SMUGGLING AND PRICE DISPARITY

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This paper proposes a model of smuggling consistent with the coexistence of smuggling, legal trade and price disparity, defined as a domestic price which exceeds (is less than) the return from legal export (import). These phenomena have been found to characterize Indonesian smuggling. A framework is presented in which legal trade is used to cloak smuggling activity with the implication that the greater the volume of legal trade, the less the costs of smuggling. This model is then used to explain the observation noted above and to show that smuggling may be welfare increasing vis-à-vis the non-smuggling situation, and that even if the suppression of smuggling is costless, tax revenue maximization may require a positive level of smuggling. In addition, the model is applied to coffee and rubber exports from Indonesia.

1. Introduction

Illegal transacations have been known to account for large portions of the foreign trade of many developing countries. But only recently has there been an attempt to study smuggling using the tools of economic analysis. The seminal work applying standard two-good trade-theoretic analysis in formulating models of smuggling in an open economy is that of Bhagwati and Hansen (1973). Their primary concern was the welfare implications of smuggling under assumptions of perfect competition or monopoly on one hand and constant or increasing costs in smuggling on the other. They tested the widely held view that in the small country case, smuggling implies an increase in economic welfare since smuggling by definition is the evasion of taxes (or quantitative restrictions) on trade which are always sub-optimal. They found this view to be false except under restrictive conditions. Their work has stimulated a number of extensions which basically rely on the same theoretic structure.[1]

[1]For example, Bhagwati and Srinivasan (1974), Johnson (1974), Falvey (1978) and Ray (1978). Sheikh (1974) postulates that the activity of smuggling requires a non-traded third good. While his welfare results differ from those of Bhagwati and Hansen, the nature of smuggling costs and the resulting price equilibrium is essentially the same.

Little effort has so far been made to check whether the conclusions of the Bhagwati–Hansen models correspond with the phenomena actually observed in economies characterized by widespread smuggling. In section 2 of this paper the nature of smuggling in Indonesia during the 1950s and 1960s is discussed and found not to conform to the Bhagwati–Hansen models. In section 3 an alternative model of smuggling is proposed which more adequately explains the phenomena observed. In section 4 the welfare implications of the smuggling model are analyzed. The question of trade tax revenue maximization is examined in section 5. Finally, in section 6, the importance of smuggling in altering domestic relative prices and the pattern of trade and production for some important Indonesian exports during the 1950s and 1960s is analyzed with reference to the proposed theory of smuggling.

2. Smuggling phenomena and the Bhagwati–Hansen models

In terms of the sheer dollar value of smuggling, the Indonesian experience of the 1950s and the early 1960s is probably unmatched. The smuggling of exports such as rubber, copra and coffee was most pervasive. A model of smuggling which is relevant for the Indonesian experience must be able to explain the coexistence of three phenomena: smuggling, legal trade and price disparity in a commodity. Price disparity is defined as the positive (negative) difference between the domestic market price and the tax-inclusive world price of an exported (imported) commodity. Price disparity means that the domestic price of an exportable is greater than its return from legal export, i.e. any legal export seemingly occurs at a loss.

In the models described by Bhagwati and Hansen smuggling is treated as trade at world prices (i.e. trade taxes are avoided) but involving a less favorable transformation curve than under free trade (i.e. in the absence of trade taxes) because smuggling involves a real cost, e.g., additional transport costs.

In none of the models of Bhagwati and Hansen can legal trade, smuggling and price disparity coexist. There is no incentive to trade legally at an apparent loss because it is assumed that the rate of transformation in smuggling is independent of the quantity of legal trade. In these models, as well as those of Sheikh (1974), if legal trade exists in any amount, the domestic price of the traded good is its legal trade price.

