for both cocaine and heroin (Rhodes et al, 2001). Both show substantial declines—nearly 50% for cocaine and 30% for heroin—and both have been subject to a number of revisions but in no version of the data have they shown substantial increases. Earlier research efforts suggest that cocaine demand increased during the period 1980-1988 but for the post 1988 period, during which the incarceration rose most rapidly, we are confident that the number of regular cocaine consumers did not increase. For heroin 1980-1988 data are sparse but there is no evidence of an increase in the user population.

It is possible that the number of dealers per user may have increased, so that a constant user population supported a larger number of dealers. There is no evidence of such a trend, and in any event such a change would have had to be extraordinarily large to change the conclusion that the risk of incarceration for a cocaine dealer or a heroin dealer rose.

The simplest explanations of declining prices are declining demand or increasing production efficiency. Though the prior discussion suggests that for cocaine consumption has ebbed since 1988, demand was likely increasing in the early to mid 1980s, the period of fastest price declines (Caulkins et al., 2004). There has not been comparable analysis of heroin demand (as opposed to indicators of quantity consumed), but conventional wisdom would be of stable demand in the 1980s and flat demand during the 1990s. While it cannot be dismissed completely, sharply declining demand is not a very plausible explanation for the fall in prices.

⁵ More detailed exposition can be found in Caulkins and Chandler (2005).

Technological improvement, in particular from “learning by doing” could have contributed to the price declines, and if large enough, might have overwhelmed the effects of the great expansion in supply control. However, surely these do not extend past the first few years of a dealer’s career, and there has been relatively little entry into either the cocaine or heroin market since the late 1980s, so that would not be likely to have much effect in the latter part of our period. The pattern of declining prices in the face of increasing enforcement stringency has not yet been adequately explained, so there is interest in developing explanations for how law enforcement might have a perverse effect on prices (see, e.g., Poret, 2003, and Skott and Gepsen, 2002). Our model below represents one such effort.

3. A Model with Location Advantage and Its Implications

Consider a drug market in which there are a number of locations—particular street corners, abandoned houses, and bars—where drugs can be dealt. There are, no doubt, several reasons why some of these specific locations might be particularly advantageous. We focus on one reason here: some locations present lower cost of operation because dealers in these locations face a lower probability of detection and/or the probability of apprehension given detection by law enforcement agents. Examples of this idea abound in the ethnographic literature and in news reports. Joel Garreau’s 1988 *Washington Post* article, “The Invisible Hand Guides D.C.’s Visible Menace,” for instance, provides maps of the Mayfair-Pardise apartment complex, showing how certain locations are particularly advantageous to a drug dealer. Such locations have open sight-lines, multiple paths of egress, and fences nearby that restrict police car access but can be jumped by those seeking escape from law enforcement officers. Thus while Crime Prevention Through Environmental Design (CPTED) seeks to harden physical locations against criminal exploitation (e.g., Hayes, 1994; Lurigio et al., 1998), criminals do the opposite, seeking out locations whose physical attributes are the antithesis of CPTED principles.

Suppose there are many distinct locations, each of which efficiently accommodates one dealer. Tied to each location j is a cost function, $c_j(q_j)$, with the properties that $c' > 0$ and $c'' > 0$. For the moment, we assume that consumers are indifferent over which location they visit to make a purchase.⁶ The market price p therefore pertains at all sites. For any site where dealing is profitable, maximizing behavior of course entails choosing of q_j^* such that $p = c_j'(q_j^*)$, from which a supply function $q_j^*(p)$ can be derived. Aggregating across sites gives the market supply function (recognizing that at any particular price there are

⁶ This assumption would follow if law enforcement detection probabilities vary across sites, but dealers, not users, are the primary targets.

generally some sites for which optimal supply is zero, i.e., sites at which profits would be negative). The equilibrium price is the value that equates this supply function with the demand function. Heterogeneity in operating costs across sites results in differing levels of equilibrium profit; we label the sites, $j = 1, 2, 3, \dots, m$, in order of the pure rents earned at the site.

