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Trade Data Discrepancies and the Incentive to Smuggle: An Empirical Analysis

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I. Introduction

The issue of the underground economy, in industrial economies, has become prominent in recent years, and has generated a considerable amount of research (see Tanzi (1982)). For the most part, this analysis has concentrated on evasion of domestic taxes. There is, however, an older tradition in the literature which focuses on developing countries and, in particular, on illegal international transactions encouraged by foreign trade taxes, exchange rate overvaluation, or quantitative restrictions on international trade. Many of the contributions to this literature, published in the 1960s and early 1970s, are reprinted in Bhagwati (1974).

The existence of illegal activities on a significant scale has a number of implications. The budgetary situation may be adversely affected since many developing countries depend heavily on taxes on international trade and transactions. The biased statistics which are a result of illegal trade may mislead policymakers. In addition, the illegal activities themselves and their surveillance by the authorities entail resource costs.

There is considerable anecdotal evidence of widespread illegal trade activities in many developing countries. For obvious reasons, however, firm statistical evidence is not readily available. Researchers interested in this subject, therefore, have tried to make inferences from the behavior of officially recorded trade. The most widely used method has been to examine partner country trade data discrepancies. This approach is adopted in a number of studies reprinted in the Bhagwati volume, by Nayak (1977) and de Wulf (1981), and involves the comparison of a country's reports of its trade activities with the corresponding

reports of its trading partners. Clearly, such discrepancies can have many sources--insurance and freight costs, shipping lags, misclassification of trade both with respect to country of destination and origin and with respect to commodity classification. However, the general tendency has been to assume that, once allowance has been made for insurance and freight, the residual discrepancy largely reflects illegal trade.

If trade data discrepancies are, indeed, due to illegal trade, they should vary with the incentives to engage in illegal trade. However, the literature does not seem to contain attempts to relate the discrepancies to such incentives. This paper focuses on two issues. How well do incentives to smuggle explain variations in trade discrepancies? And do measures of illegal trade based on the size of these discrepancies seem appropriate in light of the statistical evidence? The analysis provides some support for the hypothesis that there is an association between the incentive to smuggle and discrepancies in trade data, though the evidence is not strong in many cases. Indeed, the results generally suggest that great caution should be exercised in using trade data discrepancies to infer the scale of smuggling activity.

In the next section of this paper, there is a discussion of the approach adopted in the context of other contributions to the literature. Section III contains the empirical analysis and the paper concludes with some observations on the empirical findings. Appendix II contains a more detailed discussion of the statistical analysis in the form of country notes.

II. Methodology

Discrepancies in the data of trading partners on their trade with each other have frequently been used to infer the importance of illegal trade activities. But if such discrepancies do, at least to some extent, reflect illegal activities, the size of the discrepancy should be systematically related to incentives to engage in such activities. In this paper, data discrepancies concerning the export trade of a number of developing countries are analyzed in relation to export taxation and the black (parallel) market exchange premium. The focus is on exports because the trade regime affecting imports into these countries is generally much more complex and difficult to quantify.

For all but one of the countries analyzed, the set of industrial countries is chosen as the trading partner aggregate. 1/ The main reason for chosing this group is that, in relative terms, data from industrial countries are likely to be quite accurate. Data collection procedures are more advanced and refined and one would assume, given the absence of large parallel exchange market premia, that illegal

1/ The exception is Thailand, where the focus is on rice, most of which is traded with other Asian countries.

trade incentives are comparatively small and, particularly for the aggregate of industrial countries, are likely to change little over time. Another reason is the issue of data availability--comprehensive trading partner data are not always available for developing country partners, particularly as one goes back in time.

The analysis uses differing levels of trade aggregation. For many countries, total trade in primary products (excluding fuels) is examined. This includes the major part of exports in most of the countries and it also avoids the need to quantify the effects of schemes which promote manufactured exports in many countries. In some cases, all commodity exports are included in the analysis. This was done where greater disaggregation was not judged necessary or disaggregated data were not available.

Bhagwati et. al. (1974) looked at trade data discrepancies for a wide range of developing countries in the year 1966 in their trade with OECD countries and examined them in relation to the black market exchange rate premium, though no formal statistical analyses were done. Table 1 is reproduced from the study. The authors identified as "under-invoicers" countries for which the partner country discrepancy was greater than 10 percent. Twenty countries fell into this category. Of these, 12 had a black market premium of 10 percent or higher, and for 9 of these, it was at least 20 percent. However, there are some rather striking anomalies. Mexico, Honduras, Iran, and Greece, for example, had rather high trade data discrepancies, despite very low or nonexistent black market exchange premia. The case of Mexico is briefly discussed in Section III and in the country notes in Appendix II.

The existence of such major anomalies suggests the need for a closer examination of these data discrepancies. This study makes such an examination for a wide range of countries. 1/ For each country the discrepancy is analyzed over time in relation to the incentive for illegal trade. This "smuggling" incentive, I, is measured by $[(e/(s(1-t_x))-1]$, where e is the parallel market exchange rate, s is the effective official export exchange rate, and t_x is the export tax rate. The analysis takes two forms. Plots of the relevant variables are examined and the simple correlation coefficient calculated. 2/ This

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1/ Eight of the ten countries analyzed here were also included in the Bhagwati study. The other two, Ecuador and Zaire, have had large trade discrepancies.

2/ The simple correlation coefficient is the square root of R^2, from a simple regression equation. This can differ from the R^2 in the regression estimates of Table 3 for two reasons. First, when an autocorrelation adjustment is made, the variables become transformed and the R^2 in the regression equation relates to these transformed variables. Second, when the lagged dependent variable is included, the link between the simple correlation coefficient and the R^2 from the multiple regression clearly breaks down.

Table 1. Exports of Developing Countries to OECD Countries Compared With Corresponding Imports by OECD Countries from Developing Countries, and the Black Market Premium of U.S. Dollars, for 27 Developing Countries, 1966 1/

Country (by region)	Discrepancy 2/ (In percent)	Black Market Premium of US$ (In percent)
South America		
Argentina	24.2	23
Brazil	14.0	10
Chile	4.5	49
Colombia 3/	14.2	...
Mexico	37.0	—
Central America		
Costa Rica	6.8	17
El Salvador	0.1	13
Guatemala	24.2	15
Honduras	27.3	--
Nicaragua	14.7	19
Africa		
Ethiopia	14.6	24
Ivory Coast	26.9	...
Libya	11.1	20
Nigeria	9.9	...
Tunisia	47.2	67
Far East		
Hong Kong	13.7	1
Korea	-4.6	--
Philippines	16.1	2
Thailand 3/	6.4	1
South Asia and Middle East		
Egypt	30.7	111
India	23.7	74
Iran	35.2	4
Pakistan	14.3	75
Sri Lanka 4/	20.1	94
Europe		
Greece	27.9	4
Turkey 3/	15.4	40
Yugoslavia	-1.0	17

Source: Bhagwati et. al. (1974).

1/ OECD countries include only EFTA, EC, United States, Canada, and Japan.

2/ 100 (M-X)/X, where M is the imports of the OECD from the developing country in question, and X is the corresponding exports of the developing country.

3/ 1967 data.

4/ 1968 data.

approach is supplemented by regression analysis to indicate the quantitative impact of smuggling incentives.

The specification of the regression equation is as follows:

$$(1) \quad T = \alpha_0 + \alpha_1 I + \alpha_2 T(-1)$$

where T is the ratio of the reported imports of the industrial countries from the particular developing country to the reported exports of that developing country to the industrial countries. 1/ It would be expected that with no growth in trade, $(\alpha_0/1-\alpha_2)$ would be in the region of 1.1. In other words, when I is zero, the steady state trade ratio would differ from unity due to the fact that import data include costs of insurance and freight. With growth in trade, and given delivery lags, the trade ratio would be expected to be less than one plus the c.i.f. adjustment. 2/

It should be noted that certain types of illegal trade are not likely to be captured by the method used here. For example, illegal exports smuggled across land borders and exported from a neighboring country will probably not get correctly reported at either end of the transaction. The producing countries will not report them as part of their export statistics and the country of ultimate destination will probably report the origin as being one of the intermediate countries. 3/

Finally, while export taxation and exchange rate overvaluation have been the primary focus of the literature on illegal transactions,

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1/ In the case of only one country (Costa Rica) did the inclusion of the lagged dependent variable improve the regression results. Accordingly, the reported results exclude the lagged dependent variable for all other countries.

2/ Assume that goods spend 3 months in transit and that trade is growing (in nominal terms) at 2 1/2 percent per quarter. Then, with a c.i.f. adjustment factor of 10 percent, and no illegal trade, the trade ratio would be expected to be of the order of 1.07.

3/ There is an alternative methodology which can be used to detect illegal exports of this variety. This involves estimating a supply function for total exports, derived as the horizontal difference between the aggregate supply function and the domestic demand function. It is expected that the percentage of exported output channelled through the official market depends on the incentives for illegal exports. Hence, official market exports should be a positive function of factors influencing supply, a negative function of factors influencing domestic consumption, and a negative function of the incentive for illegal trade. Such methods have been used by Pitt (1981) in a study of Indonesian rubber exports, and by Franco (1981) in a study of Ghanaian cocoa exports.

evasion of domestic income taxes can also give rise to underinvoicing of exports. By understating exports, one can conceal income and hence evade domestic income taxes. To the extent that the incentives to smuggle resulting from the taxation of income change significantly over time, the results of the analysis here, which ignore this motive for smuggling, may be biased.

