SMUGGLING AND TRADE POLICY *

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Bhagwati and Hansen (1973) have shown that the phenomenon of smuggling in an open economy can be incorporated readily into standard trade—theoretic analysis by treating smuggling as essentially involving a less favourable transformation curve insofar as smuggling involves a real cost.¹

In this paper, we utilise the same analytical device and extend the Bhagwati–Hansen analysis to a number of other issues traditionally considered in the theory of international trade policy. We use the same analytical simplifications:

(i) Smuggled goods and legal imports are cleared at the same final price: consumers do not discriminate in their purchases between the two sources of supply.

(ii) Changes in social welfare are analysed by reference to a standard Crusoe-type social utility function defined on the *current* availability of goods and services.

(iii) Goods constituting consumption and directly entering the utility function are smuggled, and not bads (e.g. heroin) or assets (e.g. gold): the model used for our analysis is the traditional trade—theoretic model where non-traded primary factors produce traded final goods entering the utility function.

(iv) Expenditure on enforcement of the tariff is held implicitly constant in comparing the tariff-with-smuggling and tariff-without-smuggling situations and is not explicitly considered, it keeping with

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¹ This real cost arises insofar as the avoidance of normal trade channels leads to increased costs – e.g. more expensive transport and higher f.o.b. price for imports.

the tradition of trade theory, in comparing either with the free-trade situation; one important effect is to rule out analysis of the possible trade-offs between increased enforcement expenditure and reduced smuggling.

(v) Finally, the bulk of our formal analysis is based on the two-traded-goods model.

Sec. 1 considers a country with monopoly power in (legal) trade (the small-country analytical results then being derivable as a special case) and derives the first-order conditions for an optimal solution when smuggling is possible and examines the set of policies that would yield this optimum. Noting that this set of policies is not operationally feasible in general, we proceed to examine therefore in sec. 2 the following issues in the 'second-best' domain where a tariff is the only policy instrument available. The following questions are considered:

(i) How does the optimal tariff without smuggling — which is clearly the first-best policy instrument — rank with the optimal tariff with smuggling — which is clearly, in light of sec. 2, not a first-best policy instrument?

(ii) How does the maximal-revenue tariff in the presence of smuggling compare with the optimal tariff in the presence of smuggling? ²

(iii) How does the maximal-revenue tariff in the presence of smuggling compare with the maximal-revenue tariff in its absence?

(iv) Is the maximal revenue that can be collected with smuggling lower than the maximal revenue in the absence of smuggling?

(v) For any *given* revenue, is the tariff rate with smuggling greater than the tariff rate without smuggling?

In sec. 3, we summarise our results in tabular form.

1. Consider a country producing two goods at levels X_1 , $G(X_1)$ when G is the transformation function ($G > 0$, $G' < 0$, $G'' < 0$ for $0 \leq X_1 \leq \bar{X}_1$). Let foreign trade take place through two channels: legal and smuggler's. Let the first commodity be imported. Let the second commodity (exportables) be the numeraire.

Let p_d be the domestic price ratio and p_l , p_s the foreign price ratios for legal trade and smuggler's trade. Let C_i be the consumption of commodity i . Let x_l , x_s be the imports of commodity 1 through the

² Harry Johnson (1950–51) has shown that, without smuggling, the maximal-revenue tariff is greater than the optimal tariff.

legal and smuggler's channels respectively. Let $U(C_1, C_2)$ be the concave social utility function.

Let $p_q = g(x_q)/x_q$ where $g(x_q)$ represents the exports of commodity 2 needed for getting imports of x_q units of commodity 1 through legal trade. We shall assume that $g(0) = 0$, $g' > 0$, $g'' \geq 0$ (where primes denote derivatives of appropriate order) implying that p_q is a non-decreasing function of x_q and $p_q < g'$. Clearly the case where $g'' \equiv 0$ will correspond to a situation where there is no monopoly power in trade. Analogously, let us assume $p_s = h(x_s)/x_s$ where $h(0) = 0$, $h' > 0$, $h'' \geq 0$ will correspond to the case where there are constant costs in smuggling.

