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**The Effect of Joint-Product Export
Smuggling on Export Tax Policy**

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ECONOMIC DEVELOPMENT AND TRADE LIBERALIZATION:

THE INDONESIAN EXPERIENCE

ABSTRACT

This paper analyzes the effect of joint-product export smuggling on the revenue-maximizing export tax rate and tax revenue collection under the small country assumption. The results indicate that the effect of introducing joint-product export smuggling is dependent on whether legal and illegal exports are considered a substitutable or complementary activity for the exporting firm.

The results of the model are applied to the issue of cigarette smuggling in the United States. The paper concludes that if legal and illegal interstate trade in cigarettes are substitutable activities for firms in the wholesale and retail tobacco industry, then states levying relatively high excise taxes should reduce their tax rates. This action will increase legal trade at the expense of illegal trade and raise the level of tax revenue collected.

The proposed increase in the federal cigarette excise tax to fund health care reform is also discussed within the framework of the paper's model. The model suggests that a substantial increase in the federal cigarette tax may generate over-invoicing of cigarette exports and thereby reduce the market share of legal cigarettes. A rise in the cigarette tax rate could therefore have an ambiguous effect on tax revenues collected and jeopardize the funding of the health care program. (JEL: F13, H26, H21)

I. Introduction.

The smuggling of imports and exports is a common phenomenon in lesser developed countries where high tariff or export tax rates are levied on traded goods. Trade taxes have a long history of being used as a revenue raising device in the third world.

This paper expands on the work by Johnson (1972), Bhagwati and Srinivasan (1973), Pitt (1981), and Deardorff and Stolper (1990) by examining the effect of smuggling on trade tax rates and revenue collection. A partial equilibrium export tax revenue maximization model is presented in this paper. The results of the analysis indicate that the introduction of joint-product export smuggling alters the revenue-maximizing export tax rate. It is demonstrated that the revenue-maximizing tax rate and revenue collected will rise or fall depending on whether legal and illegal trade are complementary or substitutable activities, respectively, for the exporting firm.

II. Assumptions on the Exporting Firm and the Export Supply Function.

The country is assumed to produce a pure export good, and the domestic export producing firm is assumed to be a price taker in the world market. The goal of the government is to maximize export tax revenue. If firms in the export industry engage in smuggling, then they produce a joint-product export, assumed to be of the type described in the paper by Pitt (1981).¹ Pitt described a smuggling firm that produced a joint-product export good composed of a legal export unit combined with an illegal export unit. Pitt's smuggling production function embodied a real resource cost associated with smuggling, a

¹ A number of papers in the smuggling literature have developed joint-product smuggling models. For examples, see Martin and Panagariya (1984), Thursby et al. (1991), and Fausti (1992).

confiscation cost associated with smuggling, and legal trade as a cover for illegal trade. With respect to the model presented below, Pitt's confiscation cost assumption is modified by assuming that confiscation revenues collected by the government just offset the real resource cost of enforcement incurred by the government.

The country's export supply function is assumed to have two possible states of nature: 1) all firms engage in legal trade only; and 2) all firms engage in joint-product smuggling. Under state 1, the export supply function is assumed to be a function of the tax distorted world price of exports: $P^f \cdot (1-t) = P^b$. Holding the world price P^f constant, the export supply function is defined as $L(t)$, $L'(t) < 0$, where t is the percentage tax rate levied on exports. Under state 2, the legal export supply function, $L(t, S)$, is defined as a function of the export tax rate and the smuggling supply function, $S(t)$, $S'(t) > 0$. It is assumed that joint-product smuggling generates Pitt's price disparity result, such that P^s , the equilibrium price under state 2, is greater than P^b , the equilibrium price under state 1. Finally, it is assumed that all other factors affecting the legal export supply function under both states of nature are held constant.

