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CRIME AND ECONOMIC DEVELOPMENT IN A SMALL, OPEN ECONOMY

Frank SANSARRICQ

Abstract: This paper provides a simple model of a small, open economy whose resources are partially used in illegal activities. Taxes on legal income pay for law enforcement. If, at given terms of trade, economic growth is originally "pro-illegality biased" ("anti-illegality biased"), even more resources will be channeled (withdrawn) to (form) the illegal sector, because of the associated decrease (increase) in law enforcement expenditures. Thus, we observe a "magnified" Rybczinski effect in either case. This prediction does not depend on whether the government adjusts its law enforcement efforts to the degree of lawlessness. The large country case requires a few qualifications.

I. INTRODUCTION

The "War on Drugs", as it is called, that is now being waged by the United States against drug smugglers from some Latin American and East Asian countries has put in sharp relief the importance of illegal activities here and abroad. In 1980, U.S. "underground economy", a blanket term that covers tax evasion, illegal financial transactions, smuggling, narcotics, prostitution, and gambling represented between 4.49% and 6.07% of GNP, depending on the measure used[1]. In Italy, official estimates suggest that the underground economy (mostly services, hotels and catering) adds about 20% to actual DGP[2]. In Asia, the illegal sector adds 25–40% to the official Taiwanese GNP figure[3].

Traditionally, four main factors have been identified with the growth of illegal activities: high tax rates, market regulations, government prohibitions and bureaucratic corruption[4]. Taxation and prohibitions are known to be responsible for a large share of illegal activities in the U.S., while market regulations have played an important role in the development of the underground economy in Italy and Taiwan.

[1] See Tanzi (1983a), pp 299 and 301. These estimates may underestimate the actual size of the illegal sector in the USA because they are derived under the assumption that underground activities are the direct result of high tax rates.

[2] "The Flawed Renaissance," The Economist, 27 February–4 March, p 9.

[3] "Even richer than they seem," The Economist, 19–25 March 1988. The resulting loss of tax revenues has become an added source of worrying for the Taiwanese government.

[4] See Tanzi (1983b).

Changes in any of these factors will obviously affect the development of illegal activities. But, what will happen to the size of the illegal sector in a *growing* economy *when none of these four factors changes*?[5]

To answer this question I shall look at illegal activities as specific industries that compete with legal ones for the use of the available resources and operate under the threat of being eliminated by the government[6]. Given the variety of illegal activities and factors that are responsible for their existence, it would be pointless to seek to build a general model. Instead, I shall focus on activities like illegal drugs, wild game poaching, prostitution, etc., which are made illegal by government prohibitions.

The present paper will emphasize the fact that, while a government's efforts to enforce its prohibitions do influence with more or less success the size of the illegal sector, the latter also determines the extent of the tax base on which the government can rely to finance its law enforcement operations: ceteris paribus, an increase in the size of the illegal sector reduces the tax base of the government and thus reduces its ability to "fight crime".

Section II presents a simple, two-sector, static model of production, taxation and law enforcement while section III and IV study the effects of factor accumulation and technical progress on the growth of the illegal sector. Section V considers the welfare consequences of economic growth and suggests that immiserization may occur, even at given terms of trade. Section VI concludes. Many of the computations are left to an appendix.

II. THE MODEL

Consider a small, open, economy producing two internationally traded commodities. The production of one of these two commodities is illegal (narcotics, arms, smuggled wild animal hides or precious metals). Without any loss of generality I assume that the illegal product is exported. "Legal" commodities are all the manufactures whose production is not forbidden by the government. Both commodities are traded on world market at a fixed relative price. Both activities requires capital[7] (K) and labour (N) and technology exhibits returns to scale. Letting X_L and X_I denote, respectively, legal output and of illegal output, we have

$$X_L = G(K_L, N_L) = g(k_L)N_L, \tag{1}$$

[5] The effect of economic growth on the level and types of criminality is a question that has long attracted the interest of historians and sociologists. Numerous theories have been put forward that tend to suggest that increased criminality is an inevitable consequence of economic development. For an interesting survey and partial refutation of these theories, see Rogers (1989).

[6] The model in the text is not one of criminal behavior and optimal enforcement policy, as in Becker (1968).