$$C_1 \leq X_1 + x_q + x_s \quad (1)$$

$$C_2 \leq G(X_1) - g(x_q) - h(x_s) \quad (2)$$

$$C_1, C_2, X_1, x_q, x_s \geq 0.$$

Maximising the Lagrangean $\Phi = U - \lambda_1 [C_1 - X_1 - x_q - x_s] - \lambda_2 [C_2 - G + g + h]$, we get (for our interior solution):

$$U_1 = \lambda_1 \quad (3)$$

$$U_2 = \lambda_2 \quad (4)$$

$$\lambda_1 + \lambda_2 G' = 0 \quad (5)$$

$$\lambda_1 - \lambda_2 g' = 0 \quad (6)$$

$$\lambda_1 - \lambda_2 h' = 0 \quad \text{or} \quad (7)$$

$$\frac{U_1}{U_2} = -G' = g' = h'. \quad (8)$$

In other words the marginal rate of substitution in consumption is equated to the marginal rate of transformation in production, in legal trade and in smuggling.

If we do not wish to rule out corner solutions we can rewrite (3)–(7) as follows:

$$U_1 - \lambda_1 \leq 0 \text{ with equality if } C_1 > 0$$

$$U_2 - \lambda_2 \leq 0 \text{ with equality if } C_2 > 0$$

$$\lambda_1 + \lambda_2 G' \leq 0 \text{ with equality if } X_1 > 0$$

$$\lambda_1 - \lambda_2 g' \leq 0 \text{ with equality if } x_g > 0$$

$$\lambda_1 - \lambda_2 h' \leq 0 \text{ with equality if } x_s > 0.$$

One particular corner solution is of some interest. Suppose there is no monopoly power in legal trade, i.e., $g = p^f x$ where p^f is the fixed world terms of trade. Ruling out specialisation in consumption and production, the optimal solution will be characterised by free trade and no smuggling if:

$$U_1 = \lambda_1, \quad U_2 = \lambda_2, \quad \lambda_1 + \lambda_2 G' = 0, \quad \lambda_1 = \lambda_2 g' = \lambda_2 p^f$$

and $h'(0) \geq \lambda_1 / \lambda_2 = p^f$.

In other words, free trade will be the optimal policy in the absence of monopoly power in trade if, as we have assumed, the marginal terms of trade of the smuggler at zero level of smuggling are not superior to the legal world terms of trade, i.e., there is no incentive for smuggling when free trade prices prevail in domestic markets.

Returning, however, to an interior solution and the case of monopoly power in trade, and assuming competitive smuggling, production and consumption, we can sustain the optimal solution obtained above by:

- (i) consumption tax at an ad valorem rate c so that $\frac{h(x_s)}{x_s} (1 + c) = h'$
- (ii) tariffs (subsidies) on legal imports at an ad valorem rate t so that $\frac{g(x_g)}{x_g} (1 + t) = \frac{h(x_s)}{x_s}$
- (iii) production subsidies at the rate s so that $\frac{h(x_s)}{x_s} (1 + s) = -G'$.

In this framework, if we introduce a non-economic objective of raising the production of importables X_1 to some preassigned level X_1^* in the form of a constraint $-X_1 \leq -X_1^*$, we add the expression

$-\lambda_3(-X_1 + X_1^*)$ to the Lagrangean and maximise. The first order conditions (3), (4), (6) and (7) continue to hold. Eq. (5) gets modified to

$$\lambda_1 + \lambda_2 G' + \lambda_3 = 0. \quad (9)$$

Of course, the solutions for C_1 , C_2 , X_1 , X_2 , x_1 , x_s , λ_1 , λ_2 will be different with the non-economic objective present. The form of policy interventions, however, are the same:³ Consumption tax, tariff (subsidy) on legal imports and a production subsidy. In the presence of the non-economic objective, the production subsidy at rate s that equates $[h(x_s)/x_s](1+s)$ to $-G'$ will be higher than the consumption tax c that equates $[h(x_s)/x_s](1+c)$ to h' since $-G' = \lambda_1/\lambda_2 + \lambda_3/\lambda_2 = h' + \lambda_3/\lambda_2 > h'$, whereas in the absence of the non-economic objective the two rates will be equal.

2. While the analysis of the optimal policy mix in the presence of smuggling and monopoly power in (legal) trade that we have just set out is technically correct, it does assume the oddity that the smuggled goods be subject to consumption taxes in the same way as legally-traded goods. If we rule this out, and assume instead that smuggled goods fetch to the smuggler the tariff-inclusive price plus or minus the tax or subsidy on consumption of the legal imports and production, then the achievement of the optimal solution is impossible. We then have a second-best problem which we propose to tackle in a subsequent paper.