III. Empirical Results

Table 2 presents for ten countries some summary statistics relevant to the issue being discussed in this paper. It shows that for most of the countries, the mean of the incentive to smuggle was quite large, ranging from 13 percent in the case of the Philippines to considerably over 100 percent in the cases of Sri Lanka and Zaire. There was also a wide variation in the incentive around its mean value for most countries.

This paper addresses two closely related issues. How well does the smuggling incentive explain variations in the trade ratio? In light of the statistical evidence, does the method of measuring illegal trade discussed in the earlier section of this paper (i.e., making inferences from the size of the trade discrepancy) seem appropriate? On this latter issue the need for caution is quite clear from a quick inspection of the data.

Table 2 and the plots for the individual countries (Appendix II) show that, for some countries, trade data ratios of significantly below 1 have been recorded. 1/ For Mexico, on the other hand, trade data ratios of close to 2 were recorded for trade with the industrial countries, and in excess of 2 for non-U.S. industrial country trade, despite the absence of a significant black market exchange rate premium and export taxation during the period being analyzed.

Table 2 does, however, offer evidence of a link between the trade data ratio and the smuggling incentive. For every country except Thailand and India, the simple correlation statistic between these two variables was positive over the basic period of analysis, though in some cases the correlation was quite weak. Furthermore, for many

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1/ In the context of the framework used here, overinvoicing or overrecording of trade makes sense if export subsidies exist and these outweigh tax and exchange rate factors encouraging underrecording of exports. The income tax incentive to overinvoice would seem only to apply in the case of integrated multinational companies where the income is taxed more lightly in the country being studied than in the country of the affiliate. Data deficiencies would, therefore, seem to be the cause of recorded trade ratios less than 1.

Table 2. Summary Statistics on the Trade Ratio and the Smuggling Incentive 1/

	Time Period	Trade ratio Mean	Trade ratio Range	Smuggling Incentive Mean	Smuggling Incentive Range	Correlation Coefficient	Trade Variable
1. Costa Rica	1962-79	1.25	0.86-1.56	0.30	0.02-0.76	0.41	Primary Exports
	1962-79 2/	1.22	0.86-1.56	0.28	0.18-0.58	0.67	Primary Exports
2. Ecuador	1962-79	1.52	1.20-1.87	0.27	0.11-0.44	0.25	Primary Exports
	1966-79	1.51	1.20-1.87	0.25	0.11-0.41	0.64	Primary Exports
3. El Salvador	1962-79	1.15	1.01-1.35	0.32	0.17-0.65	0.43	All Exports
	1962-78	1.15	1.01-1.35	0.30	0.17-0.65	0.53	All Exports
4. India	1962-79	1.29	1.14-1.41	0.51	0.19-0.91	-0.04	Primary Exports
	1962-71	1.27	1.14-1.41	0.69	0.46-0.91	0.58	Primary Exports
5. Mexico	1962-79	1.57	1.26-1.94	...	...	...	All exports
	1962-79	1.82	1.35-2.42	...	...	...	All exports (excl. U.S.)
6. Philippines	1962-79	1.18	1.03-1.35	0.13	0.02-0.27	0.38	Primary Exports
7. Sri Lanka	1962-79	1.15	1.04-1.37	1.40	0.67-2.12	0.04	Primary Exports
	1956-67	1.11	1.01-1.19	1.19	0.59-2.10	0.64	All Exports
8. Thailand	1962-75	1.05	0.93-1.31	0.26	0.08-0.40	-0.10	Rice Exports 3/
	1962-72	1.07	0.98-1.31	0.27	0.08-0.40	0.06	Rice Exports
9. Turkey	1962-79	1.09	0.93-1.30	0.29	0.03-0.55	0.68	Primary Exports
10. Zaire	1964-78 4/	1.71	1.28-2.29	1.64	0.71-3.22	0.21	All Exports
	1972-78	1.90	1.40-2.29	1.81	1.04-3.22	0.53	All Exports

1/ Trading partners included are the industrial countries, unless otherwise noted.
2/ Excluding 1970-72.
3/ Rice trade with major trading partners.
4/ Excluding 1971.

countries higher correlation coefficients were recorded for substantial subperiods (see discussions in country notes in Appendix II). 1/

The results of the regressions of the trade data ratios on the smuggling incentive are presented in Table 3. 2/ For most of the countries two regression results are reported, reflecting different time periods of estimation, and it is clear that, in many cases, the regression results are quite sensitive even to small variations in the regression period. 3/ Assuming the specification of the model is correct, the constant in these regressions is the point estimate of what the trade data ratio would be if no smuggling incentives existed. It is seen that for 7 of the 15 reported regressions the constant is estimated to be between 1.0 and 1.1. Only in 4 cases (regressions 1.2, 2.1, 4.1, and 9.1) does the estimate of the constant lie markedly outside this range. 4/

Turning to the estimates of the coefficient on the smuggling incentive variable, only in 4 of the 15 regressions is the estimate significantly different from zero at a 95 percent confidence level: Costa Rica (equation 1.2), Ecuador (equation 2.2), Sri Lanka (equation 6.2), and Turkey (equation 8.1). In an additional three regressions, the estimate is significant at a 90 percent confidence level: Philippines (equation 5.1), India (equation 4.2), and El Salvador (equation 3.2).

A detailed discussion of the analysis for individual countries is contained in Appendix II. The results are not statistically very strong and the regressions explain, in general, a relatively small percentage of the variation in the trade data ratio. The results do, however, provide some support for the view that variations in the trade data ratio reflect, to some extent, illegal trade activities. Given the institutional, political, and other factors which can clearly affect illegal trade, and taking into account that the series of the trade data ratio is likely to have considerable statistical noise because of the quality of trade data in many developing countries, one

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1/ One interpretation of this finding is that the hypothesized relationship is less strong over long periods because of numerous other factors which impinge on illegal trade (such as changing enforcement practices).

2/ No regressions are presented for Mexico, since variation in the smuggling incentive was limited.

3/ See the country appendix for more detail on these individual regressions.

4/ Though it should be noted that in a statistical sense, only in equation 1.2 is the estimate significantly different from 1 or 1.1 at conventional confidence levels. In equation 1.1 the steady state level of the constant is 0.91.

Table 3. Regressions of the Trade Ratio on the Smuggling Incentive

Equation	Country	Time Period	Constant	I	T(-1)	ρ	D.W.	R^2	Trade Variable
1.1	Costa Rica	1963-79	0.31 (1.18)	0.11 (0.55)	0.66 (3.93)	—	2.09	0.601	Primary exports excluding coffee
1.2	Costa Rica	1963-79 1/	-0.47 (1.33)	0.88 (2.79)	0.48 (3.11)	—	1.82	0.790	Primary exports excluding coffee
2.1	Ecuador	1962-79	1.40 (1.57)	0.58 (0.82)	—	0.392	2.09	0.298	Primary exports
2.2	Ecuador	1966-79	1.08 (1.46)	1.71 (2.91)	—	—	2.11	0.413	Primary exports
3.1	El Salvador	1962-79	1.08 (3.89)	0.23 (1.10)	—	0.487	1.91	0.394	All exports
3.2	El Salvador	1962-78	1.04 (3.67)	0.44 (2.04)	—	0.421	2.19	0.505	All exports
4.1	India	1962-79	1.28 (9.41)	0.05 (0.62)	—	0.409	2.10	0.128	Primary exports
4.2	India	1962-71	1.06 (4.12)	0.31 (2.02)	—	—	1.53	0.339	Primary exports
5.1	Philippines	1962-79	1.08 (2.43)	0.74 (1.88)	—	0.302	1.78	0.207	Primary exports
6.1	Sri Lanka	1962-79	1.18 (10.09)	-0.01 (0.15)	—	0.303	2.34	0.095	Primary exports
6.2	Sri Lanka	1956-67	1.01 (49.86)	0.05 (5.41)	—	-0.570	1.74	0.658	All exports
7.1	Thailand	1962-75	1.12 (19.55)	-0.19 (0.93)	—	-0.415	2.10	0.133	Rice exports
7.2	Thailand	1962-72	1.07 (3.16)	-0.56 (0.60)	—	-0.661	2.19	0.436	Rice exports
8.1	Turkey	1962-79	0.99 (7.92)	0.35 (3.72)	—	—	1.96	0.463	Primary exports
9.1	Zaire	1964-78	1.56 (4.45)	0.09 (0.73)	—	—	1.23	0.219	All exports

Note: I is the smuggling incentive, T is the trade ratio and ρ is the first order autocorrelation coefficient.

1/ Excluding 1970 and 1972.

might not perhaps expect to model the behavior of the trade data ratio particularly well. One would also expect instability in the relationship, a characteristic borne out by the regression results for a number of countries.

Thus, while the results provide some limited support for the hypothesized association between the smuggling incentive and the trade data discrepancy, great caution should be exercised in using trade data discrepancies to infer the scale of smuggling activity. The evidence from a number of countries suggests significant trade data problems. In the case of India, a major shift in the smuggling incentives facing exporters had little impact on the trade data ratio. Large discrepancies in trade data can exist where little incentive to smuggle is present (Mexico). Even in Zaire, where significant incentives exist, data problems are suggested by the sheer size of the trade data discrepancies. Furthermore, given concerns about data quality, a low data discrepancy does not necessarily imply that smuggling activity is relatively moderate.