3. An alternative theory of smuggling

A natural justification for legal trade at a loss is its ability to reduce the costs of smuggling. To hide their smuggling, it is necessary for trading firms to trade legally. Domestic firms which make large purchases of an exportable

(such as rubber in Indonesia) will find that unreasonably small levels of registered legal export will invite scrutiny by the authorities. A large share of smuggling occurs not via 'ships in the night' but rather in broad daylight off the wharves of customs-administered ports. Traded goods are misweighed, misgraded, misinvoiced or not invoiced at all with or without the cooperation of customs authorities. Some legal trade is necessary for this type of activity. The greater the legal trade, the easier it is to hide smuggle activity from enforcement agencies and therefore the less costly will be smuggling. Thus, legal trade can be viewed as an input into the smuggling activity. In what follows, a formalization of this conception of smuggling is undertaken.

Consider a small economy, i.e. one for which the terms of trade are fixed, that produces two traded goods, X and M, an exportable and importable, respectively, with primary factors in perfect competition. Production and trade is carried out by identical firms. Each firm can trade illegally according to the 'smuggling function'

$$\bar{s} = g(\ell, s), \tag{1}$$

where $\bar{s}$ is the quantity of good X smuggled, ℓ is the quantity of good X legally traded, s is the quantity of good X input into the smuggling activity, and $g(\cdot)$ is a strictly concave and twice continuously differentiable linear homogeneous function. It is further assumed that it has the properties:

$$g_\ell \geqq 0, \tag{1a}$$

$$1 \geqq g_s \geqq 0, \tag{1b}$$

$$s \geqq \bar{s}. \tag{1c}$$

Assumption (1a) states that the marginal product of legal trade in the smuggling activity is non-negative. Assumption (1b) states that a unit increase in the smuggling input results in a positive but less than unit increase in actual (ex post) smuggling. The difference between ex ante smuggling, s, and ex post smuggling, $\bar{s}$, is the cost of smuggling. Assumption (1c) prohibits this cost from being negative.[2]

Profit maximization in production implies producing on the production possibility curve where the marginal rate of transformation equals domestic relative prices, q^s. The traders'/smugglers decision is then to maximize profits

[2]Note that both the Cobb-Douglas and linear production functions do not possess the properties assumed for $g(\ell, s)$. An example of a form which does, is $\ell s/(\ell + s)$.

given by

$$\Pi = q^f g(\ell, s) + q^f (1 - t)\ell - q^s(\ell + s), \tag{2}$$

with first-order conditions

$$q^f g_\ell + q^f (1 - t) = q^s, \tag{2a}$$

$$q^f g_s = q^s, \tag{2b}$$

where q^f represents the fixed international terms of trade and t is the tax rate.[3] Conditions (2a) and (2b) state that the marginal cost of an additional unit of tradable will just equal its revenue in trade, be it legal or illegal trade. Note that an additional unit of legal trade results in both additional legal revenue of $q^f (1 - t)$ and additional smuggling revenue of $q^f g_\ell$. Furthermore, firms will earn zero economic profits because the revenue from all foreign trade is just equal to the domestic cost of the tradables. Setting (2) equal to zero and solving for q^s yields an expression for the equilibrium domestic price as the weighted average of all trade:

$$q^s = q^f \frac{\bar{s}}{\ell + s} + q^f (1 - t) \frac{\ell}{\ell + s}. \tag{3}$$

Note that the optimization problem of firms could have been equivalently stated as maximizing q_s, the domestic price ratio, given by eq. (3). That is to say, firms choose the mix of legal trade and smuggling that provides the highest rate of transformation in trade.

In contrast to the results of Bhagwati–Hansen and Sheikh, the domestic price of a commodity which is both legally traded and smuggled is not its legal trade price. Furthermore, because the domestic price will exceed the legal trade price, the international value of output in the presence of smuggling will exceed that value in its absence.

4. Smuggling and welfare

Bhagwati and Hansen in their welfare analysis of smuggling find that smuggling necessarily reduces welfare vis-à-vis the non-smuggling situation whenever legal trade and smuggling coexist. This is true irrespective of whether smuggling is characterized by constant or increasing costs. Since the coexistence of smuggling and legal trade characterizes real world smuggling

[3] While the algebra here applies to export smuggling, the geometry to be presented (see below) applies equally to import and export smuggling in a manner analogous to the symmetry of import and export taxes demonstrated by Lerner.

situations, their conclusion is an important one for policy. It suggests that governments could improve economic welfare by strictly enforcing sub-optimal taxes on trade as opposed to allowing some evasion. However, below it is shown that these conclusions do not hold in our model.