Instead we proceed to examine the question of the optimum level at which the tariff can be set, in the presence of smuggling, when the tariff is the only policy instrument available.⁴ We also extend the analysis, using only the tariff as a policy variable, to questions posed by revenue as an objective.

Let us then set out the conditions of equilibrium, given a tariff rate t , in the absence of (A) and in the presence of (P) smuggling:

³ Other non-economic objectives analysed by Bhagwati-Srinivasan (1969) can be introduced in the presence of smuggling with exactly the same type of policy consequences as for the case of production analysed in the text.

⁴ This is a problem of policy relevance as a number of LDCs are not equipped to utilise other instruments (such as production and consumption taxes) with quite the same efficacy.

$$\begin{array}{c} \text{A} \\ \hline C_{1A} = X_{1A} + x_{2A} \end{array} \quad (10A)$$

$$C_{2A} = G(X_{1A}) - g(x_{2A}) \quad (11A)$$

$$\frac{U_{1A}}{U_{2A}} = p_{dA}(t) \quad (12A)$$

$$-G'(X_{1A}) = p_{dA}(t) \quad (13A)$$

$$\frac{g(x_{2A})(1+t)}{x_{2A}} = p_{dA}(t) \quad (14A)$$

$$\begin{array}{c} \text{P} \\ \hline C_{1P} = X_{1P} + x_{2P} + x_{3P} \end{array} \quad (10P)$$

$$C_{2P} = G(X_{1P}) - g(x_{2P}) - h(x_{3P}) \quad (11P)$$

$$\frac{U_{1P}}{U_{2P}} = p_{dP}(t) \quad (12P)$$

$$-G'(X_{1P}) = p_{dP}(t) \quad (13P)$$

$$\frac{g(x_{2P})(1+t)}{x_{2P}} = p_{dP}(t) \quad (14P)$$

$$\frac{h(x_{3P})}{x_{3P}} = p_{dP}(t). \quad (15P)$$

As a preliminary to deriving the tariff rates that maximise revenue or welfare, let us derive the rates of change of the equilibrium values of some of the variables (denoted by a dot over the variable) with respect to changes in tariff. It can be shown that:

$$\dot{X}_{1A} = \frac{G'(1-\theta_A)}{G''(1+t)} > 0$$

$$\dot{x}_{2A} = \frac{-\theta_A}{(1+t) \frac{g'}{g} - \frac{1}{x_{2A}}} < 0$$

$$\dot{p}_{dA} = \frac{p_{dA}(1-\theta_A)}{(1+t)} > 0$$

$$\dot{X}_{1P} = \frac{G'(1-\theta_P)}{G''(1+t)} > 0$$

$$\dot{x}_{2P} = \frac{-\theta_P}{(1+t) \frac{g'}{g} - \frac{1}{x_{2P}}} < 0$$

$$\dot{p}_{dP} = \frac{p_{dP}(1-\theta_P)}{(1+t)} > 0$$

$$\dot{x}_{3P} = \frac{(1-\theta_P)}{(1+t) \frac{h'}{h} - \frac{1}{x_{3P}}} > 0$$

where

$$\theta_A = \frac{P_A/G'' + U_2}{P_A/G'' + U_2 - Q_A/p_{dA}} \quad \theta_P = \frac{P_P/G'' + U_2 - R_P/p_{dP}}{P_P/G'' + U_2 - (Q_P + R_P)/p_{dP}}$$

$$P_A = (U_{11} - p_{dA} U_{21})$$

$$P_P = (U_{11} - p_{dP} U_{21})$$

$$-p_{dA}(U_{12} - p_{dA} U_{22}) < 0$$

$$-p_{dP}(U_{12} - p_{dP} U_{22}) < 0$$

$$Q_A = \{(U_{11} - p_{dA} U_{21})$$

$$Q_P = \{(U_{11} - p_{dP} U_{21})$$

$$-g'(U_{12} - p_{dA} U_{22})\}$$

$$-g'(U_{12} - p_{dP} U_{22})\}$$

$$\times (g'/g - 1/x_{rA})^{-1} < 0$$

$$\times (g'/g - 1/x_{rP})^{-1} < 0$$

$$R_P = \{(U_{11} - p_{dP} U_{21})$$

$$-h'(U_{12} - p_{dP} U_{22})\}$$

$$\times (h'/h - 1/x_{sP})^{-1} < 0$$

Since $U_2 > 0$, $G'' > 0$ it is clear that $0 < \theta_A, \theta_P < 1$. Neither good is assumed inferior in consumption to ensure P_A, P_P, Q_A, Q_P, R_P are negative.