It is worth making a brief digression to consider what this market would look like if there were property rights to the sites, and these could be sold in a real estate market. In a site that would be more profitably utilized in the sale of drugs than for any other use, the site would be valued at the present value of rents generated from the sale of drugs at the site. Drug dealing at each site would then generate zero economic profit (as the opportunity cost, or lease price, of the site would be included on the cost side of the profit function).

Our model, though, has a missing market; real estate is not allocated via a price system, but instead through the use of violence and the threat of violence.⁷ The nastiest, most aggressive, dealer can use his (or less often her) talent to secure the most profitable location; the fact that the market is illicit means that this dealer can then earn rents from his or her unusually high ability or taste for violence. The second nastiest dealer earns somewhat lower rents, the third nastiest fewer rents still, and so on. In a competitive equilibrium only the marginal dealer, say dealer n , earns zero profit.

In a deterministic case with perfect information, a weaker dealer does not ever try using force to take over a stronger dealer's more desirable territory because the aggression would fail. In reality there is some degree of uncertainty, over-confidence, and misjudgment which may lead to turf fights but, as noted, dealers do a lot of posturing and signaling to avoid actual dealer-on-dealer violence.

Now consider the consequences of a law-enforcement action that removes say Dealers 1 and 2—the two nastiest dealers—from the market. Dealer 3, who was previously the third nastiest dealer in the market moves into the number 1 position, and as a consequence experiences a reduction in the costs of doing business. Each other dealer in the market experiences a similar decline in costs. Most importantly, Dealers $n+1$ and $n+2$, who previously were not active participants in the market, see a sufficient decline in their own costs to make it now profitable to deal. The total number of dealers supplying drugs to the market remains unchanged as do dealers' marginal costs; the supply curve does not shift at all.

This same observation holds true for the departure of *any* active dealer from the market. When any dealer leaves the market, costs decline for lower-rank

⁷ Our observation about the inability of dealers to buy and sell locations is doubtless applicable in most of the markets. Interestingly enough, there is at least one newspaper report of a gang selling a desirable location for dealing.

dealers, and the supply curve is unaffected. Equilibrium quantity and price are unchanged.

Our model is an unusual example of a “positional externality,” driven in this case by differential ability and inclination toward violence.⁸ The most violent of the dealers gain an advantage in the market, but this advantage necessarily comes at the expense of the less violence-prone dealers. The departure of any dealer is beneficial to all other dealers who were previously affected by this externality.

Our prediction that the supply curve for drugs remains fixed when a dealer departs relies on an assumption that the only external cost imposed on other dealers by a particularly violence-prone dealer is the positional externality. This might be the case if the hierarchy is maintained entirely through the threat, not actual use, of violence and the law enforcement response is the same for potentially violent and for tamer drug markets.⁹ If, on the other hand, violent confrontation occurs routinely as dealers vie over position in the queue, there is an additional externality—*injury or risk of death* caused by the violence itself or by increased police stringency in response to that violence or its threat (e.g., signaling capacity for violence by possessing powerful guns), as discussed in Buchanan’s (1974) explanation for the monopoly control then thought to characterize illegal markets. In this case, removal of a particularly violent individual from a drug market is beneficial to other dealers not only because it allows them to advance to preferred selling locations but also because of a decline in the absolute level of violence and violence-induced law enforcement pressure they are likely to encounter. When such dealers depart from the market, the net effect is to draw in other dealers “from the margin” who will in fact be the least nasty of the new set of dealers. The cost of operation for each dealer in the queue declines; the supply curve shifts downward.

Notice that this last prediction is quite novel. The departure of any active dealer from the market causes the market price to *decline* and the equilibrium quantity of drugs to *increase*. Thus, the exit of a violence-prone dealer from the drug market does *not* reduce the supply of drugs, even if the departing dealer has a considerable advantage (by virtue of his ability or inclination toward violence) over potential entrants into the market.

⁸ The idea of positional externalities is now common enough in economic theory to have found its way into introductory textbooks (e.g., Frank and Bernanke, 2004), though we are not aware of applications of this idea to drug dealing.