IV. Conclusions

The general nature of the results provides some limited support for the hypothesized relationship between trade data discrepancies and the incentive to smuggle. In almost all cases the simple correlation coefficient between the two variables is positive, albeit not very strong in many cases. However, only in relatively few countries is the coefficient on the smuggling incentive variable significantly different from zero at conventional confidence levels. Moreover, the results are quite sensitive, in many cases, to the time period chosen for analysis. This is perhaps not surprising given the nature of the activities being examined. Clearly, factors such as the level of official surveillance, for example, may change over time and this could lead to structural instability in the estimating equation. The results suggest therefore that great caution should be exercised in using trade data discrepancies to infer the scale of smuggling activity.

APPENDIX I

Data Sources

Trade data came from two sources. Disaggregated data in general came from the United Nations' data tapes on Trade by Commodities, supplemented by data from the United Nations Yearbook of International Trade. Aggregate trade data came from the IMF Direction of Trade data tapes.

Data on black market exchange rates were obtained from various issues of Pick's Currency Yearbook. The smuggling incentive was defined as

$$I = \frac{e}{s(1-t_x)} - 1$$

where e is the black market exchange rate, s is the official market exchange rate, and t_x is the export tax rate.

In cases where the official exchange rate for exports differed across commodities, attempts were made to calculate an effective official export exchange rate for the particular commodity aggregate used. Export tax rates were the average tax rate for the particular export aggregate being used. Again, inasfar as possible, the tax revenue aggregate was chosen to coincide with the level of export aggregation or vice versa. Since export tax revenue information is not broken down by country of destination of the export, tax rates relate to exports to all destinations.

Case Studies

Costa Rica

The trade ratio for primary exports (excluding coffee) and the corresponding smuggling incentive are plotted in Figure 1. While in the later years of the period the smuggling premium has been relatively moderate, it varied considerably between 1962 and 1979, ranging from a low of 2 percent in 1970 to a high of 76 percent in 1972, and has averaged 30 percent over the whole period. The trade data ratio has ranged from 0.86 to 1.56 with a mean value of 1.25. Figure 1 suggests a positive correlation between the trade data discrepancies and the corresponding smuggling incentive; this is supported by the simple correlation coefficient which is calculated (for the period 1962 to 1979) at 0.41.

Equation 1.1 in Table 3 contains the results of the regression for Costa Rica over this period. The coefficient on the smuggling incentive is positive but not significantly different from zero. At the average smuggling incentive for the period, the estimate would suggest illegal trade of 3 percent of officially reported exports.

Figure 1 indicates that 1970 and 1972 were years of very dramatic shifts in the smuggling incentive, which reflect sharp movements in the black market premium following major changes in the exchange regime. 2/ Because of these major changes it was decided to run the regressions inserting separate dummies for the years 1970 through 1972. The result is presented as equation 1.2 in Table 3. With these years excluded, the coefficient on the smuggling incentive becomes significant and would explain illegal activities of 12 percent of recorded exports at the sample average of the smuggling incentive.

Pick's Currency Yearbook reports that underinvoicing of coffee exports (in addition to overinvoicing of imports) has been an important vehicle for capital outflow. However, investigation using regression analysis of the coffee export trade data ratio in relation to its corresponding incentive did not bear this out and the simple correlation coefficient between the two variables was almost zero. 1/ When the analysis for Costa Rica for primary exports includes coffee, the results are very similar to those reported in Table 3.

1/ Toward the end of 1969 the exchange rate was unified and the black market premium disappeared. In mid-1971 a dual rate system was again introduced, after which the black market premium increased dramatically.

2/ Indeed, the trade data ratio for coffee exports was 1.08 with a small standard deviation of 0.06.