[7] The notion of capital used in the text is loose enough to include land. In the case of illegal drugs land may indeed be the most important input. Recent estimates suggest that Peru and Bolivia have, respectively, 100,000 and 50,000 hectares planted with coca [See The Economist, April 2, 1988].

(2) $$X_I = F(K_I, N_I) = f(k_I)N_I\,,$$

where k_L and k_I are the capital-labour ratios in the legal and illegal sector.

Profit maximization in the legal sector leads firms to choose a technique of production such that:

(3) $$\frac{g(k_L) - g'(k_L)k_L}{g'(k_L)} = \Omega$$

where Ω is the wage rental ratio in the legal sector.

Illegal activities are risky since the government tries to discourage them. In any given period the government spends resources to discover and dismantle illegal operations. I assume that whenever an illegal network is discovered its output is totally destroyed. Let π be the probability that law enforcement agents discover an illegal network. Presumably, unless the government spends some of its revenues on law enforcement, π will be zero. We also expect π to increase with the level of law enforcement expenditures, that is

(4) $$\pi = \pi(E)\,,\quad \pi(0) = 0\,,\quad \pi'(E) > 0\,,$$

where E is the level of law enforcement expenditures, measured in units of legal output. I shall assume that law enforcement expenditures are financed by (proportional) income taxes that do not discriminate between capital income and labour income. Since only legal income can be taxed, $E = \{\tau g'(k_L)k_L + \tau[g(k_L) - g'(k_L)k_L]\}N_L = \tau X_L$, where τ is the uniform income tax rate[8] (not to be confused with a tax on legal output).

Assuming that wages and rentals are paid "at the beginning" of each period, regardless of whether output will be destroyed by the government or not, expected profits in the illegal sector are $[1 - \pi(E)]P_I F(K_I, N_I) - RK_I - WN_I$, where P_I is the money price of one unit of illegal output and R and W are the money rental and wage rate. I assume that illegal activities are competitive and that R and W are bid up to their respective *expected* values of marginal product. Then, profit maximization by illegal producers will drive the capital-labour ratio in the illegal sector to a level determined by

(5) $$\frac{f(k_I) - f'(k_I)k_I}{f'(k_I)} = \Omega\,.$$

Note that law enforcement does not distort relative factor prices. Perfect capital mobility between the legal sector and the illegal sector[9] implies that:

(6) $$p_I[1 - \pi(\tau X_L)]f'[k_I(\Omega)] = (1 - \tau)g'[k_L(\Omega)]$$

where p_I is the (fixed) relative price of illegal products in terms of legal goods and $k_L(\Omega)$, $k_I(\Omega)$ are obtained by solving (3) and (5) for k_L and k_I as functions of Ω.

[8] We can also take tax evasion into account by assuming that only a fraction ε of legal income is actually reported to the government.

Perfect factor mobility and full price flexibility ensure full-employment of both K and N, so that we can write that:

$$(7) \qquad N_I = \frac{k - k_L(\Omega)}{k_I(\Omega) - k_L(\Omega)} N \,,$$

where $k = K/N$ is the overall capital-labour ratio in the economy. Finally, recalling the dependence of k_L and k_I on Ω, we can write:

$$(8) \qquad X_L = g[k_L(\Omega)](N - N_I) \,,$$

$$(9) \qquad X_I = f[k_I(\Omega)]N_I \,.$$

Equations (6), (7), (8) and (9) determine Ω, N_I, X_L and X_I as functions of K, N, p_I and τ.

III. CHANGES IN FACTOR ENDOWMENTS AND THE SIZE OF THE ILLEGAL SECTOR

In the absence of law enforcement, an increase in the supply of one factor of production would lead to the expansion of the sector that uses the growing factor intensively, whatever that sector may be[10], and the contraction of the other sector [Rybczinski (1955)]. In this section we want to see whether and how the presence of law enforcement financed by levying taxes on the legal sector affects this well-known result.

