Land control or interdiction? Searching for a clue in the colombian cocaine market

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Abstract

The purpose of this note is to estimate the relative impact of interdiction and land control on the colombian cocaine market. The government interdicts part of the cocaine traffic and controls part of the arable land with the aim of weakening this illegal market. Our estimation depends on the price elasticity of the coca-leaf supply, in particular, the importance of the land with respect to other factors in the production of coca-leaf.

Key words: cocaine, coca-leaf, land control, interdiction

JEL classification: K42, D42, J42

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1 Introduction

The colombian cocaine market is imperfectly competitive. The narco-insurgency, a collection of illegal groups such as FARC-EP, ELN, AUC and BACRIM, controls the markets of coca-leaf and cocaine[1]. The government fights against the narco-insurgency in two fronts: controlling the land where there is coca-leaf production and interdicting the cocaine traffic.

The purpose of this note is to estimate the relative impact of interdiction and land control on the colombian cocaine market. We build a vertically integrated model following to Grossman and Mejía (2008) and introduce the bilateral monopoly remarked in UNODC and Government of Colombia (2013). We do not model the dynamic conflict between government and narco-insurgency in each front.

The narco-insurgency sells the cocaine to international traffickers and buys the coca-leaf to peasants, both in an imperfect competitive structure. Our estimation depends crucially on the price elasticity of the coca-leaf supply. This elasticity represents both the importance of land factor in the coca-leaf production and the ability of the peasants to substitute it for other factors.

2 Peasants

The narco-insurgency has the portion $\overline{a} \in (0,1)$ of arable land for producing coca-leaf (cl). The peasants, located in that portion, produce cl at the price fixed by the narco-insurgency. Let A_{cl} be the technology and f_{cl} the other factors used for producing cl. The cl production function is given by:

$$cl = A_{cl}\overline{a}^{\alpha} f_{cl}^{\beta}; \alpha + \beta = 1 \tag{1}$$

Let p_{cl} be the price of cl, $w = 1$ the price of f_{cl} and FC_{cl} the fixed cost of producing cl. The profit function of the peasants is given by:

$$\pi_{cl} = p_{cl} A_{cl}\overline{a}^{\alpha} f_{cl}^{\beta} - f_{cl} - FC_{cl}$$

The problem is maximizing π_{cl} in f_{cl}, the unique variable factor of the peasants. The non-conditional $f_{cl}(p_{cl})$ demand is given by:

$$f_{cl}(p_{cl}) = (\beta p_{cl} A_{cl}\overline{a}^{\alpha})^{\frac{1}{1-\beta}} \tag{2}$$

Inserting (2) in (1) we arrive to the direct supply function of cl.

$$cl = \left[(\beta p_{cl})^{\beta} A_{cl}\overline{a}^{\alpha}\right]^{\frac{1}{1-\beta}}$$

Let $\varepsilon_{cl,p_{cl}} = \frac{\partial cl}{\partial p_{cl}} \frac{p_{cl}}{cl}$ be the price elasticity of the cl supply. In this case, $\varepsilon_{cl,p_{cl}} = \frac{\beta}{1-\beta}$. The inverse supply function, which we will use for solving the cocaine trafficker problem, is given by:

$$p_{cl}(cl) = \frac{1}{\beta}\left(\frac{cl^{1-\beta}}{A_{cl}\overline{a}^{\alpha}}\right)^{\frac{1}{\beta}} \tag{3}$$

[1] We consider the insurgent and contra-insurgent groups as an agent because there is no any substantial difference in the way they control the markets.

3 Narco-insurgency

The narco-insurgency produces and traffics cocaine (c) using cl and a fixed portion of other factors ($\overline{f}_c$). It sells c to international traffickers and buys cl to peasants. Let A_c be the technology for c. The c production function is given by:

$$c = A_c cl^{\gamma} \overline{f}_c^{\varphi}; \gamma + \varphi = 1 \tag{4}$$

Let $\tau_c \in (0,1)$ be the proportion of c surviving the governmental interdiction, $p_c(c)$ the exogenous c demand and FC_c the fixed cost of using $\overline{f}_c$. The profit function of the narco-insurgency is given by:

$$\pi_c = p_c(c)\tau_c c - p_{cl}(cl)cl - FC_c \tag{5}$$

Using $p_c(c) = c^{-\delta}$ with $0 < \delta < 1$ and $p_{cl}(cl)$ as it is in (3) we re-write (5) as:

$$\pi_c = \tau_c (A_c cl^{\gamma} \overline{f}_c^{\varphi})^{1-\delta} - \frac{1}{\beta}\left(\frac{cl}{A_{cl}\overline{a}^{\alpha}}\right)^{\frac{1}{\beta}} - FC_c$$