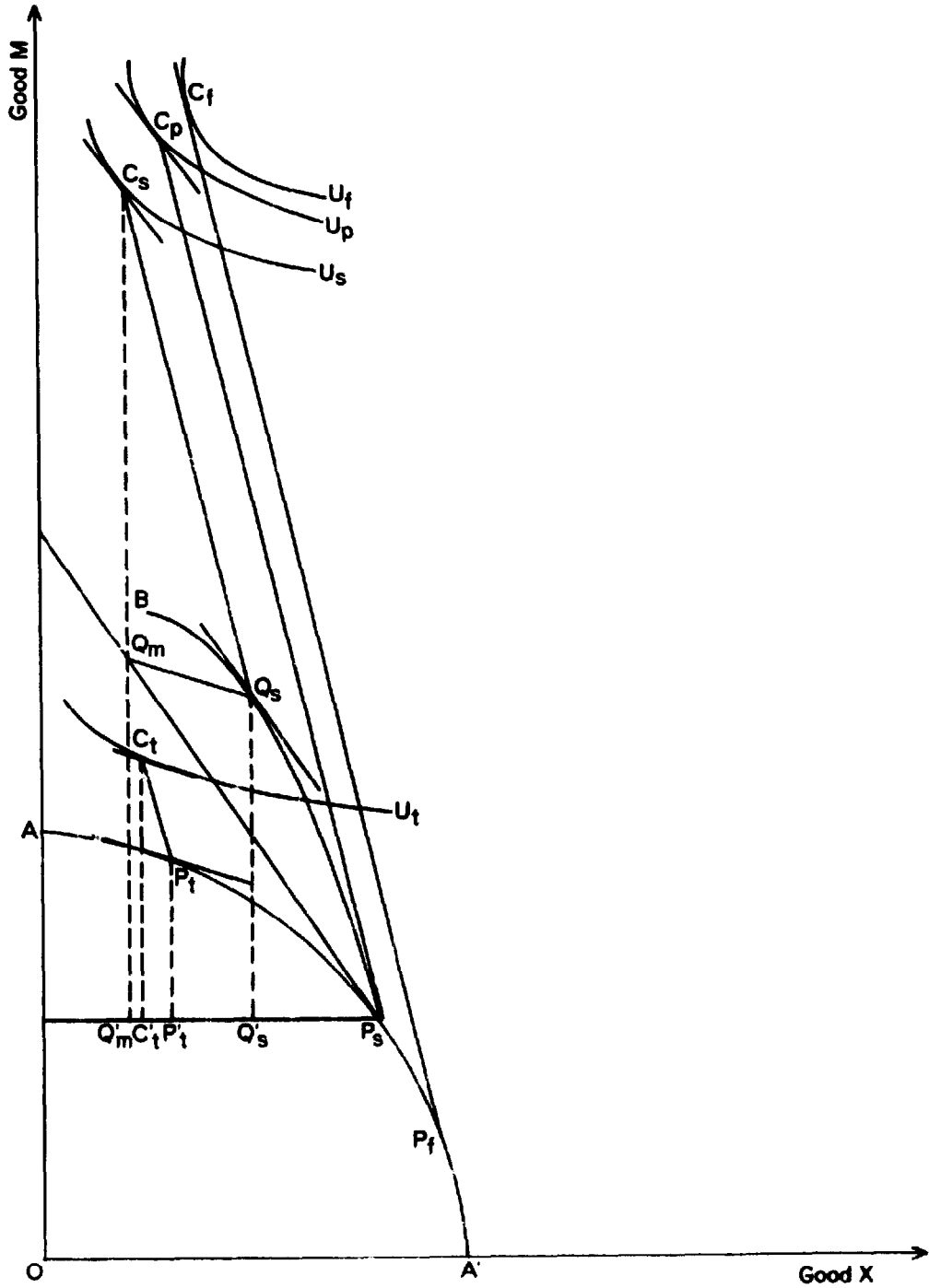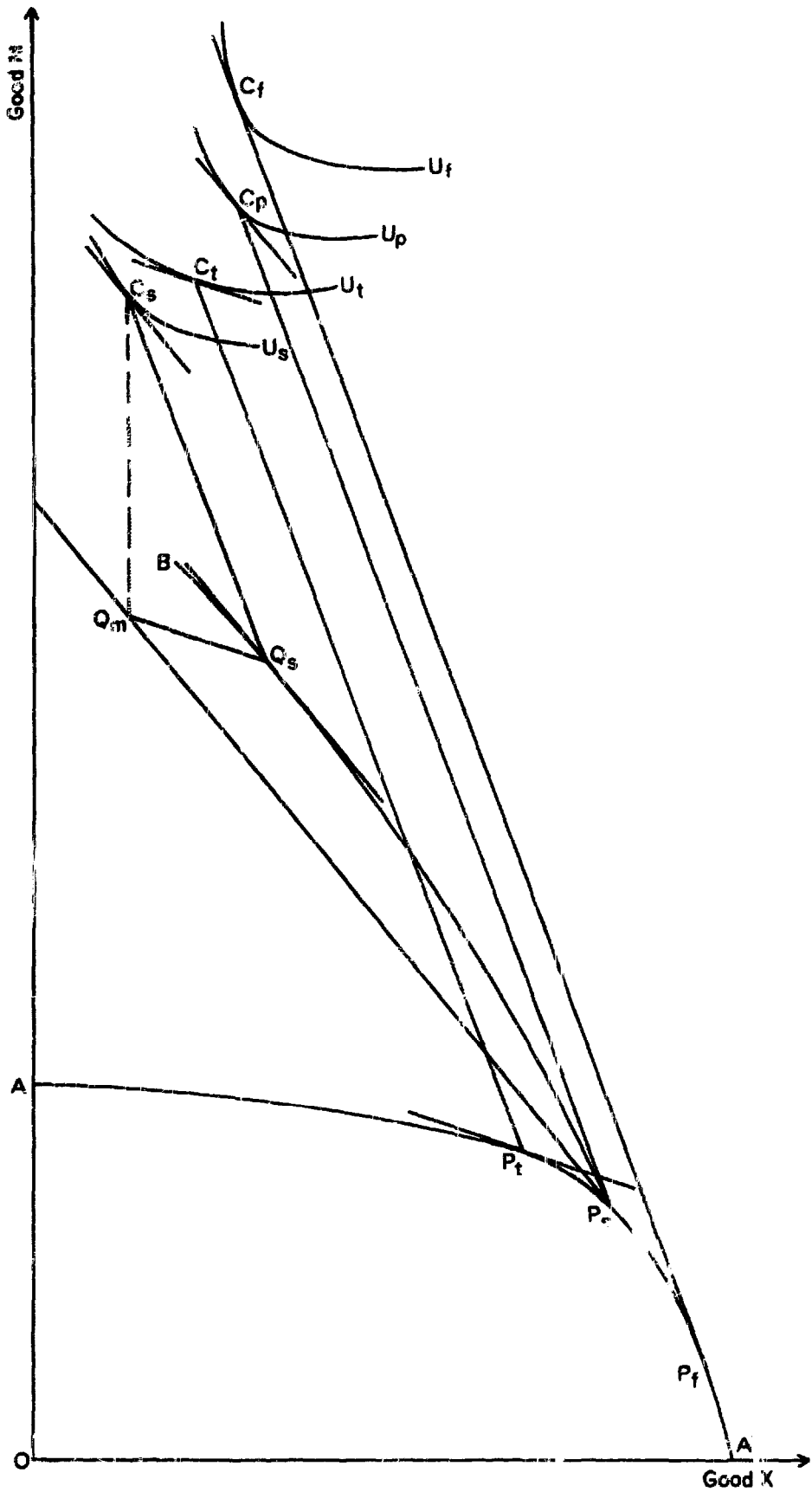Figs. 1 and 2 illustrate the case of greater and less welfare, respectively, in