III. The Effect of Joint-Product Smuggling on Total Exports and Trade Tax Revenues.

The first issue addressed is the effect of the introduction of joint-product smuggling on total exports, legal exports, and tax revenue collection:

PROPOSITION 1. *The introduction of joint-product smuggling will: 1) increase total export production; and 2) have an ambiguous effect on legal exports. Thus, the introduction of joint-product smuggling has an ambiguous effect on tax revenue collection.*

The small country assumption made earlier implies that the demand for exports is perfectly elastic. Assuming that the level of total export production (X), after the export tax is levied but before smuggling is introduced, is equal to L_1 ,

$$X_1 = L_1. \quad (1)$$

After smuggling is introduced, the level of total export production is equal to the sum of legal and illegal exports,

$$X_2 = L_2 + S_2. \quad (2)$$

Assume the supply of total exports has a positive relationship with the price of exports. The introduction of joint-product smuggling generates price disparity, $P^s \geq P^t$. This implies the production of total exports increases, $X_2 \geq X_1$. Substituting for X_2 , we have $L_2 + S_2 \geq X_1$, or equivalently, $S_2 \geq X_1 - L_2$. The presence of smuggling implies that

$S_2 \geq 0$. Substituting for X_1 produces inequality (3),

$$S_2 \geq L_1 - L_2. \quad (3)$$

Inequality (3) demonstrates that the production of exports destined to be marketed via illegal channels is greater than the change in the production of exports destined to be marketed via legal channels. However, as in Pitt's paper, it can not be determined if the amount of X marketed via legal trade channels increases or decreases. Therefore, the effect of smuggling on export tax revenues is ambiguous.² The above discussion establishes proposition 1.

² Fausti (1992) used this approach to discuss the impact of smuggling on total exports. Pitt (1981), and Deardorff and Stolper (1990) also derive ambiguous results for the effect of the introduction of smuggling on legal trade. They indicate that the introduction of smuggling could actually increase tax revenue collected.

The preceding analysis is an alternative way of presenting Pitt's discussion of tax revenue maximization.³ However, an interesting implication of Pitt's tax revenue maximization analysis has been overlooked. Pitt demonstrates that a positive level of smuggling may be necessary to maximize tax revenue. In order for a positive level of smuggling to increase legal trade and tax revenues, i.e., $L_2 > L_1$, legal and illegal trade must be complementary activities for the exporting firm. This would be a plausible assumption for the Pitt type of smuggling. However, for the Bhagwati and Hansen (1973) type of clandestine smuggling, one would expect legal and illegal goods to be substitutes. If legal and illegal trade are assumed to be substitutable activities in a joint-product smuggling model, then the introduction of smuggling will reduce legal exports and tax revenue, $L_1 > L_2$.

IV. The Effect of Joint-Product Smuggling on the Revenue-Maximizing Export Tax Rate.

The export tax rate is set to maximize revenues collected before joint-product smuggling begins (state 1). Since it is assumed that the country produces a pure export good, domestic consumption can be ignored. Domestic production and thus export supply are solely dependent on the exogenous world price for the exported good. Any tax levied on exports must be fully absorbed by domestic producers. Given this set of circumstances, the legal export supply function as defined under state 1 is $L(t)$.⁴ The government's total revenue function is defined as,

³ See Pitt (1981, p. 453) for his discussion of tax revenue maximization in the presence of joint-product smuggling.

⁴ If one assumes that legal trade is a function of the domestic price of exports, $L(P)$, and $P = P^f \cdot (1-t)$, the results remain unaltered. The decision to make legal trade a function of the tax was done to simplify the mathematics presented in the paper.

$$TR = t \cdot P^f \cdot L(t), \text{ define } L' < 0, \text{ where } L' = dL/dt.^5 \quad (4)$$