⁹ In particular, the nastiest dealers in the hierarchy might have reputations for violence so considerable that they are rarely, if ever, challenged. That is, the actual use of violence might be an out-of-equilibrium action. The ordering of the dealers would then be the result of previous use of violence, and the very real threat of future violence, but little actual on-going violence. A model of the Mafia developed by Reuter (1983) suggested that in the 1970s there were indeed rents from a reputation for control of contingent violence.

The general point is that in illicit drug markets, the willingness and ability to employ violence allows dealers to earn substantial rents. This advantage stems from having a reputation for being nastier than other dealers in the market. The resulting equilibrium—which is characterized by positional externalities—is quite different from the standard competitive market, and policy implications can vary.

4. Consequences of Other Policy Interventions

In our model a policy that removes some dealers from the market (e.g., through incarceration) can reduce rather than increase price. Here we do parallel analyses for several other policy interventions.

Removing the Most Violent Dealers from the Market. As just discussed, the departure on any dealer in the market results in lower-ranked dealers moving one notch up the hierarchy, and the net effect is to leave the supply curve unaffected, and thus the equilibrium price and quantity sold unaffected as well. If, in addition, there is an externality associated with the absolute level of violence, and if this level declines when a dealer exits (and is replaced at the margin by a less violent dealer), then the costs of dealing drugs declines; supply shifts to the right.

A similar conclusion would apply to a law enforcement strategy that does not change enforcement of drug laws, per se, but rather increases the probability that particularly *violent* offenders are arrested and incarcerated. Suppose the sellers with the greatest proclivity for violence (i.e., the winners of the coveted, low production cost locations) actually commit the most violence and hence are differentially affected by an increase in resources in policing that “clears violence off the streets.” Whatever its other merits, such a policy need not reduce the supply of drugs or drive up the price of drugs, even if many of the incarcerated offenders were drug dealers. Indeed the policy might actually “open up” the drug market. In our model, the presence of a positional externality means that less aggressive dealers always fill the role of the more violence-prone individuals who depart from the market. Moreover, removing violent dealers from the market reduces the level of violence remaining, and this further decreases the marginal cost of entry; the policy intervention leaves behind a less aggressive, but possibly larger, force of drug dealers.

Increasing Enforcement at Known Sites. A different intervention might target the known drug sites themselves (perhaps in response to public concern about open selling), increasing the probability of arrest for dealers operating at these sites, and thus increasing the cost of doing business at some or all the available locations of business. If costs increase at the marginal sites, the supply curve shifts back and to the left, and the policy accomplishes the goal of increasing price and reducing the quantity of drugs consumed. If, alternatively,

costs increase at infra-marginal sites, this reduces the rents earned at those sites but has no effect on the equilibrium price and consumption of the drug.

A simple numerical example helps illustrate the mechanism at work. Consider a market that has many sites and enough potential dealers to fill all sites. (As will be clear shortly, in this example we assume that the number of sites N exceeds 20.) There are 5 low-cost locations that provide, for instance, easy egress, and therefore present lower risks to the dealers. The cost of operation at these sites, $i = 1, \dots, 5$, is $c_i = 1 + q_i^2$. The cost of operation at the remaining $N - 5$ sites is higher, $c_i = 9 + q_i^2$. Notice that as long as operation is profitable at a site, the individual supply curve for each of the dealers solves $p = 2q_i^*$. We are interested in evaluating the long-run equilibrium, in which profit is zero at the marginal firm, i.e., when profit at sites $i = 6, 7, \dots, N$, given by $pq_i^* - (9 + q_i^{*2})$, is zero. This later condition holds when the market price for the drug is 6. To complete the example, set demand to $D(p) = 120 - 10p$. Then it is easy to confirm that the market equilibrium price and quantity are $p^* = 6$ and $Q^* = 60$, respectively. (The outcome is illustrated in Figure 2.) Twenty dealers will service the market, each selling 3 units. The dealers occupying the high-cost sites of course earn zero economic profits, while the five low-costs dealers earn rents of 8 per period.

