# Black Markets and Trade Bans: Can Bans Reduce Illegal Production?

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## Introduction

Despite the fact that their consumption is not, by their nature, harmful to people, transactions of some goods are prohibited by law. Key examples include endangered species or derivatives of them. In these cases, "production", not consumption, is the main focus of the law implemented; to try to increase production of these goods is considered damaging to nature or human society.

Although prohibited, the purchase of the goods in question is still possible to some extent through "illegal markets" or "black markets". It is extremely difficult to completely wipe out such markets from society, especially in developing nations, despite the efforts of governments and other authorities. In general, it is assumed that the black market would shrink if legal trade were prohibited, since this would reduce demand for the goods and make laundering impossible. Thus, a trade ban is thought to be a useful way of reducing illegal production. This assumption provides the basic case for banning trade, or for not lifting trade bans.

CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) is the main multilateral framework legal framework aiming at preventing species extinction, banning trade of those species that are listed in CITES Appendix I. However, it is pointed out that the CITES trade ban is not always effective in protecting threatened species. For example, according to 'tSas-Rolfes (2000), the ban seemed to work for protecting African elephants, but it failed to stop the extinction of rhino species such as black rhino, because it sharply raised the price in the black market and boosted poaching. That is, a trade ban may have adverse effects, far from the desirable ones expected, and illegal production (i.e., poaching) may not always decline under a trade ban. It could, on the contrary, increase[1].

In the literature in terms of economic theory, Bergstrom (1990) shows in a simple supply and demand model that reducing legal supply of elephant tusks and rhino horns could increase poaching. Barbier and Swanson (1990) and Heltberg (2001) also point out that a trade ban might be ineffective, since it could stimulate the illegal trade through increasing the incentive for poachers, using a model where the demand for ivory declines by the introduction of the ban.

Fischer (2004) gives a microfoundation for considering the effects of a trade ban. In addition, Fischer neatly includes laundering activity, which is crucial in considering the effect of lifting the ban. With this inclusion of laundering, Fischer links the legal and illegal markets and deals with the interaction between the two markets. The result is that a trade ban reduces poaching where laundering is present, and will minimize poaching if it can be assumed that other conditions remain unchanged. That is, a trade ban fails only if laundering would not occur under legal trade.

However, laundering might be inevitable under legal trade, especially in a commodity in great demand

[1] For the detail of these facts, see Onuma (2006).

like rhino horn. In the rhino horn case, the CITES trade ban was not successful. Thus, whether a trade ban is effective may not be determined by the question of whether laundering would occur in legal trade. A trade ban may still fail even if there is laundering under legal trade. This research aims at clarifying this point, regarding the legal and illegal markets as being interdependent.

In Fischer's analysis, the two markets are kept virtually separate; there exist two groups of people, one consisting of completely immoral people who purchase goods from the black market whenever the price there is lower than that in the legal market. The other consists of completely moral people, who never resort to the black market. Thus, the two markets interact only when the two market prices are identical, or when launderers act as intermediaries between the two markets.

However, it might not be realistic to think that the legal and illegal markets are separate. There may be many people who resort to the black market if the price there is relatively low, but who abide by the law and purchase from the legal market if the price difference between the markets is small enough.

Based on this understanding, this paper provides a simple general equilibrium model in which both legal and illegal markets exist interdependently, and examines whether a trade ban is effective in preventing the endangered species from becoming extinct.

## The Model

We assume an economy where the transaction of a commodity is either completely prohibited or permitted only if it is certified by the authorities. We call the former case a "trade ban". However, in each case there exists a black market, where the goods are illegally traded. The goods are produced by illegal activities such as poaching. Let us denote the illegal output by $X$ and its price in the black market by $P_B$. We assume a representative producer who maximizes his profit defined by, as in the literature,

$$\pi_X = rP_B X - C,\ 0 \le r \le 1 \ .$$

Here $r$ represents the rate of the output that is not confiscated by the authorities, and $C$ is the cost of illegal production. $1\text{-}r$, which is the rate of confiscation, is a proxy for the efforts of the authorities to eradicate illegal trade and production.

At the same time, we assume that the cost of illegal production C is dependent only on $X$ as $C=C(X)$ with $C'>0, C''>0$. Thus, the producer's profit maximization leads to $rP_B=C'$.

On the other hand, we assume that there is a representative launderer. Fischer (2004) characterizes laundering behavior as a launderer buying black-market goods and laundering them for subsequent sale in the legal market. The authorities detect this laundering, and confiscate a part of the goods that the launderer tries to sell in the legal market. Let $(1\text{-}\phi)$ be the rate of confiscation from laundering. So $\phi H$ represents the supply from the launderer to the legal market. $G(H)$ denotes the cost of laundering behavior, with $G'>0, G''>0$. So the launderer's profit $\pi_H$ must be defined by $\phi P_L H - G(H) - P_B H$.