Total tax revenue is defined as tax revenue collected on exports evaluated at world prices. To determine the revenue-maximizing tax rate, the first derivative (dTR/dt) is derived and set to zero in equation (5) and the revenue-maximizing tax rate is given in equation (6),

$$dTR/dt = P^f \cdot L + P^f \cdot t \cdot L' = 0, \quad (5)$$

$$t_0 = -(L/L') > 0. \quad (6)$$

When joint-product smuggling is introduced, the government's total revenue function is altered by replacing the legal export supply function $L(t)$ in equation 4 with $L(t, S)$. The supply of legal exports is now a function of t and S (state 2). Following the same procedure as above, the revenue-maximizing tax rate in the presence of smuggling is derived,

$$TR = t_1 \cdot P^f \cdot L(t, S), \text{ and define } S' > 0, \text{ where } S' = dS/dt.^6 \quad (7)$$

$$dTR/dt = P^f \cdot L + P^f \cdot t_1 \cdot [L_t + \partial L / \partial S \cdot S'] = 0, \text{ let } \partial L / \partial S = L_s, \quad (8)$$

$$t_1 = -L / (L_t + L_s \cdot S') > 0. \quad (9)$$

In equations 8 & 9, the term $L_s \cdot S'$ captures the indirect effect of a marginal change in the tax rate on the supply of legal exports. From the discussion above, its sign is dependent on whether legal and illegal export trade are substitutable or complementary activities for the exporting firm, $L_s < 0$ or $L_s > 0$ respectively. The partial derivative $\partial L / \partial t = L_t < 0$ represents the direct effect of a marginal change in the tax rate on the supply of legal exports.

⁵ It is assumed that in the absence of smuggling, tax revenue collection is a cost-less activity for the government. The tax revenue generated by the export tax is assumed to increase, attain a maximum and then decline as the tax rate rises.

⁶ It is assumed that the real resource cost associated with government enforcement against smuggling is exactly offset by the confiscation revenues collected by enforcement officials.

Under the assumption that the direct effect dominates the indirect effect, $t_1 > 0$. Equation (9) brings the discussion to proposition 2:

PROPOSITION 2. *The introduction of joint-product smuggling will reduce the revenue-maximizing tax rate if $\partial L/\partial S < 0$, increase the revenue-maximizing tax rate if $\partial L/\partial S > 0$, and leave it unaltered if $\partial L/\partial S = 0$.*

To establish proposition 2, the ratio

$$t_1/t_0 = (-L'/L) \cdot (-L/[L_t + L_s \cdot S']) = L' / [L_t + L_s \cdot S'] \quad (10)$$

is examined under the following assumptions: 1) $\partial L/\partial S = 0$; 2) $\partial L/\partial S < 0$; and 3) $\partial L/\partial S > 0$.

When $L_s = 0$, it indicates that the exporting of legal and illegal goods are unrelated activities. This implies that once the exporting firm decides to engage in smuggling, the amount the firm decides to smuggle is independent of the amount it decides to export via legal channels. While this assumption is intuitively unappealing, it implies that the ratio in eq. 10 reduces to L'/L_t . To simplify the analysis it is now assumed that the legal trade supply response to a change in the export tax rate is the same under both states of nature, $L' = L_t$. Under this assumption $t_1/t_0 = 1$, and this indicates that the introduction of joint-product smuggling has no effect on the revenue maximizing tax rate.

When it is assumed that $L_s < 0$, the implication is that the exporting of legal and illegal goods are substitutable activities for the exporting firm. This implies that once the exporting firm decides to engage in smuggling, the amount of legal trade it engages in declines, reducing total tax revenues collected. Also when $L_s < 0$, the ratio $t_1/t_0 < 1$, indicating the tax rate must be reduced in order to maximize the tax revenue collected.

When it is assumed that $L_s > 0$, it indicates that legal and illegal trade are complementary activities for the exporting firm. This implies that

once the exporting firm decides to engage in smuggling, the amount of legal trade the firm engages in will increase and total tax revenues collected by the government will rise. Under this assumption $L_S > 0$, the ratio $t_1/t_0 > 1$, indicating that the tax rate must be increased in order to maximize the tax revenue collected.