Straightforward differentiation of (6)–(9) in the neighborhood of the equilibrium point gives:

$$(10) \qquad \frac{\delta X_L}{\delta K} = -\frac{g}{k_I - k_L} \varphi_{L,K} \,,$$

$$(11) \qquad \frac{\delta X_L}{\delta N} = \frac{k_I g}{k_I - k_L} \varphi_{L,N} \,,$$

$$(12) \qquad \frac{\delta X_I}{\delta K} = \frac{f}{k_I - k_L} \varphi_{I,K} \,,$$

$$(13) \qquad \frac{\delta X_I}{\delta N} = -\frac{k_L f}{k_I - k_L} \varphi_{I,N} \,.$$

9 This is a strong assumption in view of the costs that are presumably attached to investing in illegal activities (organization of safe hideouts, body guards, bribes, etc.) and the psychological strain from living in the fear of being caught. These costs could be taken into account by assuming for instance that owners of capital (as well as workers) would not consider renting capital (the services of their labour) to the illegal sector unless they receive a premium over what they would earn by remaining in the legal sector. As long as both factors receive the same proportional premium, relative factor prices are not distorted and the analysis in the text still holds. Introducing different differentials for capital and labor would create the well-known pathologies studied by Bhagwati and Srinivasan (1971) and Johnson (1966).

10 It is an empirical matter to decide whether illegal activities are, on average, more capital intensive than legal ones.

As shown by (10)–(13), each partial derivative is the product of a conventional Rybczinski effect whose sign depends on that of $k_I - k_L$ and a new term, $\varphi_{i,j}$ ($i = I$, L; $j = K$, N), that reflects the effect of growth on the size of tax revenues and law enforcement expenditures. Some tedious manipulations would show that $\varphi_{i,j}$ is positive and greater than one[11] for all i, j. Hence, it follows that the asymmetry between the legal and the illegal sector enhances or "magnifies" the conventional Rybczinski effects. The reason for this "magnified" Rybczinski effect is very simple. Imagine that the legal sector is more capital intensive than the illegal sector. Then, at given relative commodity prices, an increase in the stock of capital leads to an expansion of the legal sector and a contraction of the illegal sector. This is the conventional Rybczinski effect. Now, as the legal sector expands, the goverment's tax base is enlarged since only legal income is taxed. This enables the government to enforce the law more intensively and reduces the expected profitability of illegal activities. Both capital and labour will move from the illegal sector into the legal sector. This secondary effect reinforces the initial Rybczinski effect. All other cases can be analyzed by using a similar reasoning. These results suggest that overly "optimistic" as well as overly "pessimistic" scenarios are indeed plausible, depending on the circumstances at hand (relative factor intensities and source of economic growth). A pessimistic scenario unfolds each time the factor of production used intensively in the illegal sector expands. The resulting contraction of the legal sector cripples the government's efforts to enforce the law and the illegal sector is left to prosper[12].

Relaxing the assumption of a *fixed* tax rate would not alter these results significantly, nor would abandoning the assumption of *given* terms of trade[13].

[11] See appendix.

[12] The above results are somewhat less general than the original Rybczinski theorem. Recall that they hold only in the neighborhood of the equilibrium and that we have assumed that capital and labor exihibit limited substitutability.

[13] Supose that the government fights illegal activities with stronger determination when they grow and show more laxism when they recede. A simple and convenient way to represent this "discretionary" policy is to assume that is $\tau = \mu / X_L$, where μ is a constant. Then, substituting into (6) would give:

$$p_I[1 - \pi(\mu)] f'[k_I(\Omega)] = (1 - \mu/X_L) g'[k_L(\Omega)] .$$

Law enforcement is now *stable* and π remains constant. Everything else equal, $a(n)$ increase (decrease) in X_L now makes the legal sector more (less) attractive to domestic labor and capital by raising (lowering) after-tax income. Thus, even in the case of stable law enforcement, economic growth will have the "magnified" impact that we have already described.

What if p_I is *variable*, while τ is kept constant? Consider the case of a net *exporter* of illegal goods. If, at given terms of trade, economic growth boosts (hampers) illegal activities, p_I will decrease (increase) and the resulting drop (rise) in illegal output may reduce significantly or eliminate altogether the magnification effect that we have emphasized in this paper. It still remains that, thanks to the contraction of the legal sector and the resulting reduction in law enforcement, illegal output will be larger (smaller) than if no magnification effect took place. If the country is a net *importer* of illegal goods, any increase in factor endowments that results in $a(n)$ expansion (contraction) of the illegal sector will force p_I to rise (fall) and thus strengthen the magnification effect.

