

CAN ENFORCEMENT BACKFIRE? CRIME DISPLACEMENT IN THE CONTEXT OF CUSTOMS REFORM IN THE PHILIPPINES

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Abstract—Increased enforcement can displace crime to alternative law-breaking methods. This paper examines a customs reform in the Philippines that raised enforcement against a specific method of avoiding import duties. Increased enforcement applied only to shipments from some countries, so shipments from other countries serve as a control group. Increased enforcement reduced the targeted duty-avoidance method, but caused substantial displacement to an alternative method. The hypothesis of zero change in total duty avoidance cannot be rejected. Displacement was greater for products with higher tariff rates and import volumes, consistent with the existence of fixed costs of switching to alternative duty-avoidance methods.

I. Introduction

ECONOMIC theory posits that criminal activity arises from rational assessment of the costs and benefits of lawbreaking. In the wake of Becker's (1968) economic model of crime, there has been great interest in the economics of illegal activity (Ehrlich, 1973; Andreoni, 1991; Freeman, 1996; among others). In particular, establishing the impact of law enforcement on crime is central, and several papers have made important strides in this area (Levitt, 1997; Corman & Mocan, 2000; Bar-Ilan & Sacerdote, 2001; Di Tella & Schargrodsky, 2004; among others).

There has been a long-standing concern in crime studies that increased enforcement can lead criminal activity to be displaced to alternative lawbreaking methods (Repetto, 1976). A simple model predicts that, when alternative lawbreaking methods involve fixed costs of entry, crime displacement should respond positively to the size of illicit profits threatened by enforcement. But there is little empirical evidence on the relationship between crime displacement and basic economic factors: for the most part, empir-

ical analyses of enforcement's impact have addressed displacement as a mere side note, at most examining the existence or amount of displacement.¹ Evidence on the determinants of crime displacement could shed light on the importance of economic motives in the decisions of lawbreakers more generally.

Moreover, existing studies typically conclude that displacement is a minor phenomenon, finding either no evidence of displacement or that it is small in magnitude.² But in theory, displacement can be large in magnitude, especially when enforcement is selective—that is, when it targets just one of several alternative lawbreaking methods. Substantial displacement is particularly likely when alternative methods have higher fixed costs but lower variable costs than previously used methods.³

This paper is an empirical study of the possible unintended consequences of selective law enforcement and examines crime displacement in the context of customs reform in the Philippines. In 1990, the Philippine government raised enforcement in customs against a specific method of avoiding import duties. The reform constituted a quasi experiment: the increased enforcement applied only to shipments from a subset of countries, so that corresponding shipments from all other countries serve as a comparison group. Increased enforcement reduced the targeted method of duty avoidance but led to substantial displacement to an alternative duty-avoidance method (shipping via duty-exempt export processing zones), amounting to 2.7% of total imports from treatment countries. The hypothesis that the reform led to zero change in total duty avoidance cannot be rejected. Displacement was greater for products with higher tariff rates and import volumes, consistent with the existence of fixed costs of switching to alternative duty-avoidance methods.

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¹ See Chaiken, Lawless, and Stevenson (1974), McPheters, Mann, and Schlagenhauf (1984), Ayres and Levitt (1998), Levitt (1998), Braga et al. (1999), and Di Tella and Schargrodsky (2004), among others. See also Hesselting's (1994) overview.

² For example, DiNardo and Lemieux (2001) find small amounts of displacement from alcohol to marijuana consumption in response to increases in state-level drinking ages.

³ This possibility is reminiscent of the potential perverse impact of managerial incentives in the multitask principal-agent problem (Holmstrom & Milgrom, 1991; Prendergast 2002).