CHART 1

COSTA RICA

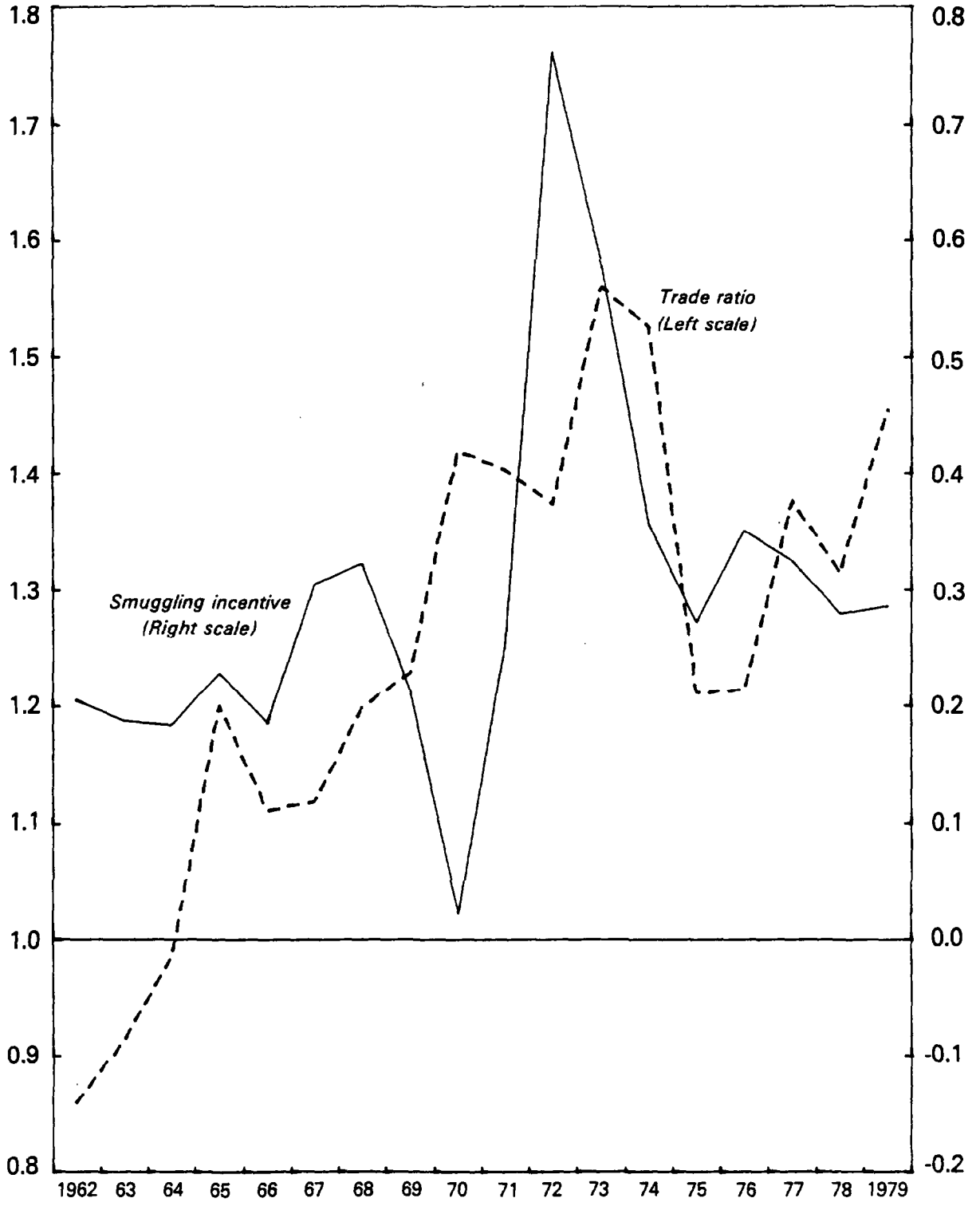


CHART 2

ECUADOR

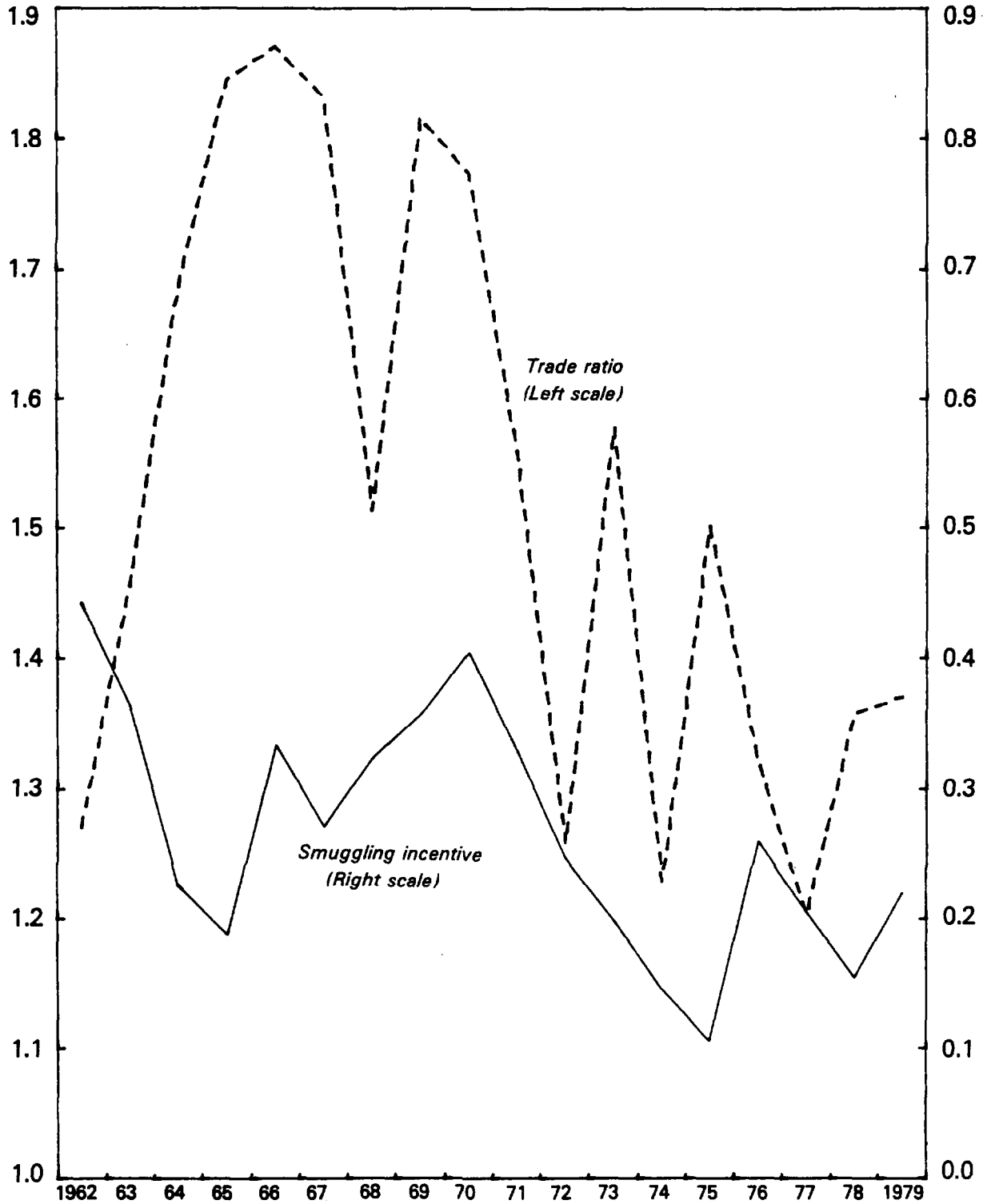
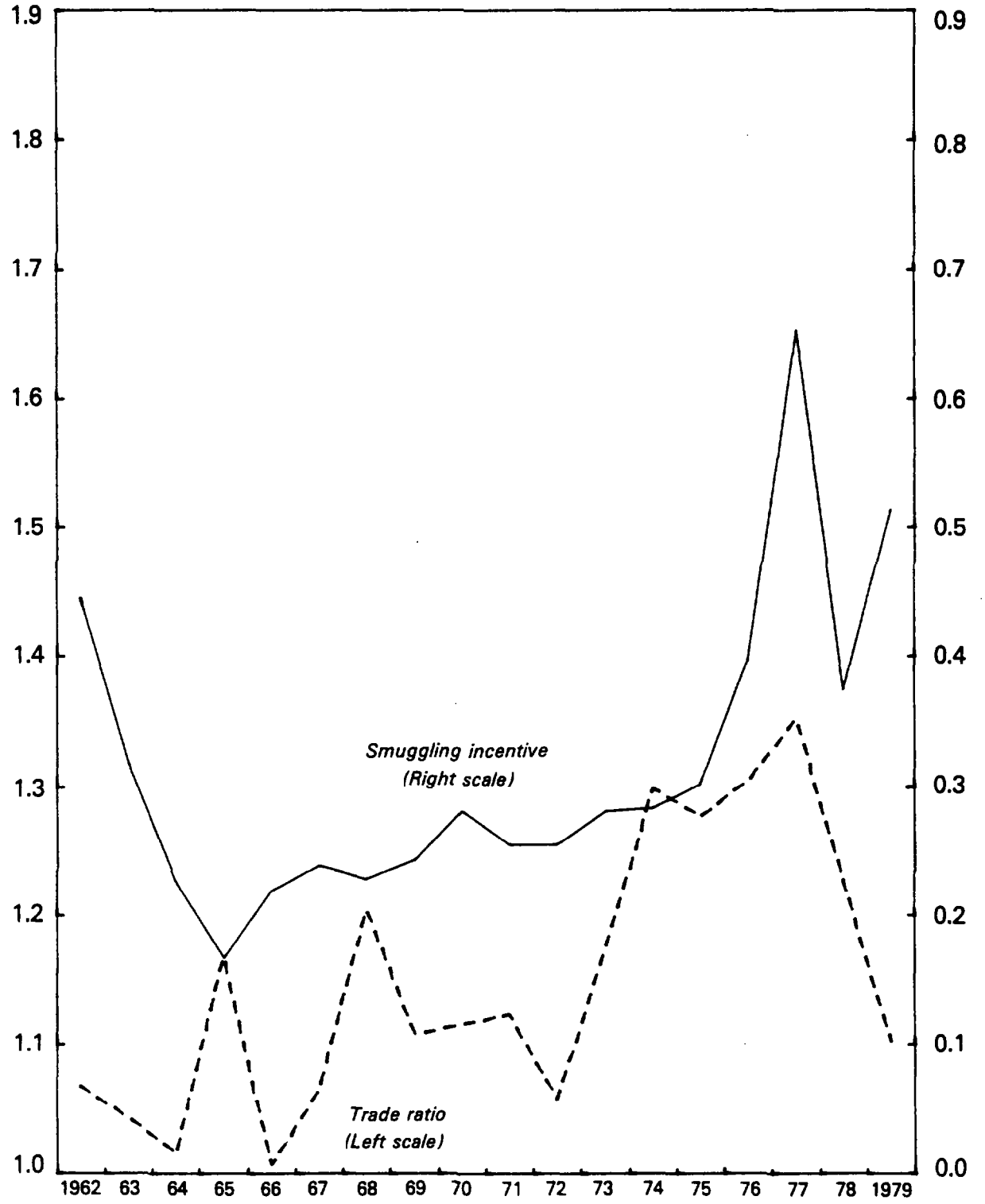


CHART 3

EL SALVADOR



Ecuador

The trade ratio and the smuggling incentive are plotted in Figure 2. As can be seen from the plots, the trade discrepancy was large throughout the period, though on average lower in the 1970s than in the 1960s. The average value of the discrepancy for the years 1962 to 1979 was about 52 percent of reported exports. The smuggling incentive has averaged about 27 percent. Figure 2 suggests that the hypothesized positive relationship between the trade ratio and the incentive does exist, in the sense that the average value of both is lower in the 1970s, than in the 1960s. The simple correlation coefficient between the discrepancy ratio and the incentive ratio is positive, though relatively weak, at 0.25. However, examining the behavior of the plots on a year-to-year basis, one sees evidence *quite contrary to the hypothesized relationship. For example, between* the years 1962 and 1965, the trade data discrepancy rose steadily from 27 percent to 87 percent of reported exports, while the smuggling incentive was falling from 44 percent to 18 percent. Similarly, large increases in the trade discrepancy occurred in 1973 and 1975, years when the smuggling incentive was falling.

Equation 2.1 in Table 3 gives results for the regression of the trade ratio on the incentive ratio over the period 1962-79. The results indicate a positive, though statistically insignificant, relationship between the incentive and the discrepancy and the point estimate only explains a trade data discrepancy of 16 percentage points of reported exports at the sample mean for the smuggling incentive. However, if one excludes the years 1962-65, the relationship between the two variables is much stronger. The simple correlation coefficient calculated over this period is 0.64 and the regression produces a significant coefficient on the smuggling variable, which explains a data discrepancy of 42 percentage points of reported exports at the mean value of the smuggling incentive.

El Salvador

Figure 3 shows that during the period under analysis, the average trade data discrepancy was 15 percent of reported exports and it varied between a minimum value of less than 1 percent and a peak value of 35 percent. The smuggling incentive had a mean value of 32 percent and ranged between 17 percent and 65 percent.

The plots suggest a positive correlation between the trade ratio and the smuggling incentive, borne out by the simple correlation coefficient which is calculated as 0.43. Equation 3.1 shows a positive but insignificant coefficient in a regression of the trade ratio on the smuggling incentive and the point estimate would account for a 7 percent trade data discrepancy at the average level of the smuggling incentive.

Figure 3 indicates that the final year of the period displays behavior sharply contrary to the hypothesized relationship. If this observation is excluded, the statistical qualities of the estimates improve significantly. The simple correlation coefficient is then calculated at 0.53 and the regression estimate is statistically more significant (at a 94 percent confidence level) and explains a trade data discrepancy of 13 percent of reported exports at the average smuggling incentive.

India

Figure 4 indicates that the trade data discrepancy was fairly large through most of the period analyzed, averaging about 29 percent and ranging from 14 percent to 41 percent of reported exports. The smuggling incentive has been more variable, ranging from 19 percent to 91 percent with a mean of 51 percent. However, an examination of the plot suggests that, for the period as a whole, the hypothesized relationship does not seem to exist--despite the sharp decline in the smuggling incentive after 1971, the trade data discrepancy did not change markedly. This observation is borne out by the simple correlation coefficient which, for 1962-79, is calculated at -0.04. The regression equation 4.1 tells a similar story with the regression coefficient small and insignificant.

