2-15-1992

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A DISCUSSION OF METHODOLOGY

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Economic Staff Paper No. 92-3**

February 1992

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ABSTRACT

The theoretical results attained from the literature on Illegal Transactions in International Trade suggest: 1) a positive link between the duty levied and the level of smuggling effort; 2) a non-negative domestic relative price effect; and 3) an ambiguous social welfare effect. The theoretical results predict the generation of some type of distortion. The literature labels these distortions "disparities" and divides them into three categories: price, value, and quantity. These distortions represent the empirically measurable effects of smuggling on the domestic economy.

This paper makes the proposition that the "price disparity" distortion is the variable that empirical studies should examine to determine whether smuggling has an impact on the economy. A suggested empirical procedure is presented. The statistical procedure employs a "classical" hypothesis test to determine if there is statistical evidence supporting the predictions made in the theoretical literature.

I. INTRODUCTION

Smuggling as an empirical issue is dependent on which commercial policy instrument or combination of

instruments are creating the incentive to smuggle. The literature has identified three policy instruments as generators of smuggling activity in developing countries: 1) import and export taxes, 2) non-tariff barriers, and 3) foreign exchange controls. The discussion in this paper assumes the absence of foreign exchange controls and non-tariff barriers.

The theoretical results attained from the literature on Illegal Transactions in International Trade suggest: 1) a positive link between the duty levied and the level of smuggling effort; 2) a non-negative domestic relative price effect; and 3) an ambiguous social welfare effect.[1] The theoretical results, however, predict that smuggling will generate some type of distortion. Bhagwati (1981) labels these distortions "disparities" and identifies them as price, value, and quantity. These distortions represent the empirically measurable effects of smuggling on the domestic economy.

The most common method of estimating the amount of smuggling in a country is by cross-country data

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[1]   The theoretical literature has produced mixed results concerning the relationship between the tax rate and the level of smuggling: an ambiguous result in the paper by Martin and Panagariya (1984) and a positive result in a paper by Sheikh (1974a). The welfare effect of smuggling has been the central issue of the majority of papers written on smuggling. A comprehensive literature review of these issues can be found in a paper by Sheikh (1989).

comparison, using either the "value" or "quantity" disparities as the variable of interest. For example, a cross-country data comparison study employing the value disparity variable as the measure of smuggling's economic impact would require the investigator to collect data in the following manner: the investigator would make a comparison of the (CIF) import values and (FOB) export values of the home country with the (CIF) import values and (FOB) export values of its trading partners. If the home country's (CIF) import values are compared to its trading partners' (FOB) export values, then the investigator is trying to detect import smuggling into the home country. Reversing the comparison detects export smuggling out of the home country. Any discrepancy found in the comparison would be the distortion Bhagwati calls "value disparity."

This type of analysis depends critically on the accuracy of international trade data. The accuracy of this type of data for lesser developed countries is questionable, at best.[2] The inability of this approach to provide reliable information on the impact of smuggling on domestic prices and production is another weakness of a cross-country data comparison

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[2] A discussion of the problems with international trade data can be found in the paper by Morgenstern (1974), and in a paper by Naya and Morgan (1974).

study when value or quantity disparity is used as the estimating variable.[3]

Bhagwati (1964; 1967) developed a cross-country data comparison approach for the detection of "underinvoicing of imports," using the value disparity variable. Bhagwati's approach has been used frequently in empirical studies by other economists to detect smuggling. The results of these empirical studies, however, have provided only inconclusive proof supporting the hypothesis that underinvoicing exists. . These studies have also failed to provide evidence that establishes a link between tax rates and smuggling or smuggling's impact on the domestic economy.[4]

An alternative empirical method examines the economic impact that smuggling has on domestic prices. This method was developed by Cooper (1974) for estimating the economic impact from import smuggling on the domestic price of imports. Cooper's study focused on the price disparity variable, and his study provided evidence that the smuggling of imports does have an economic impact on the domestic wholesale price of imported goods subject to a tariff.

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[3] See Simkin (1974) and Richter (1974) for the type of problems and disagreements that arise from this type of statistical detection method.