While studying the impact of enforcement in customs can shed light on the economics of crime displacement, it is also important for the public finances of nearly all developing countries.⁴ Smuggling and customs corruption are rife in many countries,⁵ and trade taxes are an important source of government revenue.⁶ In 1995, import duties accounted for an average of 23% of central-government tax revenue among developing countries, but the fraction was as high as 31% in the Philippines, 32% in Cote d'Ivoire, and 37% in the Dominican Republic.⁷ Most commonly, an importer underreports the value of an incoming shipment so as to pay lower import duties (a practice known as underinvoicing), and customs officials may agree to overlook the fraud in return for bribes. Government revenue ultimately suffers, and a government having difficulty collecting trade taxes may have to resort to more distortionary methods of public finance in the long term.

The customs reform examined in this paper is also of more general interest, as it was an example of a very common approach to fighting smuggling and customs corruption: hiring private firms to conduct preshipment inspection of imports (known as PSI). When a government implements a PSI program, foreign inspectors verify the tariff classification and value of individual incoming shipments before they leave their origin countries. In nearly all cases, however, the responsibility for collecting customs duties remains in the hands of the importing country's customs officials, who may choose to ignore PSI reports on specific shipments. PSI programs can fail to reduce import duty evasion if enforcers fail to use the new information available to them in the PSI reports, or if importers can find alternative methods of avoiding duties (that may involve avoiding PSI, or bringing shipments into the country outside of formal customs channels so that shipments never appear before a customs officer). The latter possibility—that importers find alternative duty-avoidance methods—is the focus of this paper. (See the appendix for further details on PSI.)

⁴ Slemrod and Yitzhaki (2002) appeal for research on the responses of tax evaders to greater enforcement.

⁵ Following common usage in the customs field, in this paper the term "smuggling" refers to any illicit means by which an importer reduces duties paid on a shipment, whether the shipment passes through formal customs channels or avoids formal channels entirely.

⁶ In the international trade context, existing research finds evidence of tax avoidance and evasion but does not examine the impact of enforcement on these activities. Pritchett and Sethi (1994) find that collected import duties as a share of import value rise less than one-for-one with the tariff rate, and interpret this as evidence of tax evasion/avoidance. Fisman and Wei (2004) find that the extent of import underinvoicing rises in the tariff rate among Chinese imports from Hong Kong. A number of authors examine tax-induced transfer pricing within multinational firms (Bernard & Weiner, 1990; Hines & Rice, 1994; and Clausing 2001; among others). In the related realm of income tax evasion, Klepper and Nagin (1989) examine cross-sectional correlates of income underreporting on specific line items of U.S. tax returns.

⁷ The source of these figures is World Development Indicators (World Bank, 2002).

A standard problem when assessing the impact of increased enforcement is establishing a credible counterfactual, with which the causal impact of the new enforcement can be separated from time trends in crime rates, from the impact of other simultaneous enforcement efforts, or from reverse causation (higher crime rates leading to more enforcement). To establish the causal impact of increased enforcement, this paper takes advantage of the fact that—for the 28-month study period—the Philippines' PSI program only covered imports from a subset of countries. Then, during the course of the study period, the Philippine government increased enforcement against duty avoidance for imports from PSI-covered countries, by expanding inspections to a previously exempt shipment category (shipments below a certain dollar value). The key element of the identification strategy is the existence of a plausible control category—imports from countries not covered by the Philippine PSI program—against which changes in imports from PSI countries can be compared. Because changes over time in a treatment group are compared with corresponding changes in a control group, this difference-in-difference identification strategy purges the empirical estimates of time trends in the use of various duty-avoidance methods, as well as general changes in customs enforcement that should affect imports from all countries equally (such as changes in legal sanctions against smugglers and salaries of customs officials). The empirical analysis finds that when the Philippine government increased enforcement by expanding inspections to low-value shipments, imports from treatment countries shifted differentially to an alternative duty-avoidance method: shipping via duty-exempt export processing zones.

Section II outlines a simple model of crime displacement, applied to import duty evasion. Section III presents empirical evidence on the economics of displacement in the context of the Philippine PSI program. Section IV concludes. The appendix provides more detail on PSI programs and on the calculation of the revenue loss to the Philippine government due to the reform studied.