Now consider a policy that effectively increases the fixed component of the dealer's cost at particular sites. It is obvious that if the policy targets only a few of the high-cost sites, dealers will simply move to other available high-cost sites, and the policy will have no effect at all. Similarly, if the policy targets only the low-cost sites, so that there is no effect on dealer cost at the marginal site, the policy has no effect on equilibrium price and quantity. The more interesting case is where the cost increases at the marginal site. Suppose, for instance, that the target policy increases the cost of operation at all high-cost sites from 9 to 16. Replicating the steps described in the preceding paragraph we find in that market the price increases to $p^{**} = 8$ and equilibrium quantity declines to $Q^{**} = 40$. See Figure 2.

It is not at all surprising that a policy that increases the cost of the marginal dealer has the desired effect of driving up prices and reducing equilibrium quantity. The interesting feature of the example is how that policy affects the distribution of profits. The marginal dealers still earn zero profit, of course; revenue per dealer increases, but so too does the expected cost. For infra-marginal dealers—the five most violent-prone dealers, who are able to capture the low-cost locations—pure rents increase from 8 to 15.

It is difficult to know how an increase in profits affects the use of violence, as the instrumental application of violence is an understudied phenomenon. The most distressing possibility for our example is that violence-prone individuals might dissipate the rents to high-profit dealing by engaging in

violent confrontation over opportunities to earn the high profits created by the policy. Then, when the rewards for accepting the risks of violent confrontation have increased dramatically, we expect to observe dramatically more violence.

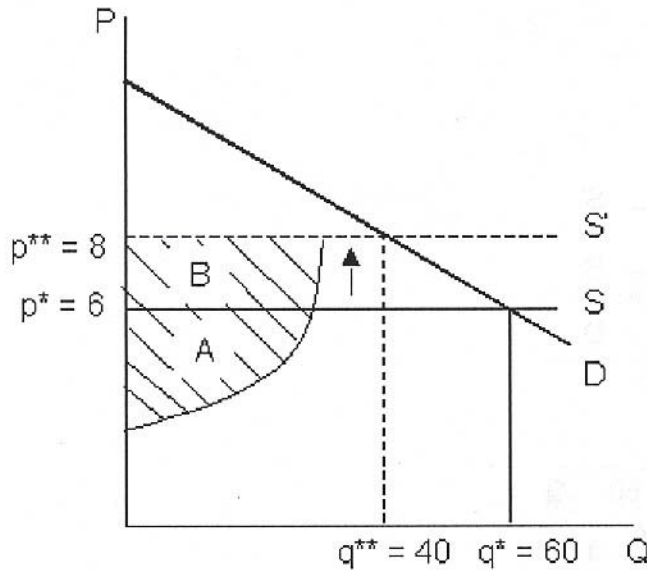


Figure 2. Equilibrium for the Numerical Example, and the Effect of Increasing Enforcement at the Marginal Site. Before the enforcement increase, rents to the infra-marginal dealers are area A. Increasing enforcement results in rents to the area (A+B).

The sobering conclusion is that when a policy raises costs for the marginal dealer and thus increases the equilibrium price, it may also increase the returns to violence, and ultimately increase the level of violence associated with drug markets. Notice that there is nothing about our argument that relies on the demand curve being inelastic. (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. In our example total revenues to dealers *declines* when the price increases.) Our argument pertains any time the policy increases the cost of the marginal dealer more than the cost of the infra-marginal dealer. Of course, the more inelastic the demand, the more dramatic will be the increase in rents to be earned by the most violent dealers.

Increasing the Penalties for Dealing Drugs. A different policy that surely increases the equilibrium price of the drug is an increase in the penalty associated with arrest and conviction of drug dealers. The social cost of high-penalty drug policies has been widely discussed (see, e.g., Caulkins et al., 1997). Our focus here is not social injustice that might be created by high penalties levied for drug dealing, but rather their equilibrium consequences in our particular model.