Consumers gain utility from the goods in question. There is no difference for each consumer between the goods from the black market and from the government. That is, legal goods and illegal goods are perfect substitutes. However, each consumer feels more or less morally guilty if he or she purchases illegal goods.

Let y and z express the quantity of legal and illegal goods purchased, respectively. The net utility to consumers is represented by

$$V(y,z,\alpha) = U(y+z) - (P_L y + P_B z) - \alpha z, \quad 0 \le \alpha \le \overline{\alpha}$$

where $U$ represents the utility gained from consuming the goods and $P_L$ the price of goods in the legal market. We assume $U'>0$ and $U''<0$. On the other hand, $\alpha z$ is the disutility that arises due to the purchase of illegal goods. We call this disutility "moral pain" and refer to $\alpha$ as the moral pain coefficient. We assume that $U$ is identical across consumers, but that $\alpha$ differs across the same consumers. The number of population with $\alpha$ is denoted by $f(\alpha)$ with $\int_0^{\overline{\alpha}} f(\alpha)d\alpha = 1.$ A consumer's behavior is described by the following expression:

$$\max_{y,z} U(y+z) - (P_L y + P_B z) - \alpha z \quad .$$

Three types of consumers are possible: consumers who purchase only legal goods, consumers who purchase only illegal goods, and consumers who are indifferent between legal and illegal goods. We refer the third type of consumers "marginal moralists", since they move to the black market if the price difference between legal and illegal markets expands even slightly.

## Market Equilibrium

Let $Y$ and $Z$ express aggregate demand for legal and illegal goods, depending on $P_L$ and $P_B$. We can show that

$$\frac{\partial Y}{\partial P_L} < 0, \frac{\partial Y}{\partial P_B} > 0, \frac{\partial Z}{\partial P_L} > 0, \frac{\partial Z}{\partial P_B} < 0, \left|\frac{\partial Y}{\partial P_L}\right| > \frac{\partial Z}{\partial P_L}, \frac{\partial Y}{\partial P_B} < \left|\frac{\partial Z}{\partial P_B}\right| \quad .$$

These properties come from the role of marginal moralists.

Legal supply from the authority is $\overline{Y}$. In this economy, the market equilibrium is expressed by

$$\begin{aligned} Y(P_L, P_B) &= \overline{Y} + \phi H \\ Z(P_L, P_B) &= rX - H \\ rP_B &= C'(X) \\ \phi P_L &= P_B + G'(H) \end{aligned}$$

*where* $P_L$, $P_B$, $X$, and $H$ are determined endogenously, given $\overline{Y}$, $r$ and $\phi$.

## Two Policy Measures

The authority has two policy instruments to control illegal production. One is to change the confiscation efforts in the illegal market and with regard to laundering, i.e., changing $r$ and $\phi$. The other is also changing

the level of legal supply $\overline{Y}$. Investigation of a trade ban is mainly related with the latter instrument.

### A Trade Ban

Under the above model, a trade ban is characterized as $\overline{Y} = 0$ so that $H$=0 in the equilibrium. We are interested in the level of $X$ under $\overline{Y} = 0$ and that under $\overline{Y} > 0$. Thus, $X$ can be expressed by $X(\overline{Y})$. We compare $X(0)$ with $X(\overline{Y})$. We say that a trade ban should not be lifted or a trade should be banned if

$$X(0) < X(\overline{Y}),\ \forall \overline{Y} > 0 \quad .$$

On the other hand, if it holds for some $\overline{Y}$ that $X(0) > X(\overline{Y})$ and that level of $\overline{Y}$ is feasible for the authority, a trade ban should be lifted.

### Result without Laundering

If laundering is not possible, that is, if $H$=0 at any level of $\overline{Y}$, then we have

$$X(0) > X(\overline{Y}),\ \forall \overline{Y} > 0 \quad .$$

In this case, a trade ban maximizes illegal production, so the ban should be lifted. However, the result changes considerably if we include the aspect of laundering.

### Result with Laundering

Let us suppose that laundering occurs, i.e., $H$>0 at any level of $\overline{Y}$.

We can show that there exists a $\overline{Y}_T$ such that

$$\begin{aligned} X(0) &< X(\overline{Y}_T), \text{ if } \overline{Y} < \overline{Y}_T \\ X(0) &= X(\overline{Y}_T), \text{ if } \overline{Y} = \overline{Y}_T \\ X(0) &> X(\overline{Y}_T), \text{ if } \overline{Y} > \overline{Y}_T \end{aligned} \quad .$$

This relationship is depicted in Figure 1. From this property, we can say that, with laundering, trade bans can become effective if legal supply is sufficiently small, and that a ban has a desirable effect because illegal production is worse under the supply. In this case, lifting a trade ban might worsen the situation, so that it should be maintained. Only if there is sufficient legal supply is it appropriate to open up the legal market.

We call $\overline{Y}_T$ a “threshold” in the sense that it divides a legal supply into either harmful or effective with

respect to reducing illegal production.