II. Crime Displacement in Theory

I describe here a simple model of the impact of enforcement on criminal activity, when enforcement only targets a subset of methods by which a particular crime can be carried out. In this situation we should expect crime to be displaced to the alternative, untargeted methods. The extent of displacement to alternative lawbreaking methods depends on the relative fixed and variable costs of the different methods, and on the size of illicit profits that are threatened by enforcement.

Consider an importer choosing between smuggling methods 1 and 2, each of which has distinct fixed and variable costs. Fixed costs include the costs of falsifying documentation, of finding and maintaining suppliers willing to collude in smuggling, or of setting up and maintaining smug-

gling facilities (like front companies). Bribes paid to government officials may also have fixed components. Variable costs include legal penalties, which rise in expectation if the likelihood of detection increases in the smuggling rate (the fraction of goods smuggled). If risks for bribe-takers rise in the smuggling rate, bribes paid could also have a variable component that rises in the smuggling rate.

Let there be many identical importing firms that each inelastically import a fixed amount M (say that they face capacity constraints). The importer must decide which of the two smuggling methods to use; without loss of generality, assume that method 1 is the initially chosen method. The importer chooses the smuggling rate γ_1 , the fraction smuggled out of total imports.

Let the net benefit of using smuggling method 1 (B_1) be as follows:

$$B_1 \equiv \tau M \gamma_1 - v_1 \gamma_1^2 - F_1. \quad (1)$$

τ is the tariff rate per unit of imports. $\tau M \gamma_1$ is therefore the value of tariffs avoided via smuggling. Smuggling costs are convex—assumed here to rise in the square of the smuggling rate—and are parameterized by v_1 . F_1 is the fixed cost of smuggling method 1. Convex smuggling costs could arise if the authorities devoted more effort to apprehending large smugglers than smaller ones. Alternately, it could become increasingly difficult to hide evidence of smuggling when the total amount of smuggling is large.

The importer chooses a smuggling rate γ_1^* to maximize equation (1) with respect to γ_1 :

$$\gamma_1^* = \frac{\tau M}{2v_1}. \quad (2)$$

The government can increase enforcement on a smuggling method by raising the variable costs of that method. Say that the government implements an antismuggling program (like PSI) that targets just smuggling method 1, raising its variable cost parameter v_1 . If the importer is constrained to use only method 1, an increase in v_1 must lead an optimizing importer to choose a lower smuggling rate.

But the importer may not continue using smuggling method 1, since smuggling method 2 is also available. Before the rise in v_1 , method 1 was the preferred, profit-maximizing smuggling method. But after the increase in enforcement on method 1, method 2 may now be more profitable. If so, the importer should switch smuggling methods, choosing the optimal smuggling rate for method

$$2, \gamma_2^* = \frac{\tau M}{2v_2}.$$

Once the importer has switched methods, the new smuggling rate under the method 2, γ_2^* , could be higher or lower than (or, of course, identical to) the original smuggling rate γ_1^* . The smuggling rate falls with the switch ($\gamma_2^* < \gamma_1^*$) if method 2 has a higher variable cost ($v_2 > v_1$), while the smuggling rate rises with the switch ($\gamma_2^* > \gamma_1^*$) if method

2 has a lower variable cost ($v_2 < v_1$). For the smuggling rate to have risen with the switch to method 2, it must be that method 2 has a fixed cost sufficiently higher than method 1's, to explain why method 2 was not selected in the first place.