The effect of smuggling on the revenue-maximizing tax rate can also be explained within the framework of a Laffer Curve, i.e., a tax revenue/tax rate diagram. If legal and illegal trade are complementary activities ($L_S > 0$) for the exporting firm, then the introduction of smuggling will shift the Laffer Curve up and to the right. If the initial tax rate remains unchanged after the shift, it will be to the left of the tax rate that would maximize tax revenue in the presence of smuggling. On the other hand, if legal and illegal trade are substitutable activities ($L_S < 0$) for the exporting firm, then the introduction of smuggling will shift the Laffer Curve down and to the left. If the initial tax rate remains unchanged after the shift, it will be to the right of the tax rate that would maximize tax revenue in the presence of smuggling.⁷

The contribution of this paper is to introduce the concept of legal and illegal trade as being either complementary or substitutable activities for the exporting firm. An analysis of the consequences stemming from this contribution for the revenue maximizing tax rate and tax revenue collected provides an answer to the contradictory results found in the smuggling literature on these issues.

⁷ A graphical exposition of the effect smuggling has on total tax revenues can be found in the appendix.

In the clandestine smuggling literature, Bhagwati and Srinivasan (1973) demonstrate that the introduction of smuggling reduces tax revenue collected for a given tax rate. This result is consistent with legal and illegal trade being substitutable activities. A comparison of revenue-maximizing tax rates under the smuggling and non-smuggling scenarios is not possible with the Bhagwati and Srinivasan model. The ranking of the revenue-maximizing tax rate in the presence of smuggling below the rate for non-smuggling was presented in a paper by Johnson (1972). His result is consistent with legal and illegal trade being substitutable activities. With respect to the relationship between legal and illegal trade, the results of the clandestine smuggling literature indicate an implicit assumption of legal and illegal trade being substitutable activities for the smuggling firm.

In the joint-product smuggling literature the issue of ranking revenue-maximizing tax rates for the smuggling and non-smuggling scenario has not been addressed. Pitt (1981), Deardorff and Stolper (1990) and Fausti (1992) address the comparison of tax revenue collected issue and they arrive at ambiguous results.⁸ The ambiguous results would become deterministic and consistent with the results derived in this paper if an additional assumption is made with respect to whether legal and illegal trade are substitutable or complementary activities for the smuggling firm.

Other papers in the joint-product and clandestine smuggling literature do not address the issue of whether legal and illegal trade are substitutable or complementary activities. For examples, see Thursby et al. (1991), Sheikh (1989), Scholär (1989), and Martin and Panagariya (1984). However, an implied

⁸ Their results are called ambiguous because a positive level of smuggling only holds the possibility of increasing tax revenues.

or overt assumption that legal and illegal trade is either a substitutable or complementary activity for the firm provides a common strand connecting trade flows, tax rates, and tax revenue implications discussed in the smuggling literature.

V. Federal and State Excise Taxes and Smuggling: A Discussion.⁹

The "buttlegging" of cigarettes is a type of smuggling that has arisen in the U.S. because of state excise tax differentials.¹⁰ In a recent paper on joint-product smuggling by Thursby et al. (1991), commercial interstate cigarette smuggling between states was used to provide empirical support for the price disparity phenomena generated in their theoretical model. The results of the model presented in this paper suggest that if legal and illegal interstate commercial trade in cigarettes represent substitutable activities for the firm, then in high tax states where smuggling is most pervasive the tax rate should be reduced in order to increase revenues and reduce smuggling activity.

Smuggling to avoid the federal excise tax on cigarettes is non-existent today because of tight regulatory control over cigarette manufacturers who are required to pay the federal excise tax on domestic consumption. The American consumer purchased and paid federal and state taxes on 510 billion cigarettes in 1991. The cigarette industry, however, is not subject to an export tax, and

⁹ The price effect of state and federal excise taxes on cigarettes is analogous to a tariff levied on an imported good. The model's results derived in the previous section can be applied to the cigarette industry based on the symmetry between import and export taxes as described by Lerner (1936).