Fig. 1.

Fig. 2.

the smuggling situation as compared with the non-smuggling situation. In the absence of smuggling, production occurs at P_t where the tax-inclusive price is tangent to the production possibility curve AA'. Trade occurs at international prices P_tC_t and welfare is at U_t. In the presence of smuggling, production occurs at P_s where the endogenously determined domestic relative price equals the marginal rate of transformation in production. Smuggling proceeds on the smuggling transformation curve P_sQ_sB from P_s until Q_s, where the smuggling transformation curve is tangent to domestic prices.[4] Legal trade permits exchange at the international terms of trade Q_sC_s with welfare at U_s.[5]

If the costs of smuggling to the trader are penalties and confiscation by the government, then the resulting price and production equilibrium will not differ from (2a) and (2b) (pictured in figs. 1 and 2), where it was assumed that costs of smuggling are real resource costs to the country. However, since the costs of smuggling to the trader/smuggler are merely revenue to the government, the aggregate rate of transformation in trade is the free trade terms of trade P_sC_p (in figs. 1 and 2) with the resulting level of welfare given by $U_p > U_s$. In this case it then follows that smuggling results in an unambiguous welfare gain vis-à-vis the non-smuggling situation. Moreover, to the extent that the costs of smuggling to the trader represent a mix of penalties and real resource costs, price and production levels are independent of that mix, while levels of welfare are bounded by U_s and U_p.[6]

5. Tax revenue maximization and smuggling

Assume that the customs authority is given an export tax rate t by the central government and given the objective of maximizing trade tax revenues. The only instrument the customs authority has at its disposal is the level of its enforcement. Assume enforcement to be costless and that the customs authority is able to completely eliminate smuggling so as to obtain $g(\ell, s) = 0$. Given these assumptions, it is possible that tax revenue maximization may require a positive level of smuggling.

[4]It is easy to see that condition 2(b) is fulfilled by this tangency. It can be seen that condition 2(a) is also satisfied by noting that it is required for the zero profit condition (3). That (3) holds in the diagram is demonstrated by the equality of the domestic rate of transformation P_sQ_m to the total rate of transformation in illegal plus legal trade $P_sQ_sQ_m$.

[5]In the case of quantitative restrictions, Falvey (1978) has shown that for the Bhagwati–Hansen model, smuggling results in an unambiguous welfare gain. It is easily shown that this is also true for our model.

[6]With a smuggling function of the Bhagwati–Hansen type, Kemp (1976) demonstrated that any tariff-ridden competitive equilibrium which exists in the absence of smuggling exists in the face of smuggling when the cost of smuggling represents penalties against smugglers who are caught. As a result, the proportion of trade which is smuggled is irrelevant to optimal commercial policy. Our findings contradict those of Kemp because in our model smuggling results in domestic prices above that which would exist in its absence (price disparity), thus altering production and trading decisions vis-à-vis the non-smuggling situation.

In fig. 1, with a trade tax and in the absence of smuggling, production is at P_t and legal trade is $C_t'P_t'$. In the presence of smuggling, production is at P_s with legal trade $Q_m'Q_s'$. The quantity of legal trade (and hence tax revenue) in the smuggling situation exceeds that of the non-smuggling situation. Therefore, the policy of complete and effective enforcement against smuggling may not maximize the level of legal trade.[7] As the enforcement activities of the customs authorities are determinants of the function g, they can choose a g which maximizes tax revenue given the fixed tax rate. Intuitively, the explanation of this phenomenon is that smuggling may have an effect on domestic relative prices (through price disparity) great enough to call forth an increase in the exportables production net of any change in domestic consumption in excess of that lost to legal channels by smuggling. That is to say, the increase in total trade due to higher prices is greater than the quantity which is smuggled.[8]