The simple model presented here assumes away elements that are easy to consider. The theory appendix presents a fuller model of smuggling displacement and is available from the author on request.⁸ The basic conclusion—that the smuggling rate can either rise or fall in response to targeted enforcement—holds when assuming a more general functional form for the convex variable cost, and when allowing the domestic market price and each firm's total import volume to be endogenously determined. The fuller model also demonstrates that importers could endogenously choose to use just one of the two smuggling methods at a time. This possibility emerges naturally when variable costs are convex in the total amount of smuggling across methods (i.e., in $\gamma_1 + \gamma_2$), and the fixed costs of the method initially not chosen (method 2 in this case) are high enough. Costs that rise in total smuggling $\gamma_1 + \gamma_2$ make sense if there is a certain amount of smuggling (irrespective of method) above which enforcers may be highly likely to notice and investigate a dishonest firm. Authorities can determine certain things like the firm's approximate size and scale fairly well (from say, income tax and employment records), and if a firm appears to be importing too little (or paying too few taxes) for its size, then it can become a prime target for investigation by the authorities.

Of course, an importer may not always find it profitable to switch to an alternative smuggling method. What determines whether an importer will choose to switch smuggling methods in response to increased enforcement? The expressions for the net benefit from smuggling (equation [1]) and for the optimal smuggling rate (equation [2]) can be used to write the net benefit from optimally using smuggling method i as

$$B_i^* \equiv \frac{\tau^2 M^2}{4v_i} - F_i. \quad (3)$$

It will be optimal for the importer to switch to method 2 if

$$B_2^* > B_1^* \quad \text{and,} \\ \frac{\tau^2 M^2}{4v_2} - F_2 > \frac{\tau^2 M^2}{4v_1} - F_1.$$

In the case where method 2's variable costs are lower but its fixed costs are higher than method 1's ($v_2 < v_1$ and $F_2 > F_1$), the inequality becomes

⁸ The theory appendix may also be downloaded from the author's web site. <http://www.umich.edu/~deanyang/papers/papers.html>.

$$\tau M > 2 \sqrt{\frac{v_1 v_2}{v_1 - v_2}} (F_2 - F_1).$$

This inequality provides a very simple and intuitive condition for displacement to method 2 to be profitable for an importer: total tariffs on one's imports (τM) must exceed a certain threshold (determined by the fixed and variable costs of using the two methods).

The implication of this inequality for the empirical analysis to follow is straightforward. Let there be an increase in enforcement against a specific smuggling method, and let d_h be displacement of imports of a certain product h to an alternative method in response to an increase in enforcement. Displacement to an alternative method should rise in the tariff rate τ and in the volume of imports M :

$$\frac{\partial d_h}{\partial \tau_h} > 0, \quad \text{and} \quad \frac{\partial d_h}{\partial M_h} > 0.$$

In addition, the fact that displacement occurs as long as $\tau_h M_h$ exceeds a certain threshold means that the impact of increases in the tariff rate on displacement will matter less when import volume is already high, and vice versa. In other words, the cross-partial derivative should be negative:

$$\frac{\partial^2 d_h}{\partial \tau_h \partial M_h} < 0.$$

These predictions as to the determinants of the amount of displacement will be tested in the empirical analysis to follow.

III. Smuggling Displacement in the Philippines

I focus on a 28-month period in the Philippine PSI program during which preshipment inspections were only required for imports from a subset of origin countries. Over the course of 1990, the government made changes to the PSI program that made it harder to avoid PSI using a previously exploited exemption. I ask whether shipments from countries requiring PSI subsequently shifted to other methods of avoiding import duties. To account for potential changes over time in the attractiveness of different duty-avoidance methods, it is helpful that a comparison group exists for which PSI was not required at all during the period of analysis.

During the study period, between November 1989 and February 1992, PSI was only required for imports from nine countries (Brunei, Hong Kong, Japan, Indonesia, Malaysia, Singapore, South Korea, Taiwan, and Thailand). I use imports from countries not subject to PSI—all other countries—as the comparison group during this period to identify the impact of the rule changes on PSI-country imports. From now on, I will refer to the nine countries whose imports were included in the program as the treatment countries, and all other countries as the control countries. I

take November 1989 as the beginning of the study period because six of the treatment countries were newly added to the PSI program in the previous month.⁹ The end of the study period is February 1992 because the PSI program was extended to cover all countries in the following month (no control group exists after that date).