IV. TECHNICAL PROGRESS IN THE LEGAL SECTOR

We now explore the consequences of technical progress in the legal sector on the composition of output. I shall limit myself to the case of a Hicks-neutral improvement[14]. To study this problem, we need to redefine (6) and (8) as follows:

$$(6)' \qquad p_I[1-\pi(\tau X_L)]f'[k_I(\Omega)] = (1-\tau)\beta g'[k_L(\Omega)]\,,$$

$$(8)' \qquad X_L = \beta g[k_L(\Omega)](N-N_I)\,,$$

where β is degree of improvoment in the productivity of both factors of production. Differentiation of (6)′, (7), (8)′ and (9) with respect to β yields:

$$(14) \qquad \frac{\delta X_L}{\delta\beta} = \frac{A-B}{A+\dfrac{\pi}{1-\pi}\Theta B} X_L > 0\,,$$

$$(15) \qquad \frac{\delta X_I}{\delta\beta} = -\frac{\dfrac{(\Omega+k_L)(k_I-k)}{(\Omega+k_I)(k_L-k)}\left[1+\dfrac{\pi}{1-\pi}\Theta\right]B}{A+\dfrac{\pi}{1-\pi}\Theta B} X_I < 0\,.$$

As expected, a technical improvement in the legal sector does raise the output of the legal sector and reduce that of the illegal sector. Notice however that, in both cases, [see (14) and (15)], the larger π (or θ) is, the larger the change in output becomes. This is once more because the expansion of the legal sector helps the government to collect more taxes and deter illegal activities more effectively. Technical progress in the illegal sector would have the opposite (magnified) effect.

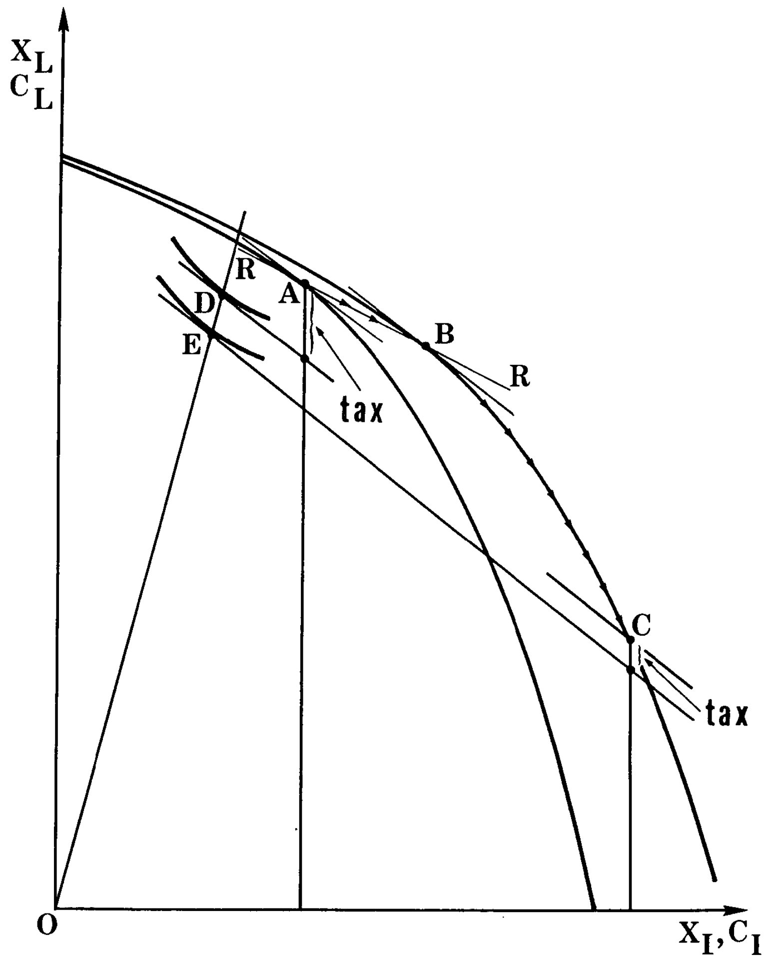
V. WELFARE ANALYSIS

The welfare analysis of the above model remains relatively simple as long as one treats illegal products as *goods*[15]. The following diagram represents a trading equilibrium in which the home country is a net exporter of illegal goods. The output and consumption of legal goods and of illegal goods are measured, respectively, on the vertical axis and horizontal axis. I assume that the terms of trade, p_I, are fixed. Points A and C are, respectively, the production point *before*

[14] The interested reader can extend the analysis to the various cases studied in Findlay and Grubert (1959).