6. Smuggling and price disparity

In a many commodity model of smuggling similar to the one described, the domestic relative price of the exportable in terms of any importable will be bounded by the tax-inclusive free trade relative price and the free trade relative price, i.e. $q^t \leq q^s \leq q^f$. However, in a many commodity model where prices are measured in monetary units, the domestic price of an exportable subject to an export tax may be more than its free trade price. This is because smuggled exportables can earn foreign exchange (or be exchanged for commodities) which may be highly valued in illegal (black) markets. Even if there are no trade interventions directed at a particular exportable, its domestic price may exceed its legal trade price if there are interventions in the markets for other commodities or capital flows which result in black markets.

Price disparity for any commodity whose prices are measured in terms of money can be calculated by comparing the domestic price of the commodity (p^d, in domestic currency units) to the quantity of domestic exchange that can be earned through legal trade. The latter is just the world price (p^f), quoted in dollars for example, times the legal effective exchange rate for the exportable (EER), defined as the number of domestic currency units legally earned per dollar of legal export. Price disparity as a percentage of the legal trade price may be written as $((p^d/p^f \times EER) - 1) \times 100$.

Price disparity for natural rubber in Indonesia calculated in the above

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[7]This finding is contrary to the result of Bhagwati and Srinivasan (1974) for the Bhagwati–Hansen model. They established that, for a given tariff, the revenue that can be collected in the presence of smuggling is less than the revenue in the absence of smuggling.

[8]If the costs of smuggling are fines and confiscation and the customs authority's objective is to maximize revenue from fines, confiscation and trade taxes, all the above still holds.

manner clearly demonstrates the significant impact of smuggling on domestic prices. Over the period 1955–65, price disparity increased the domestic price of rubber by an average of 39 percent over the legal trade price. In some periods, price disparity resulted in a domestic market price almost double the legal trade price.[9] It is not surprising that the price effects of smuggling seem to have completely counter-balanced the price distorting effects of Indonesian trade policy during the 1960s. The realized domestic currency return to a dollar's worth of export (both legal and illegal) during the period 1958–64, generally regarded as the period of greatest government intervention in trade, was on the average slightly greater, in real terms, than it was in 1971 at the end of Indonesia's dramatic trade liberalization.[10]

An interesting application of the concept of price disparity in establishing the presence of smuggling is the case of Indonesian coffee in the early 1960s. In the years 1960–61 the price disparity of Indonesian coffee averaged about 40–45 percent. Yet during 1962, price disparity apparently leaped to over 200 percent and remained at a similar level for a number of years. This magnitude of price disparity implies that coffee prices were *triple* what they would have been in the absence of smuggling and quantitative restrictions. These levels of price disparity also indicate that either the level of smuggling in coffee leaped from 1961 to 1962 or that the smuggling function changed abruptly or both. There is a good explanation why this would be so. In 1962 Indonesia became a member of the International Coffee Organization (ICO) and was required to adopt a coffee export quota.[11] This quota was allocated more than proportionately to the government-owned estate coffee sector which produced the higher quality arabica coffees. Smallholders, predominantly in Sumatra, and producers of lower priced robusta coffees were left with a relatively small legal export allotment. The quota should therefore be expected (in the absence of smuggling) to cause a large fall in domestic coffee prices. It might also be expected that the smuggling function would be altered substantially. That is because it might not be in the government's interest to enforce legal trade provisions since the enforcement

[9]Kenneth Thomas (1966) claims that price disparity for rubber reached 160 percent in September 1965. Estimates of price disparity for a number of agricultural commodities in Indonesia in 1960 are found in Sadli (1961). The greatest price disparity found in the commodities he examined was 162 percent in the case of vetiver oil. Although Sadli and Thomas explicitly recognized price disparity and its importance as an indicator of illegal trade, only Cooper (1974) among those who have more recently investigated Indonesian smuggling have discussed its price effects. He compared the domestic wholesale prices of imported commodities to their tariff inclusive c.i.f. prices and concluded that there was an unmistakable tendency for prices to rise less than proportionately with duties. To explain this phenomenon, Cooper suggested a model of smuggling involving a threshold of law-abidingness below which smuggling would be negligible.