In general, it can be reasonable for a government to exempt some types of taxable transactions from monitoring, if the expected gain from monitoring the transactions is small relative to monitoring costs. At the beginning of the Philippine PSI program, a shipment from a PSI-covered country was exempt from preshipment inspection if its declared f.o.b.¹⁰ value was less than \$5,000. However, an obvious drawback of exempting certain transactions from monitoring is that exemptions may be exploited by tax evaders. In practice, smugglers did seek to take advantage of the \$5,000 threshold to avoid PSI, by simply declaring shipment values below that threshold. Anecdotal evidence suggests that the main approach was to split shipments into batches that each could reasonably be declared as valued below \$5,000. In addition, single shipments that were somewhat above the threshold in actual value were simply underinvoiced to fall below the threshold.

On two dates in 1990, the government took steps to remove this exemption. On May 2, 1990, the government lowered the minimum value threshold to \$2,500. Six months later, on November 1, 1990, the government further lowered the threshold to \$500.¹¹ In terms of the theoretical model, these threshold reductions increased the variable cost of using one particular duty-avoidance method: exploiting the minimum value threshold exemption. Packaging and freight costs become much more onerous when shipments are split into smaller batches. The strategy of simply underinvoicing a single shipment to fall below the threshold also became more difficult.¹²

At the outset, it is important to address a potential alternative interpretation of the displacement patterns: perhaps importers are not seeking to avoid import duties, but only seeking to avoid the transaction cost of the preshipment inspection. (The inspection fee is paid by the Philip-

⁹ The countries added to the program in October 1989 were Brunei, Indonesia, Malaysia, Singapore, South Korea, and Thailand. The only change in country coverage during the study period was the inclusion of the Portuguese enclave of Macau in the PSI program on May 2, 1990. For this reason, imports from Macau will be excluded from the analysis. This exclusion is of very minor importance: recorded imports from Macau are negligible, at just \$5.3 million over the entire period (0.02% of total imports).

¹⁰ The f.o.b., or free-on-board, value of a shipment is its value excluding the costs of freight and insurance.

¹¹ There is no reason to believe that firms could have anticipated these changes in the minimum value threshold, as they were enacted without warning and were not preceded by public deliberation of any sort. Announcements were made on certain days that henceforward, preshipment inspections were now required for all shipments above the new (lower) value thresholds.

¹² Grossly undervalued shipments also would have been much more likely to catch the attention of *domestic* customs officers, even if they escaped the PSI requirement.

pine government, so the transaction cost arises from a potential delay in the departure of the shipment.) The empirical results in section III D below provide evidence for the duty-avoidance motivation: displacement across product groups is positively correlated with the tariff rate, which should not be the case if mere inspection-avoidance was the motivation behind the displacement.

A. *Identifying Shipment Types Amenable to Smuggling*

The empirical analysis uses data on individual shipments and their characteristics, obtained from the National Statistics Office of the Philippines. The data set contains information on each shipment that entered the country via formal customs procedures. Prior to the present study, these data had only been used to calculate aggregate Philippine import statistics.

After the reduction of the minimum value threshold to \$500, what alternative methods of duty avoidance were available to importers from PSI countries? Two other methods exist that importers from PSI countries could have used to avoid the preshipment inspection, and thus continue avoiding import duties. The methods are the following:

1. *Valuing shipments below the new minimum value threshold, \$500.*
2. *Importing shipments via an export processing zone.* Export processing zones are Philippine-government-created geographic areas into which licensed manufacturing enterprises can import raw materials and intermediate inputs without payment of duties. To encourage investment in government-sponsored export processing zones, imports required by enterprises in the zones were also exempted from the preshipment inspection requirement. Such zones could have been used as a conduit for smuggling: zone imports could simply be diverted into the domestic market.¹³