(1) Maximal-revenue tariffs: Let us first consider the maximization of revenue: T_A, T_P . Now:

$$T_A = g(x_{rA})t$$

$$T_P = g(x_{rP})t$$

$$\dot{T}_A = g + tg'\dot{x}_{rA}$$

$$\dot{T}_P = g + tg'\dot{x}_{rP}$$

Let us assume that T_A and T_P attain a unique maximum at the solution of $\dot{T}_A = 0$ and $\dot{T}_P = 0$ respectively. Let us denote the solutions by t_{AT}^* and t_{PT}^* . By definition,⁵ $\dot{T}_A \geq 0$ according as $t \leq t_{AT}^*$ and $\dot{T}_P \geq 0$ ac-

⁵ This is true, in general, only for values of t in a neighbourhood of t_{AT}^* and t_{PT}^* respectively.

according as $t \lesseqgtr t_{PT}^*$. By substituting for $\dot{x}_{QA}$, $\dot{x}_{QP}$, in the expressions for $\dot{T}_A$ and $\dot{T}_P$ respectively, we can then show that:

$$\frac{1+t}{t} \gtrless \frac{\theta_A(g'/g)}{g'/g - 1/x_{QA}} \quad \text{according as } t \lesseqgtr t_{AT}^* ;$$

$$\frac{1+t}{t} \gtrless \frac{\theta_P(g'/g)}{g'/g - 1/x_{QP}} \quad \text{according as } t \lesseqgtr t_{PT}^* .$$

(2) Optimal tariffs: Denoting the welfare levels achieved in the absence and in the presence of smuggling by U_A and U_P , we can next show that:

$$\dot{U}_A = U_2 \{p_{dA} - g'\} \dot{x}_{QA} ;$$

$$\dot{U}_P = U_2 [(p_{dP} - g') \dot{x}_{QP} + (p_{dP} - h') \dot{x}_{SP}] .$$

Let us assume that U_A and U_P attain their unique maximum at the solution t_{AU}^* and t_{PU}^* respectively of $\dot{U}_A = 0$ and $\dot{U}_P = 0$. Then, by definition, $\dot{U}_A \gtrless 0$ according as $t \lesseqgtr t_{AU}^*$ and $\dot{U}_P \gtrless 0$ according as $t \lesseqgtr t_{PU}^*$. By substituting for $\dot{x}_{QA}$, $\dot{x}_{QP}$, $\dot{x}_{SP}$ in the expression for $\dot{U}_A$ and $\dot{U}_P$ respectively, we can thus show that:

$$\frac{1+t}{t} \gtrless \frac{g'/g}{g'/g - 1/x_{QA}} \quad \text{according as } t \lesseqgtr t_{AU}^* ;$$

$$\frac{1+t}{t} \gtrless \frac{\theta_P(g'/g) - (1 - \theta_P)\{g'/g - 1/x_{QP}\}(h/g)}{(g'/g - 1/x_{QP})\{\theta_P - (1 - \theta_P)(h/g)\}}$$

$$\text{according as } t \lesseqgtr t_{PU}^* .$$

These inequalities hold in a neighborhood of t_{AU}^* and t_{PU}^* respectively.

We can now proceed to answer the questions which we posed in the introduction:

2.1. Comparison of maximal-revenue and optimal tariffs in the absence of smuggling

This implies ranking t_{AT}^* and t_{AU}^* ; and, as is already known from Johnson's (1950-51) classic analysis, $t_{AT}^* > t_{AU}^*$. This follows because $(1+t)/t$ is a decreasing function of t ; t_{AT}^* and t_{AU}^* are the solutions of

$$\frac{1+t}{t} = \frac{\theta_A(g'/g)}{g'/g - 1/x_{\ell A}} \quad \text{and} \quad \frac{1+t}{t} = \frac{g'/g}{g'/g - 1/x_{\ell A}};$$

and θ_A lies between 0 and 1, and $(g'/g)/(g'/g - 1/x_{\ell A})$ crosses $(1+t)/t$ from below at $t = t_{AU}^*$.