[10]See Pitt (1981) for the details of this calculation.

[11]This price disparity calculation relates actual domestic prices to unit legal trade receipts rather than relating them to legal trade receipts less the quota's tax equivalent. Thus, the 200 percent figure understates the actual level of price disparity.

cannot divert illegal trade into legal (and taxed) channels once the quota is filled. Thus, a legal trade quota and probable slackness in enforcement (i.e. a shift in the smuggling function) led to a smuggling boom.[12] Paradoxically, being left out of the ICO quota was a boon for smallholders. They benefited from any higher level of world prices that resulted from the ICO cartel plus they received a greatly increased rupiah return per dollar of total (legal and illegal) export.

The theory of smuggling presented can be used to estimate levels of smuggling even with limited data. At the purely qualitative level, the presence of price disparity indicates that smuggling exists. Lower bound estimates of smuggling can be made based on the zero profit condition (3). Define α as the ratio $\bar{s}/s$, i.e., the average rate of transformation between smuggling output and input at equilibrium. Substituting α into eq. (3) and solving for s yields

$$s = \left(\frac{q^s - q^f(1-t)}{\alpha q^f - q^s} \right) \ell. \tag{4}$$

The case $\alpha = 1$ (i.e. costless smuggling) represents a lower bound estimate of s. Calculating such a lower bound only requires data on domestic and international prices, the legal effective exchange rate and reported legal trade, all of which are generally available in developing countries. For example, normalizing prices so that $q^f(1-t) = 1$, the average values of the variables necessary to calculate the lower bound for Indonesian rubber smuggling over the period 1959–64 are $q^s = 1.46$ and $q^f = 5.06$,[13] with a resulting lower bound of rubber entered into smuggling equal to 12.9 percent of legal trade.

More exact measures of smuggling are difficult to estimate because the smuggling function, $g(\ell, s)$, is unknown and does not lend itself to statistical estimation. However, some estimates can be obtained if the smuggling function is assumed constant over time. It then follows that smuggling would be a monotonically increasing function of the incentive to smuggle, i.e. the terms of trade in smuggling relative to the terms of legal trade. This approach has been used to explain the pattern of Indonesian smallholder rubber trade.[14]

Note that the theory of smuggling described earlier permits the specification of the output of a smuggled commodity as a function of only the domestic market price. That is because market prices, via price disparity,

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[12]The ICO was not completely unaware of these activities and penalized Indonesia for illegal trade in coffee by reducing their quota.

[13]This figure represents the ratio of the black market exchange rate to the legal effective exchange rate.

[14]All references to rubber are to smallholder rubber.

reflect the return to all trade, both legal and illegal. The simple model estimated assumes that rubber output in any year (for which there is no reliable data) is a linear function of the contemporaneous domestic price of rubber relative to rice (R), its competing activity in Indonesia, rainfall (W) and a time trend (T). Smuggling is assumed linearly related to the incentive to smuggle (S) defined as the rupiah return to a dollar's worth of smuggling relative to the rupiah return to a dollar's worth of legal trade. This is just the ratio of the black market rate of exchange to the legal effective exchange rate for rubber export. Domestic rubber consumption is small and is assumed to be constant or linearly related to time. Legal trade is the residual of (unobserved) output less smuggling less domestic consumption.

The estimated equation is:

$$\text{legal export}[15] = 38217 + 0.753W - 0.130T - 13894D$$
$$(0.251) \quad (0.037) \quad (2882)$$

$$-3969S + 66.84R$$
$$(461) \quad (22.97)$$

(standard errors in parenthesis): $R^2 = 0.84$; DW = 2.03.