[4] For applications of this approach see the studies by Sheikh (1974b), Nayak (1977), Wulf (1981).

Specifically, Cooper's empirical study found that the domestic wholesale market price of an imported good subject to tariff was, on average, 82% of what the good's theoretical full duty price should be. This result holds for goods subject to a tariff rate of 0% to 100%. For imported goods which are subject to tariffs of 100% to 200%, only 39% of the tariff increment above 100% is reflected in the domestic wholesale price of the good. An increase in the tariff above 258% causes an actual reduction in the domestic wholesale price of the good.

Cooper's study compared the wholesale domestic price of an imported good to the imported good's theoretical full duty price, using this information to calculate the percentage differences between these two prices to determine the price effect of smuggling. Cooper also employed linear regression analysis, regressing the ratio of domestic wholesale price to theoretical full duty price of imported goods upon the tariff levied.[5] Cooper's single variable model provided a very poor fit in predicting the variability of the price ratio (R^2 = .19). Cooper's model, however, did provide evidence of a strong relationship between the tariff rate and smuggling's impact on domestic prices.

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[5] Cooper's sample size was 72.

A theoretical model of smuggling developed by Pitt (1981) allows the coexistence of legal and illegal domestic export trade at a domestic price ratio higher than the domestic price ratio for the strictly legal trade alternative. Pitt attains this result by introducing a smuggling production function which allows the production of a joint export product by the smuggling firm. Pitt calls this result "price disparity." Smuggling induced by Pitt's price disparity mechanism is one possible explanation for Cooper's empirical results. Pitt (1986) developed an empirical method similar to Cooper's for estimating the effect of smuggling rubber exports out of Indonesia on the domestic price of rubber. Pitt's empirical results provide strong evidence of a link between export duty rates and smuggling's impact on domestic prices.[6]

The Cooper and Pitt empirical approach for estimating the economic impact of smuggling provides new insight unavailable with the cross-country data comparison method when either the value or quantity disparity variables are used. It should be noted that

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[6] Smuggling which generates price disparity can occur in both the export and import market. For exports, the price the smuggler can receive for a good in the world market is higher than he can receive in the domestic market. The smuggling of rubber is an excellent example of the price disparity mechanism at work in the export sector of the Indonesian economy. For imports, the domestic price of smuggled goods is less than the legal price of the imported good. The smuggler's profit therefore can be considered the proportion of the tax avoided.

the empirical method developed by Cooper and Pitt is
unable to provide any information on the volume of
smuggled goods.

II. AN ALTERNATIVE EMPIRICAL APPROACH

By extending the empirical technique developed by
Cooper and Pitt, this approach develops statistical
tests to determine: 1) if there is statistical evidence
of smuggling affecting domestic prices; and 2) if there
is a link between tax rates and the domestic price
effect of smuggling. Our alternative empirical
approach relies on observed domestic market price data
for traded goods and the constructed theoretical full
duty price for trade goods. This new approach employs
a "classical" hypothesis test procedure to determine if
smuggling has had a statistically significant economic
impact on domestic prices. If smuggling alters domestic
prices, then smuggling affects production and social
welfare. This technique avoids most of the statistical
discrepancies associated with trade statistics used in
cross-country data studies which examine either the
value or quantity disparity variable.

To construct the statistical tests, a set of
random samples of (n) imported goods subject to a
tariff is collected. Each sample is for a specific
tariff range. For example, following Cooper's
approach, three tariff categories can be constructed:

0%-100%, 101%-200%, 201% and above. The following
information on each observation in each sample is
needed to construct the hypotheses tests: 1) the C.I.F
price of each good; 2) the local domestic wholesale
price of each good; and 3) the import duty and all
other taxes levied on the imported goods in the sample.

The data are then used to calculate the
theoretical full duty price of each good in each
sample. For each observation in the sample, the ratio
of the local wholesale price of the good to its
hypothetical full duty price, {C.I.F + import duty +
all other taxes + 10% markup for importer profit}, is
calculated.[7] If smuggling is not present in the
domestic market, then the ratio of local wholesale to
full duty price should be equal to one. This ratio is
the proxy for the domestic price effect of smuggling
working through the price disparity mechanism.