Figure 4 suggests it might be interesting to analyze separately the subperiod 1962-71; here, the simple correlation coefficient (0.58) is consistent with the hypothesized relationship. The regression coefficient (equation 4.2) explains a trade data discrepancy of 16 percent at the average smuggling incentive for the period and is significant at a 92 percent confidence level.

Mexico

Figure 5 displays the different partner country trade ratios for Mexico. Over the period covered (1960-79), Mexico had a negligible black market premium, and export taxation was limited; hence no smuggling incentive is plotted and there are no regression results for Mexico. Yet, the partner country trade data discrepancy has been large throughout the period. This discrepancy increased significantly in the second half of the 1960s and seems to have been associated, in part, with a sharp increase in border industry trade. This trade was recorded in Mexico's trade data on a value added basis, but recorded gross in U.S. data.

Figure 5 plots separately the trade data ratio for U.S. trade and for trade with the rest of the industrial countries. In the case of trade with the United States, the discrepancy was not abnormally large until it started to rise in 1966 when border industries began to become important. In the case of the rest of the industrial countries, the

CHART 4

INDIA

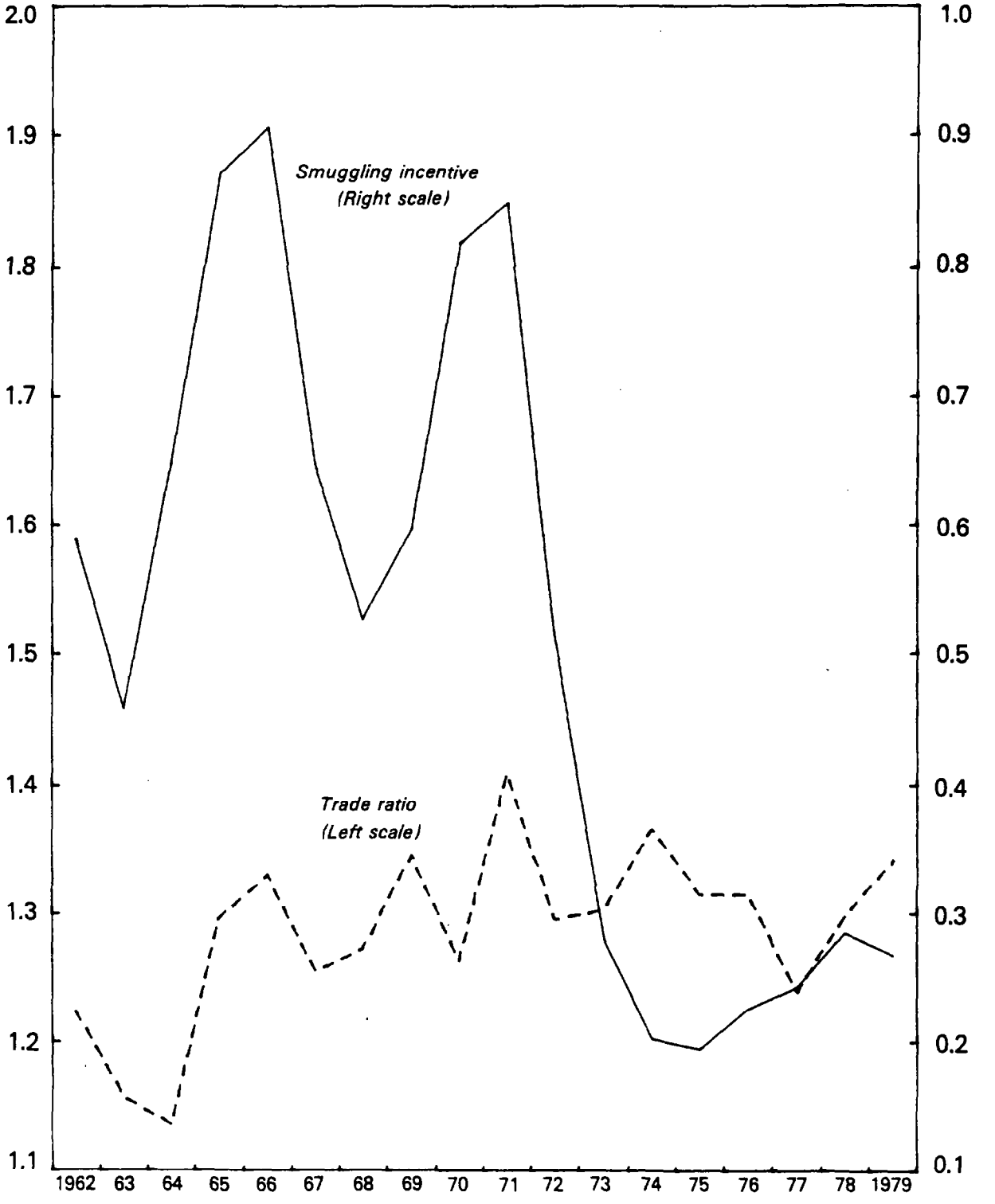


CHART 5

MEXICO

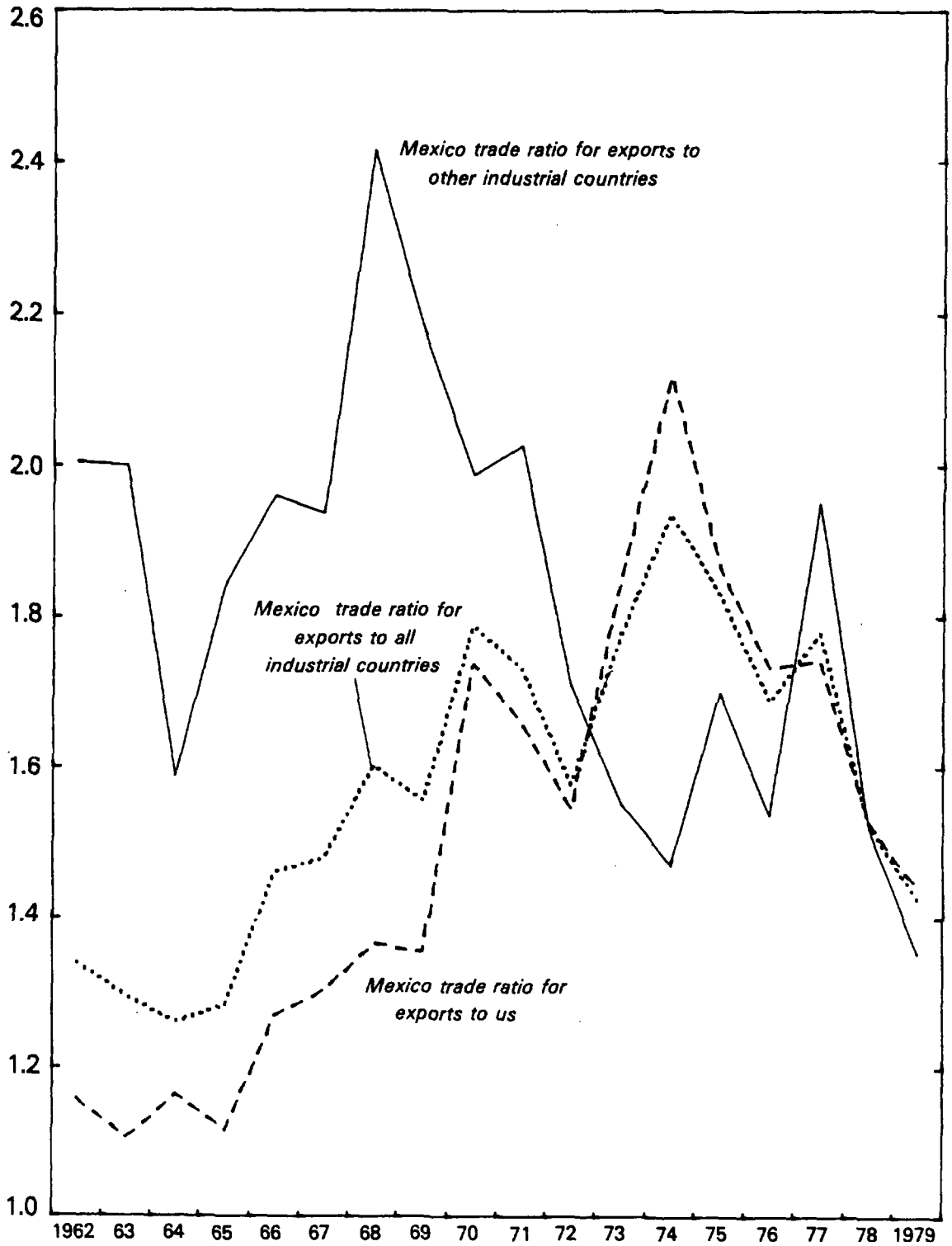


CHART 6

PHILIPPINES

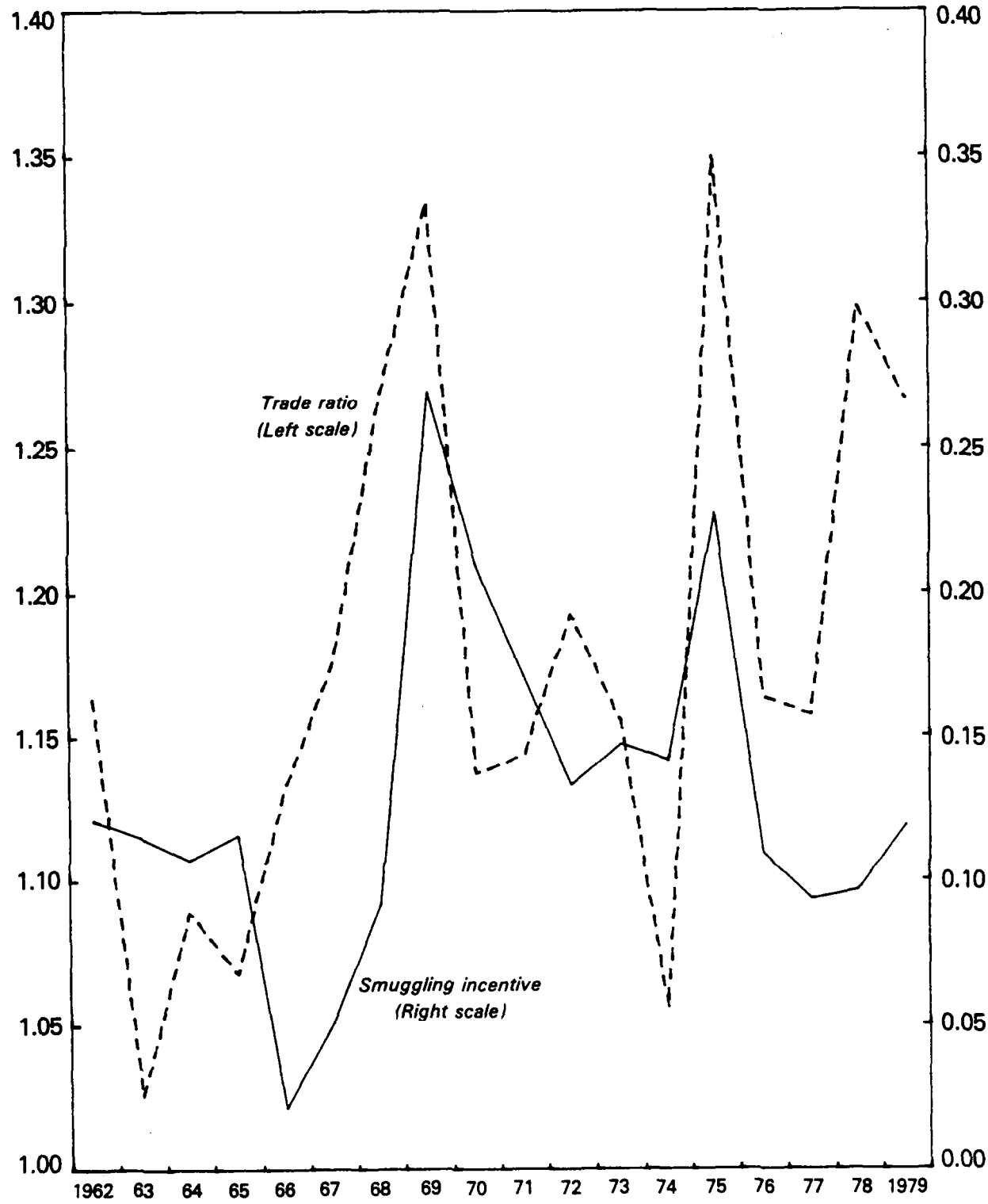


CHART 7A

SRI LANKA

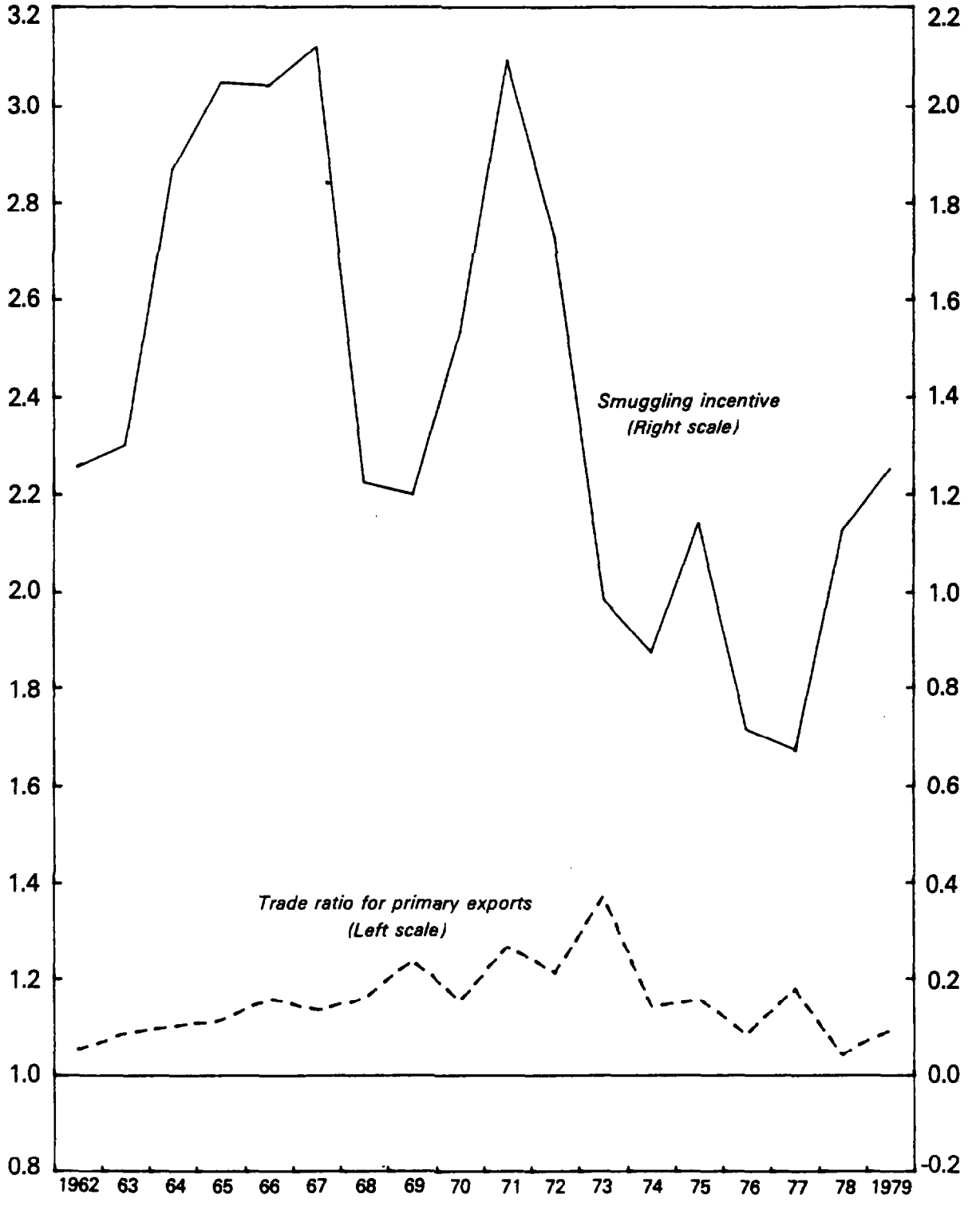
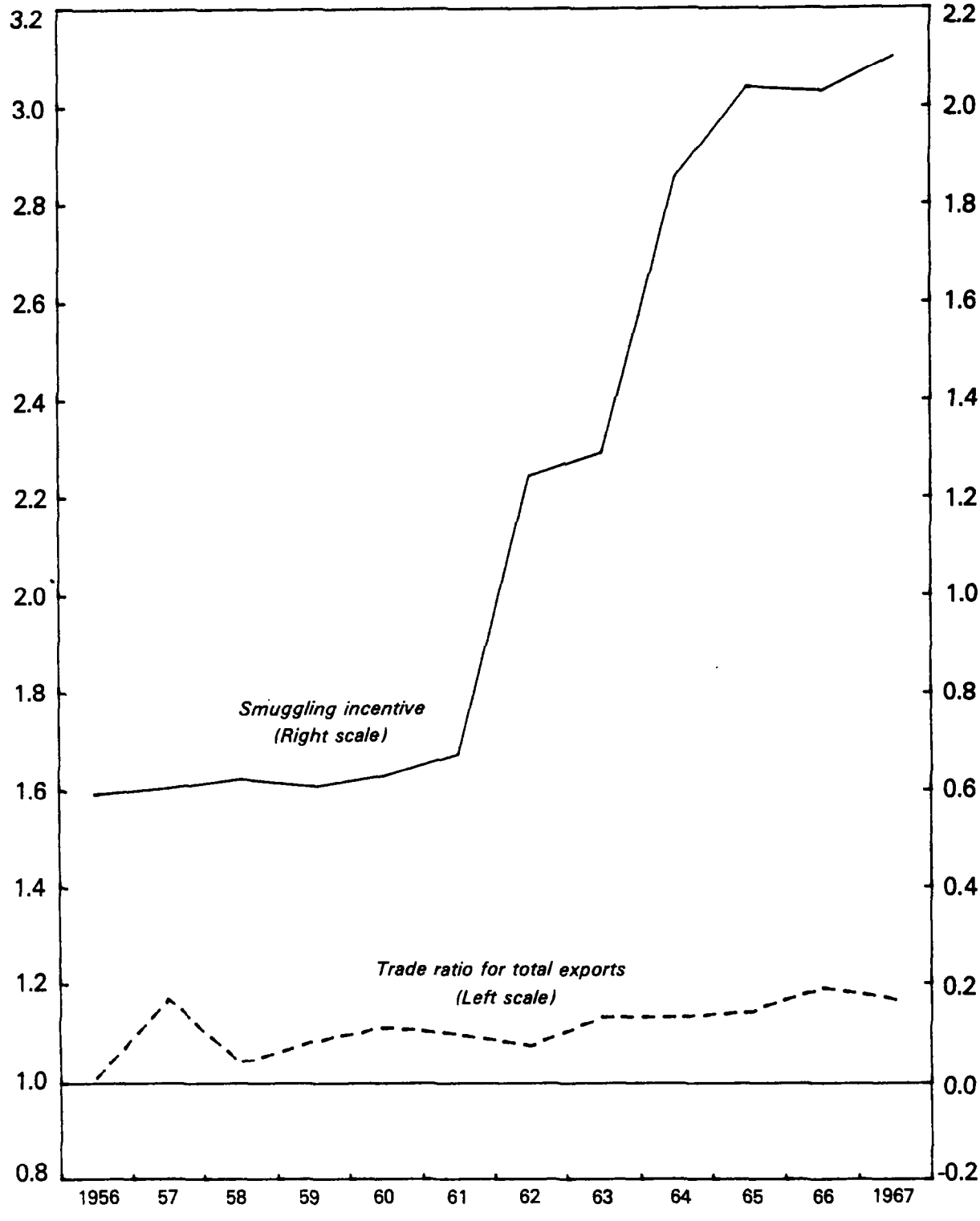