The empirical analysis will gauge the extent to which shipments from PSI countries shift toward these alternative methods in response to the reduction in the minimum value threshold. (Of course, there are other ways to avoid import duties that I cannot observe, so that I am likely to be understating total actual displacement.) Note that some of the activities to which importers switch after the increase in enforcement may include technically legal methods of avoiding import duties. For example, an export manufacturer originally located outside an export processing zone might have been smuggling via the minimum value threshold exemption, to reduce its import duty payments on imported raw materials. The threshold reduction might have encouraged the firm to bear the fixed costs of relocating to

the export processing zone; it would then have been legally exempt from import duties on its imported raw materials. This would be a case of displacement from illegal smuggling (via the minimum value threshold exemption) to legal tax avoidance.

In sum, therefore, the empirical analysis will track changes in the frequency of the following shipment types from both PSI and non-PSI countries:

1. Shipments valued between \$5,000 and \$500
2. Shipments valued under \$500
3. Shipments destined for export processing zones

The declared f.o.b. value of each shipment is reported (in nominal U.S. dollars), and this information is used to determine whether a shipment falls into one of the first two listed categories. The data set also indicates whether a shipment is destined for an export processing zone.¹⁴

It is important to note that the smuggling method targeted for increased enforcement, and the export processing zone method, qualitatively meet the conditions in the model under which displacement could be large. The increase in enforcement targeted the minimum value threshold loophole, a smuggling method likely to be characterized by low (but not necessarily zero) fixed costs: such costs would consist of convincing overseas suppliers to split shipments into smaller batches, or of finding an overseas supplier willing to do so. However, the method entailed nontrivial variable costs. Per-unit packaging and documentation costs are high when shipments must be split into small batches. Alert customs officers may also be more likely to notice when large numbers of identical small shipments are brought in by the same importer.

By contrast, shipping to export processing zones is likely to have been characterized by high fixed but low variable costs, as it is a privilege granted only to government-authorized firms. So importers seeking to smuggle via export processing zones may have had to establish and maintain presences in the zones, or find firms already in the zones willing to import on their behalf. Either option is likely to have entailed significant fixed costs. However, having established an avenue for shipping into export processing zones, importers to the zones should have faced considerably lower variable costs. Shipments to export processing zones are duty-free, so that customs inspections should have been perfunctory at best.

¹⁴ The analysis will track displacement from the first shipment type to the other two on the list, and so it is important to avoid double-counting of shipments. As it turns out, though, exceedingly few shipments to export processing zones also fall into one of the low-value categories (0.02% of imports by value). I therefore simply allocate such overlapping shipments to the relevant low-value type (either “between \$5,000 and \$500” or “under \$500”). The results are not sensitive to allocating these shipments to the export processing zone category instead.

¹³ Anecdotes related to the author by local informants suggest that diversion of export processing zone imports into the domestic market did occur.

B. Summary Statistics and Figures

The essence of the empirical results emerges in simple summary statistics and graphs for imports from treatment and control countries. Figure 1 displays the fraction of total imports entering the Philippines in shipments with declared values equal to or above \$2,500 but below \$5,000. The solid line is the fraction for treatment countries, while the dotted line is for control countries. The most striking aspect of this graph is the decline in the fraction of total imports in this value range for treatment countries after May 1990, just as the minimum value threshold for PSI was lowered from \$5,000 to \$2,500. By contrast, the fraction of total imports from control countries declared to be in this value range displays no similar change during these months. The explanation for these differential patterns is quite certain: prior to May 1990, some fraction of imports from PSI countries were being intentionally declared as valued in this range to avoid the PSI requirement. When the minimum value threshold was lowered to \$2,500, this practice ceased.