The first set of empirical tests uses the test
procedure found in box (I). These tests determine if
there is significant evidence to support the hypothesis
that smuggling working through the price disparity
mechanism is affecting local wholesale prices for the
different tariff categories. This first set of
hypotheses tests provide statistical evidence of which
tariff category the tariff level must reach before

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[7] Cooper used a 25% markup in his empirical study.

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smuggling begins to have a significant impact on domestic prices.

<div align="center">BOX I</div>

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<div align="center">Hypothesis Test I</div>

x = average ratio of local wholesale to full duty price

s_x = standard deviation for the distribution of the ratio

n = sample size

Ho: $U_x = 1$

H1: $U_x < 1$

DR: $x - 1 / (s_x / n^{1/2}) < -Z_\alpha$

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Summing up the ratio of local wholesale prices to full duty prices and dividing the sum by the number of observations generates the average ratio of local wholesale prices to full duty prices (sample mean). Under the assumption of a large sample size, the null hypothesis is that the average value of the ratio is one. This implies there is not enough evidence to conclude that smuggling has an economic impact on domestic prices. The alternative hypothesis states that the ratio is less than one, implying that there is evidence of smuggling having an economic impact on domestic prices.

The population parameter (U_x), is the population mean for a specific tariff category (X). The decision rule (DR) for this hypothesis test is to reject the

null hypothesis if the above decision rule is true. If the null hypothesis is rejected, then there is evidence to suggest that smuggling working through the price disparity mechanism is affecting local wholesale prices.[8]

The second set of empirical tests uses the test procedure found in box (II). These tests determine if there is significant evidence to support the hypothesis that smuggling working through the price disparity mechanism has an increasing effect on local wholesale prices as the tariff increases. The second set of hypotheses tests provides statistical evidence to determine if there is a positive link between tariff rates and the economic impact of smuggling on domestic prices.

BOX II

Hypothesis Test II
Ho: $U_x - U_y = 0$
H1: $U_x - U_y < 0$
DR: $d / (_xS^2/n_x + _yS^2/n_y)^{1/2} < -Z_\alpha$; $d = (x-y)$

This set of empirical tests uses the "differences between population means" hypothesis test, assuming a large sample size. The null hypothesis is that higher tariff rates do not increase the domestic price effect

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[8] The hypothesis test for export smuggling would be an upper tail test.

of smuggling. The alternative is that higher tariff rates increase smuggling's effect on domestic prices.

The population parameter (U_x), is the population mean for tariff category (X), and (U_y) is the population mean for tariff category (Y). The variable (x) is the sample mean for ratio of local wholesale to full duty prices of goods in tariff category (X), and the variable (y) is the sample mean for the ratio of local wholesale to full duty prices of goods in tariff category (Y). The variables, $(_xS^2, {}_yS^2)$, denote the sample variances for category (X) and (Y) respectively. Tariff rates are higher in category (Y).

The decision rule (DR) for this hypothesis test is that the null hypothesis is rejected if the above decision rule is true. If the null hypothesis is rejected, then the evidence suggests the existence of a positive link between tariff rates and the economic impact of smuggling on domestic prices.[9]

III. SUMMARY

The limitations and inconsistences associated with cross-country trade data comparison studies which uses either the value or quantity disparity variable for detecting smuggling in lesser developed countries requires a discussion of whether this is the correct

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[9] The hypothesis test for export smuggling would be an upper tail test.

procedure for an empirical analysis of smuggling. It is clear from the discussion in this paper that past empirical studies have failed to answer important questions concerning the economic impact of smuggling.

The purpose of this paper is to suggest a new approach for empirical studies on smuggling. The paper concludes that the variable of interest should be the "price disparity" distortion. The new approach uses formal statistical theory to develop a procedure to verify the existence of smuggling's economic impact on domestic prices, as predicted in the theoretical papers on smuggling. This approach will also be able to determine if there is evidence of a positive link between the tariff rate and the magnitude of smuggling's impact on domestic prices as predicted in the theoretical papers on smuggling.

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