CHART 7B

SRI LANKA



discrepancy was significant throughout the period and, clearly this cannot be explained in the same way. Evidence from Mexico indicates, therefore, the need for caution in making inferences from trade data discrepancies.

Philippines

Figure 6 shows that both the smuggling incentive and the trade data discrepancy have varied considerably in the Philippines over the period 1962-79. The data discrepancy varied between 3 percent and 35 percent of reported exports, with a mean value of 18 percent. The range of the smuggling incentive was 2 to 27 percent with a mean value of 13 percent. The plots tend to suggest a positive correlation between the two variables and this is borne out by the calculated simple correlation coefficient which is 0.38. The regression coefficient (equation 5.1), which is significant only at the 92 percent level, explains a trade data discrepancy of close to 10 percent at the mean value of the smuggling incentive.

Sri Lanka

Figure 7A illustrates that the smuggling incentive was large between 1962 and 1979, averaging 140 percent, and ranging between 67 percent and 212 percent. Despite these extremely large incentives, the trade data discrepancy averaged only 15 percent of reported exports with minimum and maximum values of 4 and 37 percent. Nor does the figure suggest the hypothesized positive association between the two variables, and this is borne out by the calculated correlation coefficient of 0.04.

When considering trade developments in Sri Lanka, one should take into account that nationalizations affecting major export crops during the early 1970s might have affected behavioral relationships. In addition, there was a major change in the exchange regime in 1968. Accordingly, it was decided to examine the behavior of the trade discrepancy before 1968. For this purpose, the focus is changed to total trade with the industrial countries. 1/ The plots of the trade ratio and incentive variable are contained in Figure 7B. The trade discrepancy averaged only 11 percent despite the average incentive of 110 percent. However, the correlation coefficient between the two variables (0.64) is relatively strong and equation 6.2, estimated over the period 1956 to 1967, produces an estimated coefficient for the incentive variable which, although small, is significant at the 99 percent confidence level. This coefficient explains a trade data discrepancy of about 7 percent of reported exports at the average smuggling incentive.

1/ This is for reasons of data availability. In addition, disaggregated data are less necessary for the pre-1968 period, since differential exchange rate treatment for different types of exports was only introduced in 1968.

Thailand

In the case of Thailand, the focus was on rice exports. While black market exchange premia in Thailand were small, the country's major export product, rice, has been heavily taxed. This taxation has taken the form of an export duty and a variable export premium. The function of the latter has been to insulate the domestic rice market from volatility in the international market. For the period for which data have been obtained, 1962-75, the average export tax on rice has varied from 8 percent to 40 percent of exports with a mean value of 26 percent. At the same time, the trade discrepancy ranged from -15 percent to 31 percent with a mean value of 6 percent (Figure 8). 1/

The simple correlation coefficient for the period 1962 to 1975 between the trade ratio and the export tax rate is small and negative. The regression over this period (7.1) produces a negative coefficient on the incentive variable which is not significantly different from zero.

The tax premium is not the only way in which the government has intervened in the rice export market. Apart from its involvement in direct government-to-government sales, it has also, from time to time, placed quantitative restrictions on rice exporters. Between 1962 and 1972, these do not appear to have had substantial additional impact on the domestic rice market. This is the conclusion of Tolley et. al. (1982) who point out that domestic prices during this period followed the pattern of international prices very closely. However, this is not the case for 1973-75, when the pattern of price developments diverged sharply. Since nonprice restrictions are difficult to quantify and can also be expected to affect invoicing practices of traders, the regression was also estimated over the period 1962 to 1972. Over this period, the correlation coefficent is positive but very small, and the regression estimate on the incentive variable is small, negative and close to zero.

Turkey

The reason for choosing to examine Turkish exports is not that there has been a consistently large trade data discrepancy. Indeed, the average value of the discrepancy for 1962-79 is only 9 percent of recorded exports--about what one might expect as a result of insurance and freight. However, the invoicing practices of Turkish importers have attracted attention from a number of researchers (e.g., Bhagwati (1974), de Wulf (1981), and Krueger (1974)). Furthermore, the incentives for false invoicing of exports changed considerably during the period under analysis. The effective black market premium facing primary

1/ In the case of rice, the focus is on trade with other Asian countries, because of the limited rice trade with the industrial countries.

