

How Effective Is Micro Harm Reduction At Reducing Macro Harm?

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Abstract

MacCoun (1996) distinguishes between micro and macro harm reduction and notes that reducing micro harm (harm per unit of use) may or may not reduce macro (aggregate) harm depending on its effect on use. We present a simple model that relates micro and macro harm through five parameters: price, quantity, elasticity of demand, elasticity of supply, and the social cost of drug use. Parameterizing the relationship for the US cocaine market in 1992 suggests that about 75% of the apparent benefit of reducing micro harm experienced by users would be offset by increases in use. This suggests that reducing micro harm experienced by users has merit but that reducing the costs drugs impose on non-users may merit greater attention, since reducing those costs carries no risk of being offset by increases in use.

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Introduction

Harm reduction has been suggested as “a new direction for drug policies” (see, e.g., Erickson, et al., 1997) and contrasted with current US policy which might be characterized as “use reduction” (Caulkins and Reuter, 1997). MacCoun (1996) makes an important distinction between micro and macro harm reduction, communicated most succinctly in the following equation:

$$\text{Total Harm} = \text{Average Harm per Use} \times \text{Total Use.}$$

Reducing macro (or total) harm is unambiguously good. Reducing micro harm (average harm per use) reduces total harm as long as it does not increase use too much. Similarly, reducing total use reduces total harm unless it drives up average harm per unit use too much. MacCoun notes that “it is impossible to calculate total drug harm in any literal fashion,” but that does not mean calculations have no value. This paper presents a simple model of the effect of harm per use on use and, hence, of how reducing micro harm affects macro harm. Parameterizing the model for cocaine in the US yields some interesting results.

Model

As MacCoun points out, a primary concern about micro harm reduction is that it might lead to greater drug use because reducing the adverse consequences makes drug use relatively more attractive. The tendency for increased activity to offset some or all of the benefits of making an activity safer is familiar. Perhaps the best known example is people driving more aggressively when their cars are safer, e.g., because they are wearing seat belts (Peltzman, 1975). This behavior is quite natural. It is just a manifestation of people responding to incentives. Reduce the cost of doing something (by reducing its riskiness), and people will tend to do more of it.

It is clear that the problem pertains only to reduction in harms borne by the user. Reducing sanctions on drug use would reduce the harms or costs of using drugs, and so might increase use. Aggressive action to reduce property crime (e.g., by crime prevention through environmental design) could decrease the harm users impose on others, but there is little reason to think it would lead to greater drug use. The distinction is whether the harms are borne by the users and, hence, are factored into their decisions about how much to use, or whether the harms are borne by third parties, what economists call “externalities”.

The distinction is not always clear cut. Consider interventions designed to reduce the spread of infectious diseases through needle sharing. Reducing users’ risk of infection would make use relatively more attractive. Reducing the risk that users will spread the infection to others might or might not. To the extent that the others are friends or family of the user and the user considers their welfare important, it might make use more attractive. To the extent that the others are strangers or the user is self-interested, it would make little difference.

Nevertheless, we distinguish simply between harms borne by users and by non-users. For convenience, we rephrase MacCoun's equation for total harm (denoted H) to express micro harm as harm per unit of use, not per user. Hence, we write

$$H = Q * (C_u + C_n),$$

where Q is the quantity consumed, C_u is the harm experienced by users per unit of use, and C_n denotes harms or costs per unit of use that are borne by third parties and which have no influence on consumption decisions.

Suppose the demand curve can be modeled as having a constant elasticity of demand over the range of variation considered. Suppose further that the same elasticity applies to both dollar and non-dollar costs or, in other words, that the non-dollar costs experienced by the user can be expressed in dollar terms. These non-dollar costs include so-called "search time costs" (Moore, 1973; Kleiman and Smith, 1990) as well as adverse health, social, and criminal justice consequences. Then the quantity consumed (Q) as a function of the dollar price (P) and non-dollar costs experienced by users (C_u) can be written as

$$Q = \alpha (P + C_u)^\eta,$$

where α is a proportionality constant and η is an elasticity whose relationship to the price elasticity of demand (η_D) follows from the definition of the price elasticity of demand:

$$h_D = \frac{dQ}{dP} \frac{P}{Q} = \frac{h}{P + C_u}.$$

The derivative of total harm (H) with respect to changes in non-dollar costs experienced by users (C_u) is

$$\frac{dH}{d C_u} = Q + \frac{dQ}{d C_u} (C_u + C_n).$$

The first term, Q, is what would happen if consumption did not depend on the non-dollar costs of use. In particular, reducing harm by one dollar per gram (reducing C_u by one) would reduce total harm by a dollar amount numerically equal to the quantity consumed (Q) in grams. The second term captures the feedback effect of C_u on Q, but it needs to be manipulated to express it in a more useful form. From the demand relation,

$$\frac{dQ}{d C_u} = \frac{h}{P + C_u} \left(1 + \frac{dP}{dQ} \frac{dQ}{d C_u} \right),$$

so

$$\frac{dQ}{dC_u} = \frac{h Q}{P + C_u - h P h_s},$$

where η_s is the price elasticity of supply¹. Inserting this expression into the expression for $\frac{dH}{dC_u}$ and again using the definition of the price elasticity of demand yields the desired result:

$$\frac{dH}{dC_u} = Q \left[1 + \frac{1}{\left(\frac{1}{h_D} - \frac{1}{h_S} \right) P} (C_u + C_n) \right] = Q [1 - \text{offset}].$$

The expression $\left(\frac{1}{h_D} - \frac{1}{h_S} \right)$ is always negative; otherwise the original market equilibrium would not be stable. So

reducing C_u always has a less beneficial effect on total harm than the naïve model would suggest. That is, risk compensation offsets some of the benefits of reducing C_u ; the size of the offset, in percentage terms, is given by the second term in brackets.

If demand is very inelastic ($|\eta_D|$ is small), then the offset would tend to be small. Likewise if the supply curve sloped upward steeply (η_s large). On the other hand, if demand were highly elastic ($|\eta_D|$ large) and/or the supply curve sloped downward, the offset would tend to be large.² Those effects make sense. If consumption is highly responsive to changes in the costs of use, reducing C_u a little would greatly increase use. Further, if that increase in consumption generated economies of scale that reduced the drug supply industry's average cost of production (downward sloping supply curve), that would reduce dollar prices, further increasing use and harm.

The second half of the second term says that the smaller the per gram societal costs of drug use ($C_u + C_n$) are relative to the dollar costs of using drugs (P), the more reducing C_u will reduce total harm on a percentage basis. The explanation is as follows. If the societal costs are large, then either the costs to non-users or the non-dollar costs to users must be large. If the costs to non-users are large, then any consumption increase caused by reducing the non-dollar costs of using carries a stiff penalty. If the costs to users are large, that implies dollar price plays a relatively minor role in determining consumption. However, the smaller the role price plays in consumption decisions (P small relative to $P + C_u$), the larger the overall elasticity of demand (η) must be for any given observed

¹ Percentage change in quantity associated with a 1% change in price moving along the supply curve.

² The supply curve for individual firms must always slope upward at equilibrium, but external economies of scale can generate a downward sloping industry supply curve (Samuelson, 1973, p.477). Such external economics are implied by models that capture Kleiman's "enforcement swamping" effect (Kleiman, 1993), including Rydell and Everingham (1994) and Caulkins et al. (1997).

price elasticity of demand (η_D), and, thus, the greater will be the increase in consumption caused by reducing the non-dollar costs of use.

This creates a Catch-22 for micro harm reduction. If societal costs associated with a drug are very large, reducing micro harm will have a small percentage impact on total harm and might even increase it. But if the societal costs are small, then even though micro harm reduction will be relatively effective at reducing macro harm on a percentage basis, reducing by a large percentage something that is small to begin with is of limited value.

Parameterizing the Model for the US Cocaine Market

Whether this is a serious problem depends on the specific values of the parameters. For cocaine in the US, Rydell and Everingham (1994) provide the following parameter values for 1992: $P = \$129.20/\text{gram}$, $Q = 291$ metric tons/year, total social cost = \$19.68 billion/year so $C_u + C_n = \$67.63$ per gram, and $\eta_S = -3.6$. Rydell and Everingham's estimate of the elasticity of demand was updated by Caulkins et al. (1997) to be $\eta_D = -1$.