The comparative static can be developed easily by reference to the numerical example we developed in the preceding paragraphs. In our example, the cost function is $c_i(q_i) = a_i + q_i^2$, with low-cost dealers facing lower values of a_i , because they are operating in locations where the probability of arrest is relatively low. This component of the cost function might be written more explicitly as $a_i = d_i C$, where d_i is the probability that a dealer at site i is apprehended for dealing drugs, and C is the monetized expected disutility (for simplicity assumed constant across dealers) of apprehension. We are interested in the effect of an increase in C .

An increase in C of course increases the cost of operation for all drug dealers. This cost increase is greatest for the marginal dealer, the dealer who operates in the least favorable location, and who therefore faces the highest probability of apprehension. Because costs increase for the marginal dealer, the policy results in a higher equilibrium price and reduced drug consumption. Notice, though, that the cost of operation increases less for the infra-marginal dealers than for the marginal dealer, so an increase in the expected penalty associated with being apprehended (i.e., an increase in C) actually increases profit for these dealers.¹⁰

To see this, consider again the example illustrated in Figure 2. This time suppose the fixed component of the dealers' cost functions are derived as follows: the expected cost of apprehension for any dealer is $C = 1000$, the probability of detection and apprehension is $d_i = 0.001$ in each of the five best sites, and this probability is 0.009 in the remaining sites. It is easy to confirm that if a policy change results in an increase in the penalty, from $C = 1000$ to $C = 1778$, the result is very similar to that described in Figure 2. The only difference is that costs increase modestly at the favorable sites from 1 to 1.78, so rents at those sites increase only from 8 to 14.22, not to 15. The result is illustrated in Figure 3.

Our model, then, has a similar prediction about the effect of increased penalty severity as for an increase in enforcement at marginal sites. These policies do have the intended effect of driving up price and reducing drug consumption. However, they can greatly increase profits for infra-marginal dealers, i.e., for dealers who have secured favorable market position by virtue of

¹⁰ This happens because the increase in the market price is driven by the increase in the cost of the marginal dealer. Since the cost of the infra-marginal dealer increases by less than the cost of the marginal dealer, profit earned by infra-marginal dealers rises.

their proclivity and ability to use violence effectively. In short, these policies increase the return to violence in illegal drug markets.¹¹

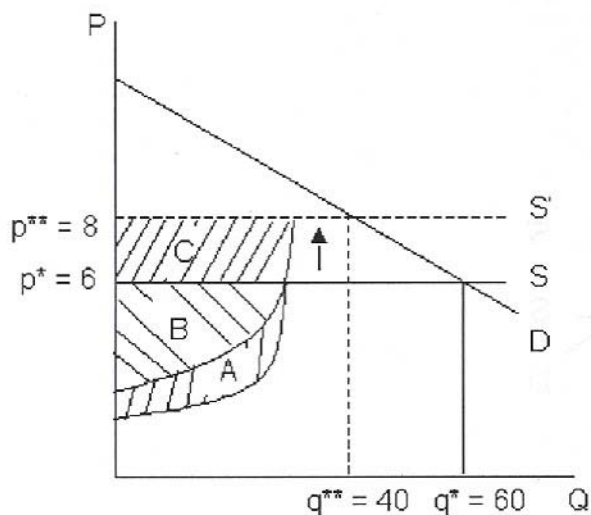


Figure 3. The Effect of an Increase in the Severity of the Penalty for Apprehension. Profits with the lower penalty are (A+B), but with the higher penalty are (B+C).

The logic of effects of penalty severity in our model is quite simple. Increasing the severity of penalties associated with dealing drugs (e.g., through mandatory minimum sentences) raises the stakes for all dealers, especially for the marginal dealers, who are the most likely to be apprehended. Some of these latter dealers respond by exiting the market. The remaining dealers command a higher market price, so the relative advantage of being in a favorable position in the market (e.g., having a location where safe transactions can be made, having access to known customers, and so on) rises. If favorable positions are secured by use and threat of violence, we might expect violence to increase.