¹⁰ For discussion and empirical analysis of interstate cigarette smuggling in the U.S., see Baltagi and Goel (1987), Baltagi and Levin (1986), Sullivan (1985), and Johnson (1984).

the industry exported approximately 180 billion cigarettes or 9 billion packs in 1991.¹¹

The Clinton administration has suggested that one way to fund health care reform is to increase the federal cigarette excise tax, by as much as 2 dollars a pack.¹² This action may spawn the type of smuggling found in Indonesia, Sudan, and other third world countries.¹³ These countries experience under- and over-invoicing of trade goods, misclassification of traded goods, etc, as firms try to avoid high trade taxes. If the federal excise tax becomes high enough, one could see over-invoicing of cigarette exports or the clandestine smuggling of exported American cigarettes back into the country.¹⁴ The commencement of this type of illegal activity will affect tax revenue collection.

The magnitude of the effect will depend on how pervasive smuggling becomes and whether legal and illegal trade in cigarettes are substitutable or complementary activities for the smuggling firm. If they are substitutable activities, then domestic legal trade in cigarettes will decline as compared to the non-smuggling situation. As a consequence, actual tax revenues may fall below projected levels and generate a shortfall in health care reform

¹¹ Additional data on the cigarette industry can be found in the USDA's Agricultural Statistics Yearbook 1992.

¹² For an insightful discussion on the issue of increasing the federal excise cigarette tax to fund health care reform see the article by Warner (1993).

¹³ A discussion of smuggling activity in these countries can be found in Cooper (1974), Pitt (1981), and Deardorff and Stolper (1990).

¹⁴ The tripling of the California state cigarette excise tax in 1989, and the large increase in the Canadian cigarette tax in 1991 have generated these types of smuggling activities. For a discussion of these issues see Bartlett (1994).

funding. However, if they are complementary activities, then legal trade will increase, compared to the non-smuggling situation. As a consequence, actual tax revenue will be above projected levels for the non-smuggling situation. In either case, illegal activity will increase.

VII. Summary.

The analysis presented in this paper demonstrated that the relationship between illegal and legal trade determines the effect of smuggling on the revenue-maximizing tax rate and level of revenues collected. It was argued that assumption of legal and illegal trade being substitutable or complementary activities for the exporting firm was consistent with the literature on clandestine and joint-product smuggling, respectively.

The results of the analysis were applied to the domestic cigarette market. The policy conclusions were based on alternative assumptions of whether legal and illegal trade were substitutable or complementary activities for the firm. However, until the empirical question of "what is the actual relationship between legal and illegal trade in cigarettes?" is answered, a policy prescription would be premature.