With these figures, reducing C_u by \$1/gram would reduce total harm by \$80 million per year. That is 27.5% of the \$291 million savings that would pertain if there were no change in consumption. Increased use offsets about three-quarters of the apparent savings from micro harm reduction.

There is some uncertainty about the Rydell and Everingham parameters, so it is worth doing sensitivity analysis. For example, using the Office of National Drug Control Policy's (1997) estimate that price was \$106.73 per gram, not \$129.20 per gram, the offset increases to 88%. Indeed, if one accepted the ONDCP's price figure and believed that the social costs of cocaine use were more than \$22.4 billion (e.g., because in light of Miller et al. (1996) Rydell and Everingham may understate the social cost of drug-related crime), then reducing C_u would actually increase total harm.

To explore such variations in greater detail, we plot offset iso-value curves as a function of two parameters at a time. There are four parameters in the expression for the offset (social cost³, retail price, and the supply and demand elasticities). Four parameters taken two at a time yield six possible plots. The two most interesting (social cost vs. elasticity of demand and price vs. elasticity of supply) are shown below. Figure 1 shows, for example, that if the social cost of cocaine were only \$9 billion per year, then the offset would be 33%, but if social costs were greater than \$27 billion per year, the offset would exceed 100%, i.e., reducing C_u would increase total harm. Similarly, Figure 2 shows that if retail prices were actually \$187/gram, the offset would be 50%. If prices were only \$94/gram, there would be a 100% offset of the aggregate benefits of reducing micro harm.

³ Social cost is expressed in aggregate terms, assuming an annual consumption rate of 291 metric tons, because that is how the literature presents estimates of social cost.

Figure 1: Risk Compensation Offset Associated with Reducing Micro Harm as a Function of Elasticity of Demand and Total Social Cost