Arresting Drug Users. If the focus of the criminal justice system shifts to arresting and prosecuting drug users, this drives the demand curve downward and reduces both the equilibrium price and quantity. Revenues to dealers clearly decline, and it is therefore tempting to conclude that dealer profits must decline as well. This latter conclusion, though, does not necessarily follow.

¹¹ Another source of violence, not treated in this skeletal model, is suspicion that an associate or transactional partner is an informant. Higher penalties increase the incentive to inform as part of a plea deal, and thus raise suspicions. This is yet another mechanism whereby increased rents might accrue to more violent dealers.

When drug users fear arrest, they will seek to purchase from dealers who make sales in a more secure environment. Consider (for a final time!) our numerical example—with 5 favorable locations and many less favorable locations. It seems plausible that if buyers face some risk of arrest, even if it is much lower than sellers' risk, buyers will prefer to buy from the 5 dealers who operate in favorable locations.¹² This does not mean that the marginal dealers, who locate in less favorable locations, necessarily go out of business. Rather, it means that in equilibrium the price commanded at the 5 favorable locations is higher than the price at the marginal locations. The total cost to the consumer is the sum of the money price and a valuation of the risk and time associated with purchase (Moore, 1977); it is that sum which should equilibrate across sites. Notice that as a consequence, the returns to operating in a favorable location must increase relative to the returns at the marginal location. Given that (in equilibrium) profit is always zero at marginal locations, this means the profit earned by individuals in favorable locations must rise.

Our somewhat counter-intuitive result, then, is that an increase in enforcement focused at *consumers* of an illegal drug serves to increase profits of dealers who have favored positions if those favored locations offer protection from enforcement for users as well as sellers. Again, if the profitable locations are secured by virtue of the dealers' standing in the violence chain, the enforcement policy has the effect of increasing the returns to violence.

5. Observations and Conclusion

We present here a simple model of the market of illegal drugs in which increasing enforcement in various ways need not lead to the expected price increase, and in some cases can increase dealer rents. The latter is undesirable because it may raise the incentives for violence and enhance the ability of dealers to corrupt enforcement agents.

Although the model presented here offers new insights, it is obviously incomplete along a number of potentially important dimensions. For clarity of exposition, the model was kept simple, static, and deterministic. However, the acquisition of a reputation for contingent violence is a dynamic and stochastic process. Newcomers must “invest” in developing their reputation. Over-investment risks premature exit by death or incarceration. Under-investment forfeits potential rents. Uncertainty complicates the calculus. Superior fighters do not always win confrontations, and capabilities are imperfectly observable (e.g., because of bluffing) and they vary (Donohue and Levitt, 1998). Capacities for violence can wane as individuals age or suffer the effects of addiction, and

¹² Perhaps the five dealers make sales out of businesses that offer some protection from law enforcement agents, while the other dealers make sales on the street.

they can grow as individuals form new alliances, acquire weaponry, or become wealthy (allowing the purchase of allegiance and protection). The optimal strategy for most dealers may thus be to occasionally test the capacities of those ranked above them (Berry and Fristedt, 1985). An obvious extension then is to consider a model in which there is some uncertainty about both outcomes of conflict and the value to the lower order dealer of attempting to ascend the hierarchy. (Note that a dealer has at least two distinct sources of gain from removal of a higher ranked dealer; not only does he move up in the rankings but he also increases his absolute reputation.)

Another interesting variation would consider interactions across market levels. There is increasing evidence that most street level distributors of cocaine today have very low earnings (e.g., Bourgois, 1996), relative both to legal employment and to earlier times (Reuter, MacCoun and Murphy, 1990). At the same time, it appears that earnings at the upper end of the system remain high (Fuentes, 1999). Though our present model envisions competition in a retail market, it may well be that the reputation for violence is what generates access to participation in the higher level markets.

In short, our work is a first exploration into the implications of heterogeneity and positional externalities in this important market, and we make no claim, for example, that our model explains recent observed prices. However, this model is more consistent with historical trends than are the conventional models and, at a minimum, they undermine *prima facie* assumptions that increasing drug enforcement necessarily drives up prices or reduces either drug-related violence or drug sellers' profits.

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