References

- Bhagwati, J., and B. Hansen, 1973, "A Theoretical Analysis of Smuggling," *Quarterly Journal of Economics* 87, pp. 172-187.
- Bhagwati, J., and T.N. Srinivasan, 1973, "Smuggling and Trade Policy," *Journal of Public Economics* 2, pp. 377-389.
- Baltagi, B.H., and R.K. Goel, 1987, "Quasi-Experimental Price Elasticities of Cigarette Demand and the Bootlegging Effect," *American Journal of Agricultural Economics* 59, pp. 750-54.
- Baltagi, B.H., and D. Levin, 1986, "Estimating Dynamic Demand for Cigarettes Using Panel Data: The Effects of Bootlegging, Taxation and Advertising Reconsidered," *Review of Economics and Statistics* 68, pp. 750-54.
- Bartlett, B., 1994, "Cigarette Taxes, Smuggling, and Revenues," forthcoming in Taxnotes.
- Cooper, R., 1974, "Tariffs and Smuggling in Indonesia," in: J. Bhagwati, ed., Illegal Transactions in International Trade (Amsterdam: North-Holland), pp.183-192.
- Deardorff, A. and W.F. Stolper, 1990, "Effects of Smuggling under African Conditions: A Factual, Institutional and Analytic Discussion," *Weltwirtschaftliches Archiv: Review of World Economics* 126(1), pp. 116-141.
- Fausti, S., 1992, "Smuggling and Parallel Markets for Exports," *The International Trade Journal* 6, (4), pp. 443-470.
- Johnson, H.G., 1972, "Notes on the Economic Theory of Smuggling," *Malayan Economic Review* 17, pp. 1-7.
- Johnson, P., 1984, The Economics of the Tobacco Industry (NY: Praeger Publishing).
- Lerner, A.P., 1936, "The Symmetry between Import and Export Taxes," *Economica* 3, pp. 306-313.
- Martin, L., and A. Panagariya, 1984, "Smuggling, Trade, and Price Disparity: A Crime Theoretic Approach," *Journal of International Economics* 17, pp. 201-217.
- Pitt, M., 1981, "Smuggling and Price Disparity," *Journal of International Economics* 11, pp. 447-458.
- Scholër, K., 1989, "Risk and Illegal Trade," *Metroeconomica* 40, pp. 87-97.
- Sheikh, M.A., 1989, "A Theory of Risk, Smuggling and Welfare," *World Development* 17, pp. 1931-1944.

Sullivan, D., 1985, "Testing Hypotheses about Firm Behavior in the Cigarette Industry," *Journal of Political Economy* 93, pp. 586-589.

Thursby, M., R. Jensen, and J. Thursby, 1991, "Smuggling, Camouflaging, and Market Structure," *Quarterly Journal of Economics* 105, pp. 789-814.

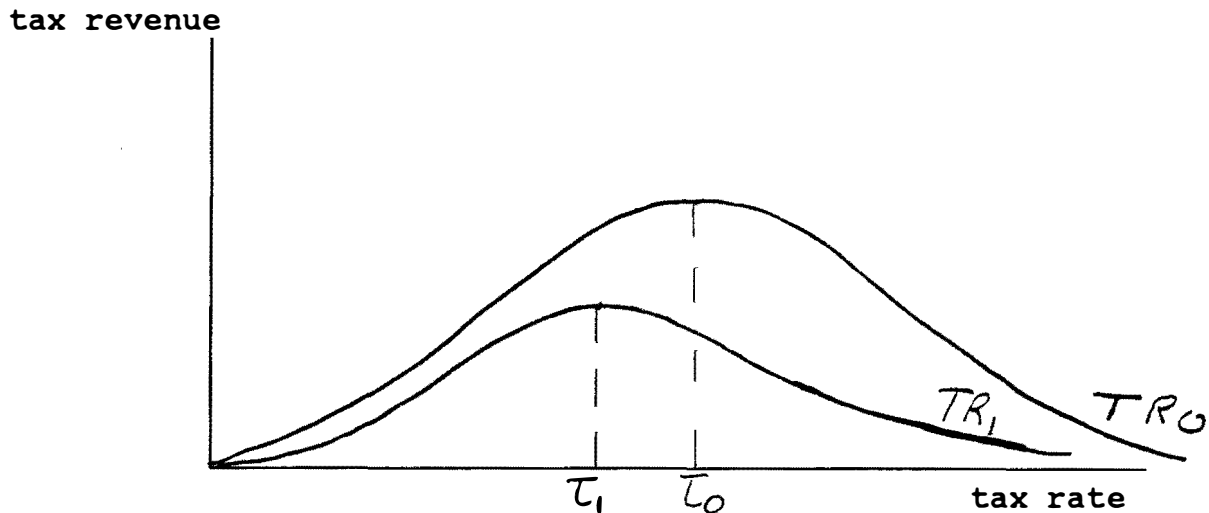
United States Department of Agricultural, 1992, Agricultural Statistics (Washington, D.C.: USGPO).