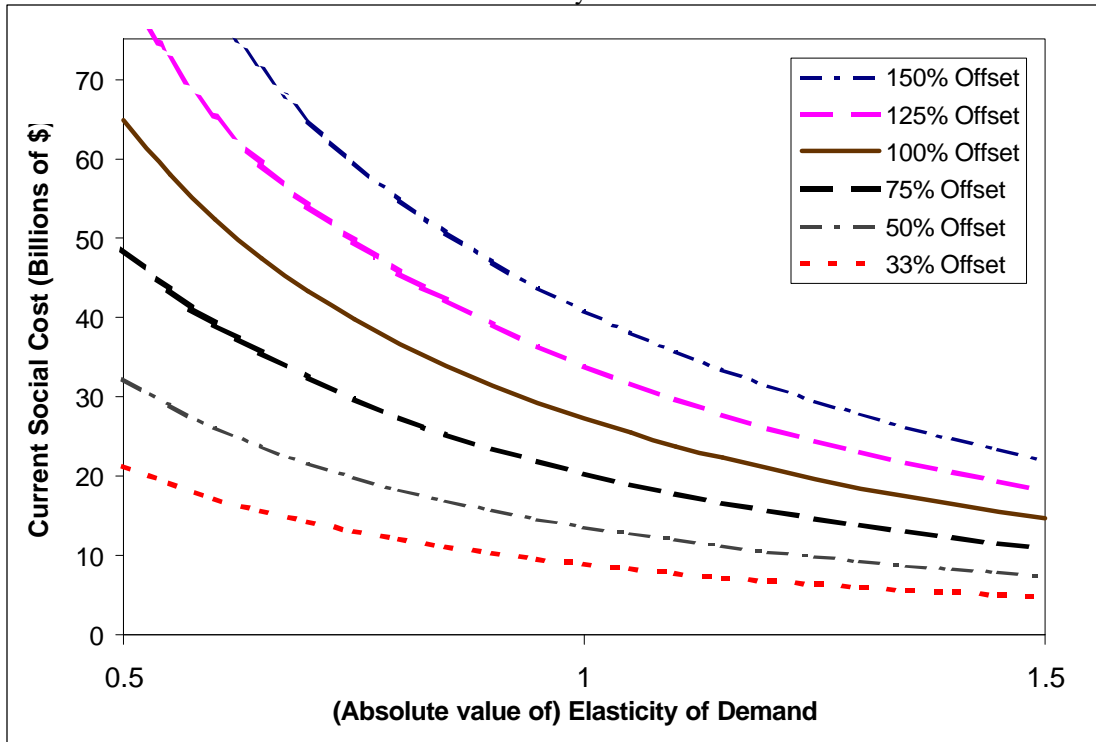
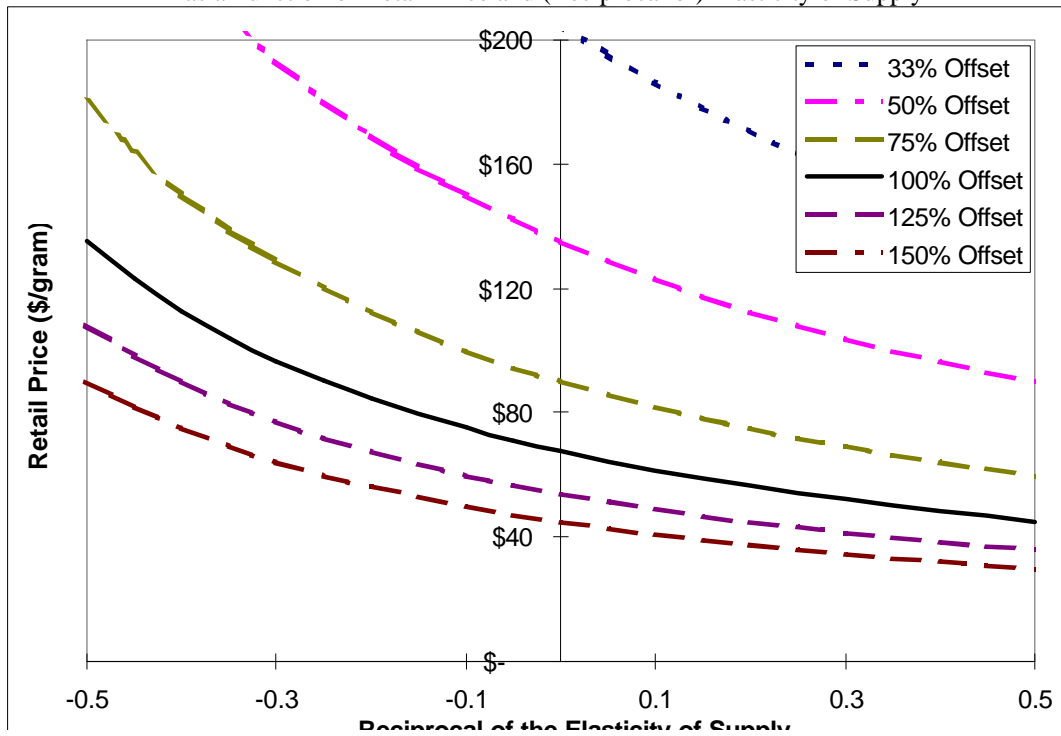


Figure 2: Risk Compensation Offset Associated with Reducing Micro Harm as a Function of Retail Price and (Reciprocal of) Elasticity of Supply



Conclusion

When thinking of harm reduction, it is important to distinguish between reducing micro harm (harm per unit use) and macro harm (total harm experienced by society). Reducing micro harm might or might not reduce macro harm, depending on whether and by how much reducing micro harm increases use, i.e., depending on how much of the apparent benefit of reducing micro harm is offset by risk compensation behavior. The relationship between changes in micro harm and changes in macro harm can be expressed as a function of just five parameters: the price elasticity of demand, price elasticity of supply, price, quantity, and social cost per unit of use. Applying Rydell and Everingham's parameter values for cocaine in the US in 1992 suggests that about three-quarters of the benefit would be offset for that drug in that context. More generally, the offset would be greatest for drugs with a high elasticity of demand, industry wide economies of scale that lead to a downward sloping supply curve, and/or a low ratio of social costs per gram to price per gram. An offset greater than 100%, meaning that reducing micro harm increases total harm, is plausible but does not appear to pertain for the US cocaine situation. However, the analysis suggests that those dissatisfied with traditional "use reduction" strategies might focus more attention on reducing costs drug use imposes on non-users (which carries no risk of being offset by increases in use) relative to reducing costs borne by the users themselves.

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