CHART 8

THAILAND

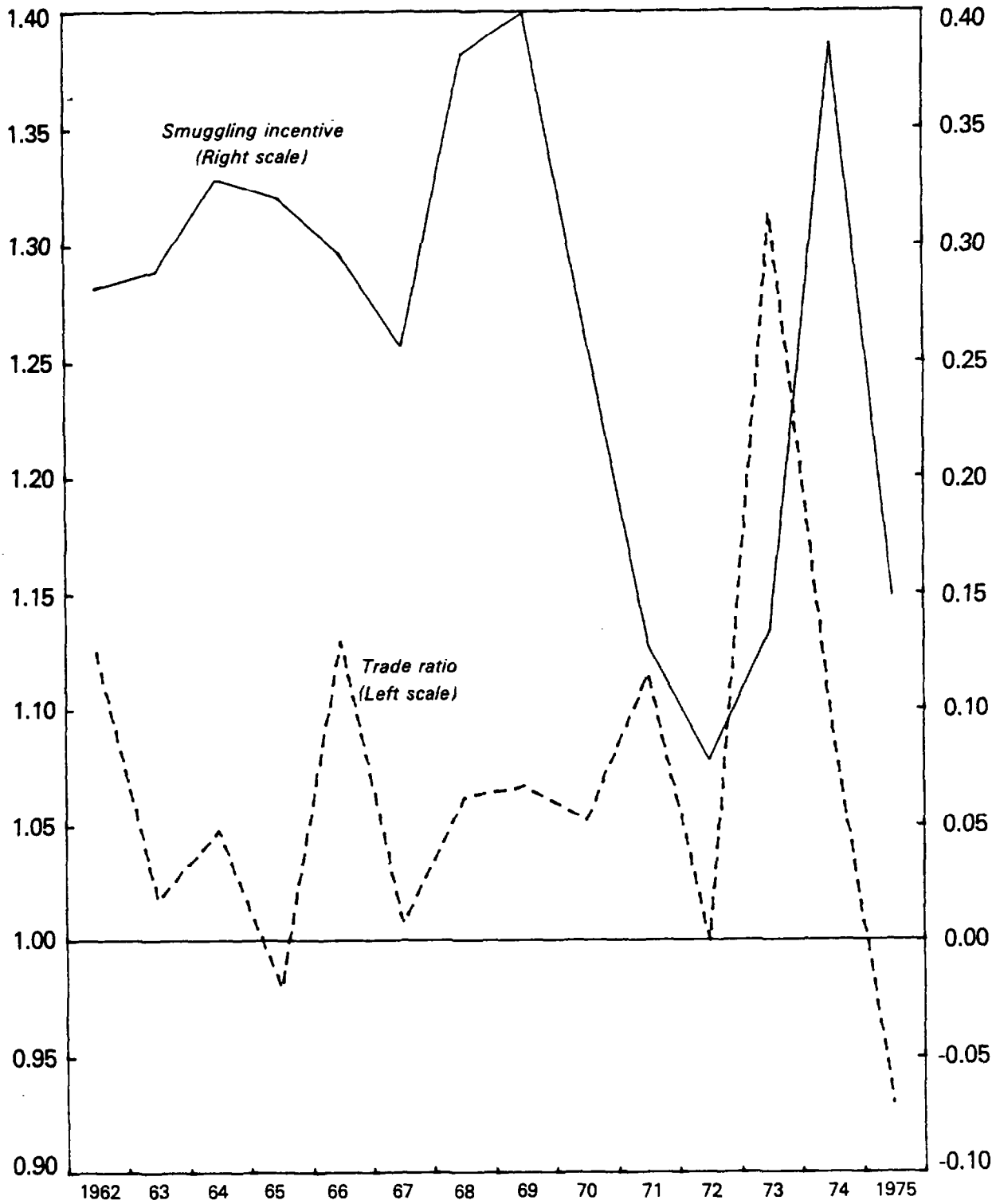


CHART 9

TURKEY

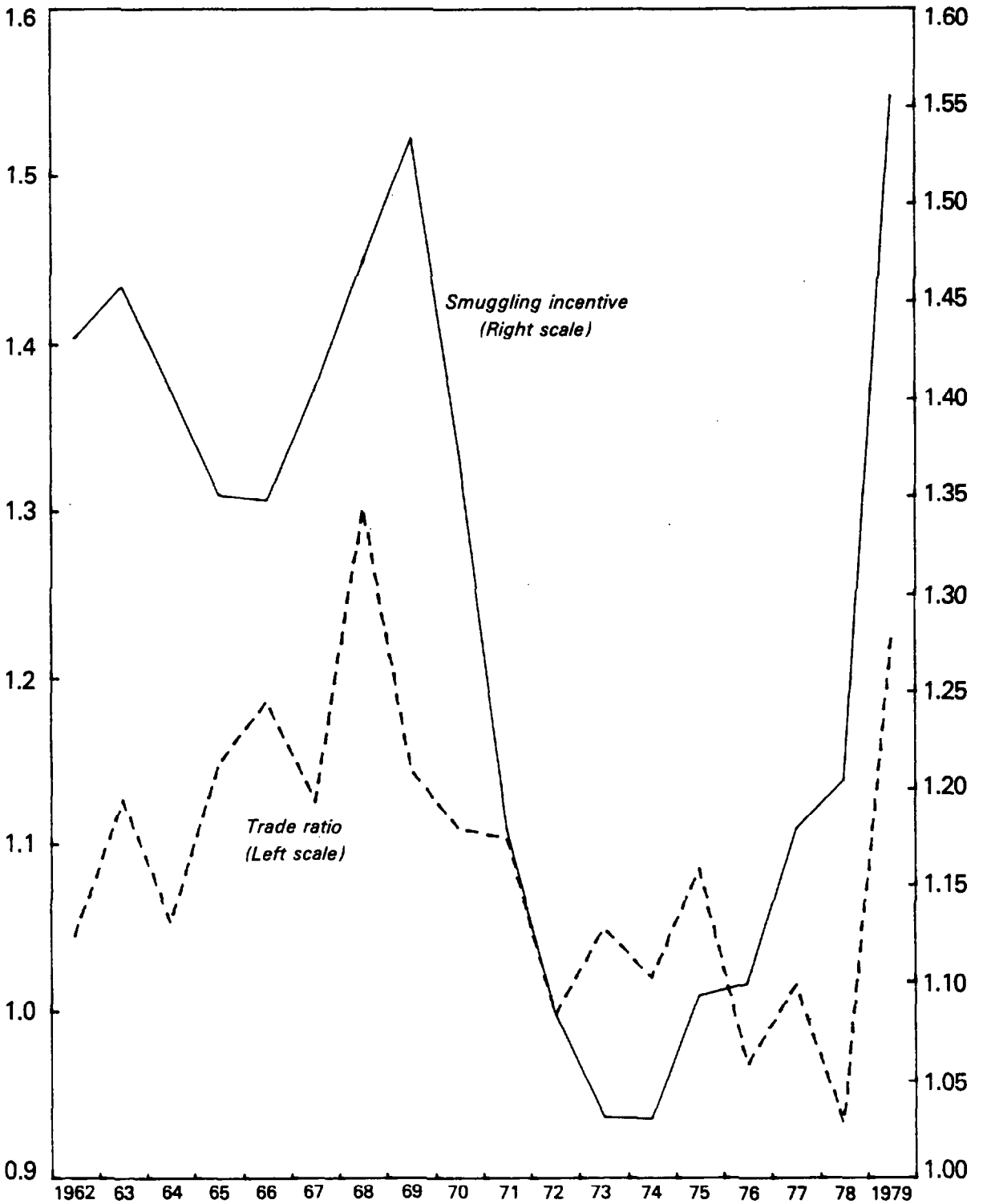
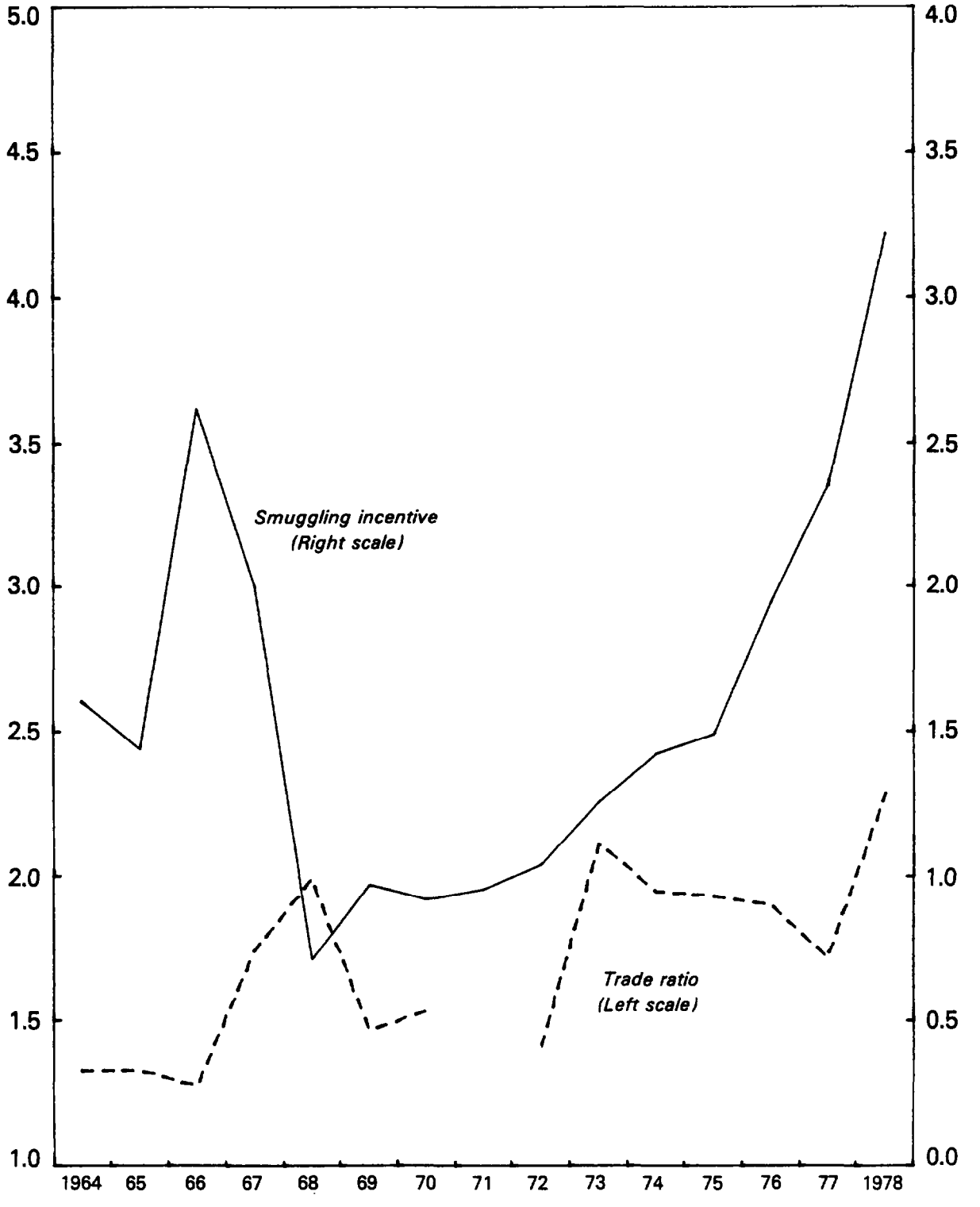


CHART 10

ZAIRE



commodity exporters averaged 42 percent between 1962 and 1970 but fell to an average of 10 percent between 1971 and 1977 before rising again in 1978 and 1979. The mean for the period as a whole was 29 percent. The plots of the trade ratio and the smuggling incentive in Figure 9 seem to confirm the hypothesized relationship between these two ratios, and their correlation coefficient is calculated as 0.68. Equation 8.1 indicates a statistically significant relationship between the trade ratio and the smuggling incentive. At the average incentive of 29 percent, the estimate suggests that illegal exports would be about 10 percent of reported exports.

Zaire

In the case of Zaire, the focus is on total exports, though this differs little from primary exports given the very low share of manufactured goods in Zaire's exports. Between 1964 and 1978, the trade data discrepancy varied between 28 percent and 129 percent of reported exports with a mean value of 71 percent (see Figure 10). 1/ Over the same period, the smuggling incentive varied between 71 percent and 322 percent with a mean value of 164 percent. However, the simple correlation coefficient, while positive, is relatively weak at 0.21, and the regression produces a statistically insignificant coefficient for the incentive variable, the point estimate of which explains a trade data discrepancy of only about 15 percent. For the period after the break in the data, 1972-78, the data are more consistent with the hypothesized relationship, with the simple correlation coefficient being calculated at 0.53. However, the regression coefficient estimated over this shorter period is still not significant at conventional confidence levels.

1/ The year 1971 is excluded from the analysis since, for this year, export data disaggregated by country of destination are not available.

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