The problem is maximizing π_c in cl. The solution for the cl market is given by:

$$cl^* = \left[\beta^2 \tau_c \gamma (1-\delta)(A_c \overline{f}_c^{\varphi})^{1-\delta} (A_{cl}\overline{a}^{\alpha})^{\frac{1}{\beta}}\right]^{\frac{\beta}{1-\beta\gamma(1-\delta)}} \tag{6}$$

$$p_{cl}^* = \frac{1}{\beta}\left[\beta^2 \tau_c \gamma (1-\delta)(A_c \overline{f}_c^{\varphi})^{1-\delta} (A_{cl}\overline{a}^{\alpha})^{\frac{\gamma(1-\delta)-1}{1-\beta}}\right]^{\frac{1-\beta}{1-\beta\gamma(1-\delta)}} \tag{7}$$

Notice cl is directly related with $\overline{a}$ and τ_c, and p_{cl} is directly related with τ_c but inversely related with $\overline{a}$. According to UNODC and Government of Colombia (2013), p_{cl} and cl tend to be stable in the short-run, which may be explained from a balloon-effect in A_{cl} and A_c.

The solution for the c market is given by:

$$c^* = \left[\beta^2 \tau_c \gamma (1-\delta)(A_c \overline{f}_c^{\varphi})^{\frac{1}{\gamma\beta}} (A_{cl}\overline{a}^{\alpha})^{\frac{1}{\beta}}\right]^{\frac{\gamma\beta}{1-\beta\gamma(1-\delta)}} \tag{8}$$

$$p_c^* = \left[\beta^2 \tau_c \gamma (1-\delta)(A_c \overline{f}_c^{\varphi})^{\frac{1}{\gamma\beta}} (A_{cl}\overline{a}^{\alpha})^{\frac{1}{\beta}}\right]^{-\frac{\delta\gamma\beta}{1-\beta\gamma(1-\delta)}} \tag{9}$$

Notice c is directly related with $\overline{a}$ and τ_c, but p_c is inversely related with them. Given the elastic c demand, the narco-insurgency gets important profits from a competitive p_c and an increasing c. In this sense, increments in A_c and A_{cl} neutralize the reductions of $\overline{a}$ and τ_c from the governmental policies.

4 Estimation

The narco-insurgency links the markets of cocaine and coca-leaf in Colombia. It allows us to explain the cocaine market from the coca-leaf market and vice versa. Let us use equations (6) and (8) to compare the impact of τ_c and $\overline{a}$ on the productions of c and cl:

$$\frac{\partial c/\partial \tau_c}{\partial c/\partial \overline{a}}|_{\overline{a}=\tau_c} = \frac{\partial cl/\partial \tau_c}{\partial cl/\partial \overline{a}} \ |_{\overline{a}=\tau_c} = \frac{\beta}{\alpha} \tag{10}$$

The proportions in the equation (10) depend directly on the price-elasticity of the coca-leaf supply. In particular, an elastic coca-leaf supply, which is $\beta > 0.5$, implies $\alpha < 0.5$, leaving us with $\partial c/\partial \tau_c > \partial c/\partial \overline{a}$ and $\partial cl/\partial \tau_c > \partial cl/\partial \overline{a}$. On the other case, $\beta < 0.5$ implies $\partial c/\partial \tau_c < \partial c/\partial \overline{a}$ and $\partial cl/\partial \tau_c < \partial cl/\partial \overline{a}$.

5 Discussion

Understanding the coca-leaf market is important for understanding the cocaine market. The relative impact of interdiction and land control on the cocaine market depends on the importance of land respect to other factors in the coca-leaf production. Specifically, if the coca-leaf production is not intensive in the land factor then interdiction would be better policy than land control.

References

[1] Grossman, H. and Mejía, D. (2008). *The war against drug producers.* Economics of Governance, Vol. 9(1), 5–23.

[2] UNODC and Government of Colombia (2013). *Colombia: coca cultivation survey 2012.*