The variable D is a dummy variable taking the value 1 for the years 1957–58 to account for disruptions in trade due to the rebellion which occurred in rubber-growing areas in those years. The equation was estimated with annual data of 1949–72. The elasticities evaluated at means for S and R are -0.276 and 0.146, respectively. The estimated equation indicates that the incentive to smuggle (as defined here) was a significant factor in explaining the variance of legal trade in rubber. A prediction of the level of smuggling in any year is the product of the coefficient of S, 3969, and the value of S in that year. For example, the model estimates that rubber smuggling out of Indonesia in 1960 amounted to 262,000 metric tons. Smuggling in that year is estimated to have been 69 percent of legal trade and 41 percent of total trade in rubber. For the period 1959–65, smuggling is estimated to account for an average of 25–30 percent of all trade in rubber.

7. Conclusion

This paper presents a model of smuggling that explains the observed

[15]Legal export in tens of thousands of kilograms of smallholder rubber. Rice prices are average retail prices in Sumatra. Rubber prices are wholesale in Jakarta. All the above data obtained from Biro Pusat Siatistik. Rainfall data are millimeters at Sungei Gerong, South Sumatra, obtained from Direktorat Meteorologi dan Geofisika. Blackmarket exchange rates from *Picks Currency Yearbook*, various issues. Legal effective exchange rates are author's computations.

coexistence of smuggling, legal trade and price disparity, defined as a domestic price which exceeds (is less than) the return from legal export (import). This model differs from those of Bhagwati and Hansen in that legal trade is used to cloak smuggling activity with the implication that the greater the volume of legal trade, the less the costs of smuggling. This model is then used to explain the observation noted above and to show:

(1) smuggling may be welfare-increasing vis-à-vis non-smuggling;

(2) if the costs of smuggling represent fines and confiscation, fines and tariffs are not equivalent, and smuggling is unambiguously welfare-increasing; and

(3) even if the suppression of smuggling is costless, tax revenue maximization may require a positive level of smuggling.

Finally, the model is applied to rubber and coffee exports from Indonesia, where it was found that smuggling had a substantial impact on their domestic prices and returns from trade.

References

Bhagwati, Jagdish and Bent Hansen, 1973, A theoretical analysis of smuggling, Quarterly Journal of Economics 87, May, 172–187.

Bhagwati, Jagdish and T.N. Srinivasan, 1974, Smuggling and trade policy, in: J. Bhagwati, ed., Illegal transactions in international trade (North-Holland, Amsterdam) 27–38.

Cooper, Richard N., 1974, Tariffs and smuggling in Indonesia, in: J. Bhagwati, ed., Illegal transactions in international trade (North-Holland, Amsterdam) 183–192.

Falvey, Rodney E., 1978, A note on preferential and illegal trade under quantitative restrictions, Quarterly Journal of Economics 92, February, 175–178.

Johnson, Harry G., 1974, Notes on the economic theory of smuggling, in: J. Bhagwati, ed., Illegal transactions in international trade (North-Holland, Amsterdam) 39–46.

Kemp, Murray C., 1976, Smuggling and optimal commercial policy, Journal of Public Economics 5, April–May, 381–384.

Picks Currency Yearbook (Pick Publishing Corporation, New York) (Annual).

Pitt, Mark M., 1981, Alternative trade strategies and employment in Indonesia, in: Anne O. Krueger et al., eds., Trade and employment in developing countries, 1: Individual studies (University of Chicago Press, Chicago).

Ray, Alok, 1978, Smuggling, import objectives, and optimum tax structure, Quarterly Journal of Economics 92, August, 509–514.

Sadli, Moh., 1961, Masalah 'Disparitet Harga' dan Export, Ekonomi dan Keuangan Indonesia 14, March/April.

Sheikh, Munir A., 1974, Smuggling, production and welfare, Journal of International Economics 4, November, 355–364.

Thomas, Kenneth D., 1966, 'Price disparity' in export trade, Bulletin of Indonesian Economic Studies 2, June, 101–102.