### A Sufficient Condition for a Trade Ban to be Successful.

We do not know the exact level of the threshold legal supply. However, we can give a sufficient condition for a legal supply to be less than the threshold. The condition is:

$$\overline{Y} \leq (1-\phi)H \quad .$$

That is, if the legal supply is small enough to be less than the confiscated laundered goods $(1-\phi)H$, then it is judged that the legal supply is strictly less than the threshold $\overline{Y}_T$, so that a trade ban should not be lifted or the ban should be shifted in this case.

According to our results, the CITES trade ban on ivory trade that was enforced in 1989 is judged a success if the actual $\phi$ then was less than 0.8. For, in the 1980s, it is estimated that about 80% of ivory trade was in fact illegal and laundered[2]. Under this estimation, $\overline{Y} = 0.25\phi H$. In this case, $\overline{Y} \leq (1-\phi)H$ is equivalent to $\phi \leq 0.8$. That is, if more than one out of five laundered goods were confiscated before the enforcement of the ban, we can say that the ban was effective for reducing the poaching of elephants.

### A Policy Mix to Discourage Incentives for Illegal Producer and Launderer

To increase confiscation efforts is not always desirable. The increasing efforts have desirable effects if *dX/dr* and $dX/d\phi$ are positive, implying that illegal production declines. Also, $d\pi_i/dr$ and $d\pi_i/d\phi$ should be positive, which means that incentives for illegal producers and launderers decrease. However, this is not always the case, as can be seen from the following results.

$$\begin{aligned}
&\text{sign}\,\frac{dX}{dr} = \text{sign}\,(\varepsilon_B - \theta_1) \\
&\text{sign}\,\frac{dX}{d\phi} = \text{sign}\,(\varepsilon_L - \theta_2) \\
&\text{sign}\,\frac{d\pi_X}{dt} = \text{sign}\,(\varepsilon_B - v_t), (t = r, \phi) \\
&\text{sign}\,\frac{d\pi_H}{dt} = \text{sign}\,(\varepsilon_L - w_t), (t = r, \phi)
\end{aligned}$$

where both $\theta_t$ and $v_t$ and $w_t$ are positive values that depend on the functional forms. On the other hand, $\varepsilon_B$ and $\varepsilon_L$ are the price elasticities of demand in the black and legal markets, respectively. As can be seen from these properties, if the price elasticity is low enough, then there can be an adverse effect.

[2] For example, see p.51 in Barbier et al. (1990).

However, let us consider the following policy mix under a legal supply: let us raise the rate of confiscation directed at laundering by $d(-\phi)>0$. Note that increasing the efforts means to reduce $\phi$. On the other hand, legal supply is increased by $Hd(-\phi)>0$. This policy focused on the detection of laundering will reduce both the illegal production and the producer's profit. Moreover, it will decrease the launderer's profit. That is,

$$\frac{dX}{d\phi} > 0,$$
$$\frac{d\pi_X}{d\phi} > 0, \quad .$$
$$\frac{d\pi_H}{d\phi} > 0$$

As we have seen before, the effects of detecting laundering are not definitive, so that it could be harmful. But by mixing this detection of laundering with an increase in legal supply, desirable effects are always achieved on both illegal production and profits in the black market. This policy can be carried out only if a legal supply is feasible, which is considered to be another merit of allowing legal trade.

## Summary

Our results suggest, in the context of biodiversity conservation, how a "sustainable use" policy, coupled with the lifting of trade bans, should be evaluated in terms of poaching when laundering is possible. The question of whether "sustainable use" policies aggravate poaching is under dispute (see, for example, Hutton and Webb (2003)). From our results, we see that a "sustainable use" policy can contribute to species conservation

if the level of sustainable supply is large enough, but it may on the contrary accelerate species decline if the level is too small. Thus, a one-sided view of "sustainable use" policies is not appropriate. Whether the policy is beneficial or not depends on how much legal supply is feasible.

Apart from trade bans, legal supply seems to be a very useful instrument for authorities to wipe out illegal production, when the option of legal supply is available. If it is politically necessary for the authorities to strengthen the detection of illegal business, the policy mix can achieve this goal without raising illegal production.

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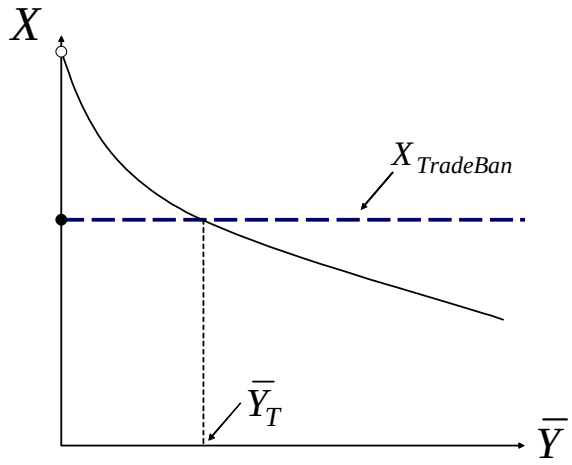


**Figure 1**