Warner, K.E., 1993, "Editorial: Profits of Doom," *American Journal of Public Health* 83, (9), pp. 1211-1213.

VII. APPENDIX:

Diagram I

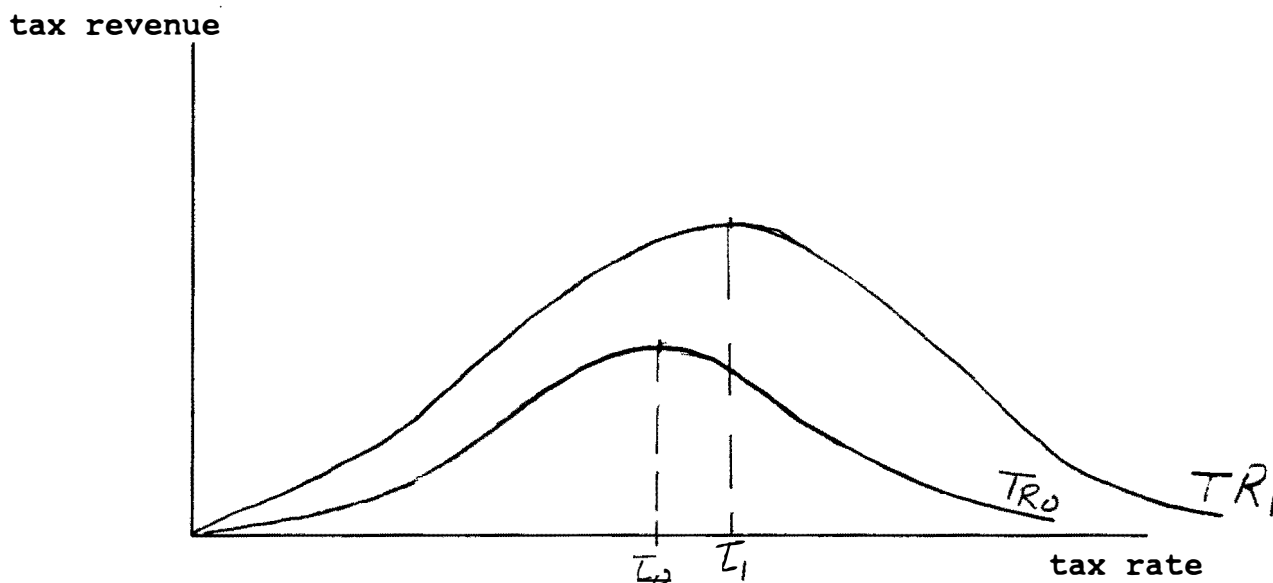
$$L_s < 0$$



In diagram I, the tax revenue function (Laffer Curve) labeled TR_0 represents the before smuggling case. The tax rate that maximizes tax revenue for this case is labeled t_0 . Assume legal and illegal trade are substitutes. The introduction of illegal trade causes the total revenue curve to shift in and to the left, labeled TR_1 . The revenue-maximizing tax rate in the presence of smuggling is now t_1 . If legal and illegal trade are substitutable activities for the exporting firm, then the introduction of smuggling reduces the revenue-maximizing tax rate, $t_1 < t_0$.

Diagram II

$$L_s > 0$$



In diagram II, the tax revenue function (Laffer Curve) labeled TR_0 again represents the before smuggling case. The tax rate that maximizes tax revenue for this case is labeled t_0 . Assume legal and illegal trade are complements. The introduction of illegal trade causes the total revenue curve to shift out and to the right, labeled TR_1 . The revenue-maximizing tax rate in the presence of smuggling is now t_1 . If legal and illegal trade are complementary activities for the exporting firm, then the introduction of smuggling increases the revenue-maximizing tax rate, $t_1 > t_0$.