[15] But then, why would the domestic government seek to deter their production? A plausible reason is that these products have some undesirable side-effects. For instance, drug addiction impairs one's judgement and work efficiency. Ultimately, it raises one's probability of early death. To reduce or attempt to eliminate this externality, the government then sees no other recourse but to make the production of these goods a criminal activity. The present model does not rest on this argument. Modelling the above externality would made the model too difficult to handle. Instead, I implicitly assume that the government acts on the "moral" ground that some products ought not be consumed in a well-behaved society.

and *after* economic growth. I consider a case of "pro-illegality" bias. Point B shows what would happen to production in the absence of a "pro-illegality" bias (points A and B are on the Rybczinski line RR). Points D and E are the consumption points before and after growth. The national *disposable* income line used to get the tangency points D and E is obtained by subtracting taxes (τX_L) from national income valued at world prices. Because of the "pro-illegality" bias, taxes are lower in the post-growth situation than in the ante-growth situation. Of course, in either case, they represent the same fraction τ of the value of legal output. The figure is drawn to show a possible, though far from necessary, case of immiserization: as the illegal sector expands, diminished law enforcement pushes its expansion wall beyond what comparative advantage would require (point B). At point C, the output of illegal goods is too large![16] This will happen only for very low tax rates and/or a very large value of θ, the expenditure-elasticity of successful enforcement.



[16] Of course, immiserization can also occur when growth imposes a "anti-illegality" bias.

VI. CONCLUSION

This paper provided an extremely simple model of a small, open economy whose resources are partially engaged in activities prohibited by the government. Depending on the circumstances, economic growth can stimulate or hamper the development of illegal activities. But, in either case, the effect of economic growth on the size of the illegal sector is "magnified". Economic growth that is originally "pro-illegality biased" ("anti-illegality biased") will attract (release) even more resources to (from) the illegal sector, because of the associated weakening (strengthening) of law enforcement efforts. It was also shown that the country can be immiserized as the result of the overexpansion of either sector.

VII. APPENDIX

The following results are the basis for the claims made in section III.

$$\varphi_{L,K}=\varphi_{L,N}=\frac{A}{A+\dfrac{\pi}{1-\pi}\Theta B}>1\,, \tag{A1}$$

$$\varphi_{I,K}=1-\frac{\dfrac{\pi(\Omega+k_L)}{(1-\pi)(\Omega+k_I)}\Theta B}{A+\dfrac{\pi}{1-\pi}\Theta B}>1\,, \tag{A2}$$

$$\varphi_{I,N}=1-\frac{\dfrac{\pi(\Omega+k_L)k_I}{(1-\pi)(\Omega+k_I)k_L}\Theta B}{A+\dfrac{\pi}{1-\pi}\Theta B}>1\,. \tag{A3}$$

with,

$$A=\frac{(k_I-k_L)^2}{(\Omega+k_I)(\Omega+k_L)}>0\,,$$

$$\Theta=\frac{E\pi'}{\pi}>0\,, \tag{A4}$$

$$B=\frac{\sigma(k_I)(k_L-k)k_I}{\Omega(k_I-k)}-\frac{\sigma(k_L)(\Omega+k_I)k_L}{\Omega(\Omega+k_L)}<0\,, \qquad \text{for all} \quad k_I,\, k_L\,,$$

where θ is the expenditure-elasticity of successful enforcement and $\sigma(k_i)$, $i=I, L$, is the elasticity of substitution between capital and labour in the ith sector. I assume that the expression $A+(\pi/1-\pi)\theta B$ is positive, even though B is negative. Notice that, as expected, the larger θ is the larger the value of $\varphi_{i,j}$, $(i=I, L, j=K, N)$ gets.

Brooklyn College of
The City University of
New York

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