2.2. Comparison of optimal tariffs in the presence and in the absence of smuggling

We can see that, for constant-elasticity offers such that $\eta_g = xg'(x)/g(x)$ is constant for all $x \geq 0$, $t_{PU}^* < t_{AU}^*$: i.e. the optimal tariff in the presence of smuggling is less than in the absence of smuggling. This follows from the facts that $t_{AU}^* = (\eta_g - 1)$ and $t_{PU}^* = (\eta_g - 1)[1 - (1/\theta_P - 1)(h/g)] < \eta_g - 1$. However, η_g is in general a function of the particular x at which it is evaluated; hence, in general, we cannot rank t_{AU}^* and t_{PU}^* .

2.3. Comparison of the maximal-revenue and optimal tariffs in the presence of smuggling

We can show that, with smuggling $t_{PT}^* > t_{PU}^*$; i.e. the maximal-revenue tariff is higher than the optimal tariff, just as in the (traditional) case without smuggling. Note that t_{PT}^* and t_{PU}^* are respectively solutions of

$$\frac{1+t}{t} = \frac{\left(\frac{g'}{g}\right)\theta_P}{\frac{g'}{g} - \frac{1}{x_{\ell P}}} \quad \text{and} \quad \frac{1+t}{t} = \frac{(\theta_P)\frac{g'}{g} - (1-\theta_P)\frac{h}{g}\left(\frac{g'}{g} - \frac{1}{x_{\ell P}}\right)}{\left(\frac{g'}{g} - \frac{1}{x_{\ell P}}\right)\left[(\theta_P) - (1-\theta_P)\frac{h}{g}\right]}.$$

Further, $(1+t)/t$ is a decreasing function t . It can be shown that, when $t = t_{PU}^*$, $(1+t_{PU}^*)/t_{PU}^* > \theta_P(g'/g)/(g'/g - 1/x_{\ell P})$. Since $\theta_P(g'/g)/(g'/g - 1/x_{\ell P})$ crosses $(1+t)/t$ from below at $t = t_{PT}^*$, we can conclude that $t_{PT}^* > t_{PU}^*$. Fig. 1 illustrates the situation.

Fig. 1

2.4. Comparison of maximal revenue tariffs in the presence and in the absence of smuggling

As we noted earlier,

$$\frac{1+t_{AT}^*}{t_{AT}^*} = \frac{\theta_A \frac{g'}{g}}{\frac{g'}{g} - \frac{1}{x_{LA}}} = \frac{\theta_A \eta_g}{\eta_g - 1} \quad \text{and} \quad \frac{1+t_{PT}^*}{t_{PT}^*} = \frac{\theta_P \frac{g'}{g}}{\frac{g'}{g} - \frac{1}{x_{LP}}} = \frac{\theta_P \eta_g}{\eta_g - 1}.$$

Now θ_A and θ_P involve second derivatives of the welfare and transformation functions and in general we cannot assert anything about the ratio of θ_A to θ_P . Thus even if we were to assume that η_g is a constant, we cannot rank t_{AT}^* and t_{PT}^* and this conclusion holds a fortiori if η_g was not a constant.

2.5. Comparison of revenue collected, given the tariff rate, in the presence and in the absence of smuggling

We may now investigate whether the revenue collected, given the tariff rate, will reduce in the presence of smuggling. This is readily shown as follows.

First, we can show that x_{LA} reduces as the tariff increases. Let $\bar{t}$ be

the tariff that reduces x_{2A} to zero. Clearly $\bar{t}$ is determined by $(1 + \bar{t})g'(0) = -G'(X_1^*)$ where X_1^* is the output of X_1 under autarky.⁶ Let us confine ourselves to tariffs in the range $(0, \bar{t})$. Given our assumptions about G , U and g already made and assuming further that neither good is inferior, corresponding to any tariff t there exists a unique equilibrium in the absence of smuggling.

Consider now a tariff t under which an equilibrium exists in the absence as well as in the presence of a smuggling. It is clear that $p_{dP}(t) < p_{dA}(t)$. For if $p_{dP}(t) \geq p_{dA}$, then:

- (i) (13A) and (13P) will imply $X_{1A} \leq X_{1P}$ since $G'' < 0$;
- (ii) (14A) and (14P) will imply $x_{2A} \leq x_{2P}$ since $g(x)/x$ is an increasing function of x ;
- (iii) by assumption, $x_{3P} > 0$; and
- (iv) (10A), (10P), (11A) and (11P) will imply $C_{1A} < C_{1P}$ and $C_{2A} > C_{2P}$.

However, given the concavity of U and non-inferiority of either good, $C_{1A} < C_{1P}$, $C_{2A} > C_{2P}$ will imply $U_{1A}/U_{2A} = p_{dA} > U_{1P}/U_{2P} = p_{dP}$, contradicting the assumption that $p_{dP} \geq p_{dA}$.

Thus, for the same tariff, $p_{dP} < p_{dA}$ and consequently $x_{2P} < x_{2A}$. Since at $t = \bar{t}$, $x_{2A} = 0$ it follows that (the maximal tariff $\bar{t}$) for co-existence of smuggling and legal trade will be less than t . Let us now confine our attention to tariffs in the interval $(0, \bar{t})$. Clearly at $t = \bar{t}$, $x_{2P} = 0$ and $x_{2A} > 0$.

From the above, it immediately follows that given a tariff, the revenue that can be collected in the presence of smuggling is less than the revenue in the absence of smuggling. For the same tariff, the equilibrium domestic price ratio and legal imports are higher in the absence of smuggling; hence the tariff revenue will be higher. This also means that the maximum tariff revenue that can be collected is greater in the absence of smuggling. However, as we have already argued, we cannot in general rank the tariff rates that generate maximum revenue in the two cases.

2.6. Comparison of tariff rates generating given revenue, in the presence and in the absence of smuggling

We may now investigate yet another problem: In generating a given.

⁶ Implicitly we are assuming $g'(0) < -G'(X_1^*)$. This simply means that there is an incentive to import commodity 1 at the autarky point, if there is no tariff.

feasible revenue, can we argue that smuggling will require necessarily a higher or a lower tariff than if smuggling were not possible?

To analyse this question, consider any tariff revenue $\bar{T}$ that can be collected in the presence and absence of smuggling. If we now assume the revenue $\{T_A(t), T_P(t)\}$ collected by a tariff to increase, reach a maximum and then decrease as t increases,⁷ there will be pairs of tariffs $(\hat{t}_A, \hat{t}_A)$ and $(\hat{t}_P, \hat{t}_P)$ that yield $\bar{T}$. Since $T_A(t) > T_P(t)$ for all relevant t , it is clear that $\hat{t}_A \leq t_{AT} \leq \hat{t}_A$, $t_P \leq t_{PT} \leq \hat{t}_P$ and $\hat{t}_A < \hat{t}_P \leq \hat{t}_P < \hat{t}_A$. Thus, of the two tariffs that collect a given revenue in the absence of smuggling, the lower one is less than the lower tariff that collects the same revenue in the presence of smuggling and the higher one is larger than the higher one.

3. The results reached in sec. 2 may now be summarised in table 1, as follows:⁸

Table 1
Summary of results obtained in section 2.

Variables \ State of the economy	Absence of smuggling	Presence of smuggling	Ranking
1. Optimal tariff rate	t_{AU}^*	t_{PU}^*	no ranking ^a
2. Revenue maximizing tariff rate	t_{AT}^*	t_{PT}^*	no ranking ^a
3. Revenue collected given a tariff	T_A	T_P	$T_A > T_P$
4. A given revenue R is collected by: ^b	$[\hat{t}_A, \hat{t}_A]$	$[\hat{t}_P, \hat{t}_P]$	$\hat{t}_A < \hat{t}_P$ $\hat{t}_A > \hat{t}_P$
Ranking	$t_{AU}^* < t_{AT}^*$	$t_{PU}^* < t_{PT}^*$	

^a For constant elasticity offers it is shown that $t_{PU}^* < t_{AU}^*$.

^b The revenue collected by a tariff is assumed to increase, reach a maximum and then decrease as the tariff rate increases. $[\hat{t}_i, \hat{t}_i]$ refer to the lower and higher rate that collects the given revenue; see illustrative diagram on the following page.

⁷ This is an additional restriction to those we have specified earlier; in general, there is no reason to assume that the revenue collected is not identical at more than two values.

⁸ We are thankful to an anonymous referee for having suggested this tabular presentation.

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