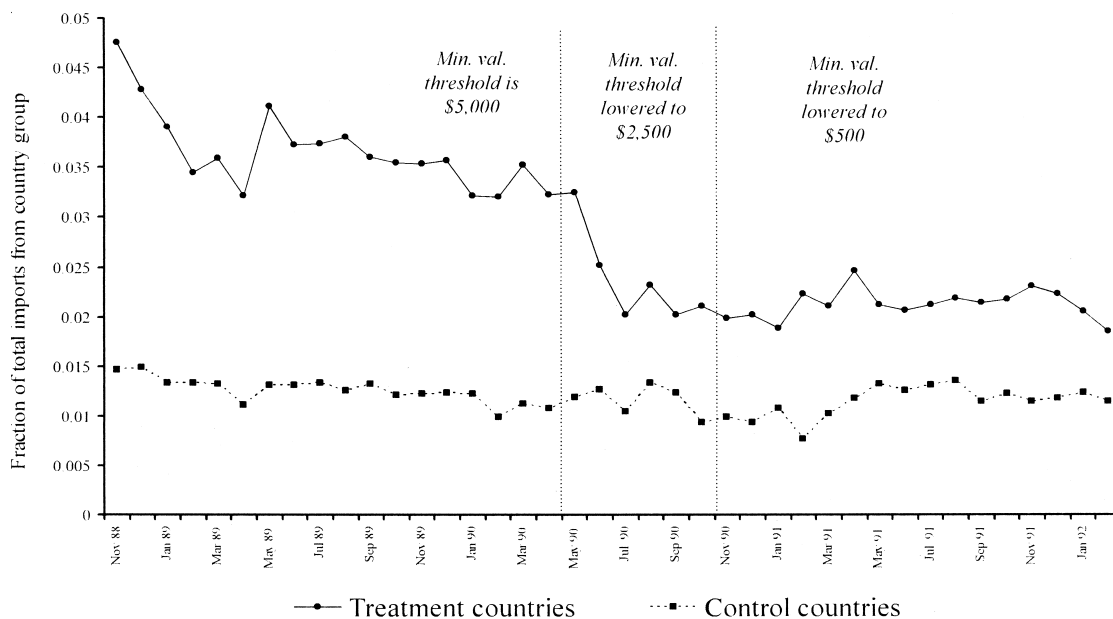
Figure 2 displays the fraction of total imports entering in shipments with declared values equal to or above \$500 but below \$2,500, for treatment countries compared with control countries. The differential changes suggest that importers of goods from treatment countries modified their PSI-avoidance strategies: the fraction of imports from treatment countries entering in this value range increases sharply when the minimum value threshold for PSI is lowered to \$2,500 in May 1990, and declines just as sharply when the threshold is lowered further to \$500 in November 1990. These changes on the part of imports from treatment countries are not mirrored by changes in control countries.

The empirical analysis that follows focuses on changes before and after the May to November 1990 transitional period, so it makes sense to simply focus on shipments valued between \$500 and \$5,000. Table 1 presents summary import statistics by shipment type and country group, for the “before” and “after” periods used in the empirical analysis to follow. Shipments valued between \$5,000 and \$500 accounted for 5.1% of treatment country imports and 1.9% of control country imports during the before period. In the after period, by which time the minimum value threshold had been lowered to \$500, shipments in this value range accounted for just 3.7% of treatment country imports, while the percentage in this value range for control countries stayed essentially constant; treatment country imports of this type therefore declined differentially by 1.4 percentage points.

Once the minimum value threshold for PSI is lowered to \$500 in November 1990, it is sensible to check for a corresponding differential increase in the fraction of total imports from treatment countries entering under that threshold. Figure 2 also displays the fraction of total imports entering in shipments with declared values below \$500 for both groups of countries. While the fraction of total imports under \$500 from treatment countries seems to rise somewhat after November 1990, this change is not obviously differential with respect to imports from control countries. Table 1 also indicates that the fraction of shipments entering in this category was very small both before and after the reform, and so not likely to be an important area of displacement.

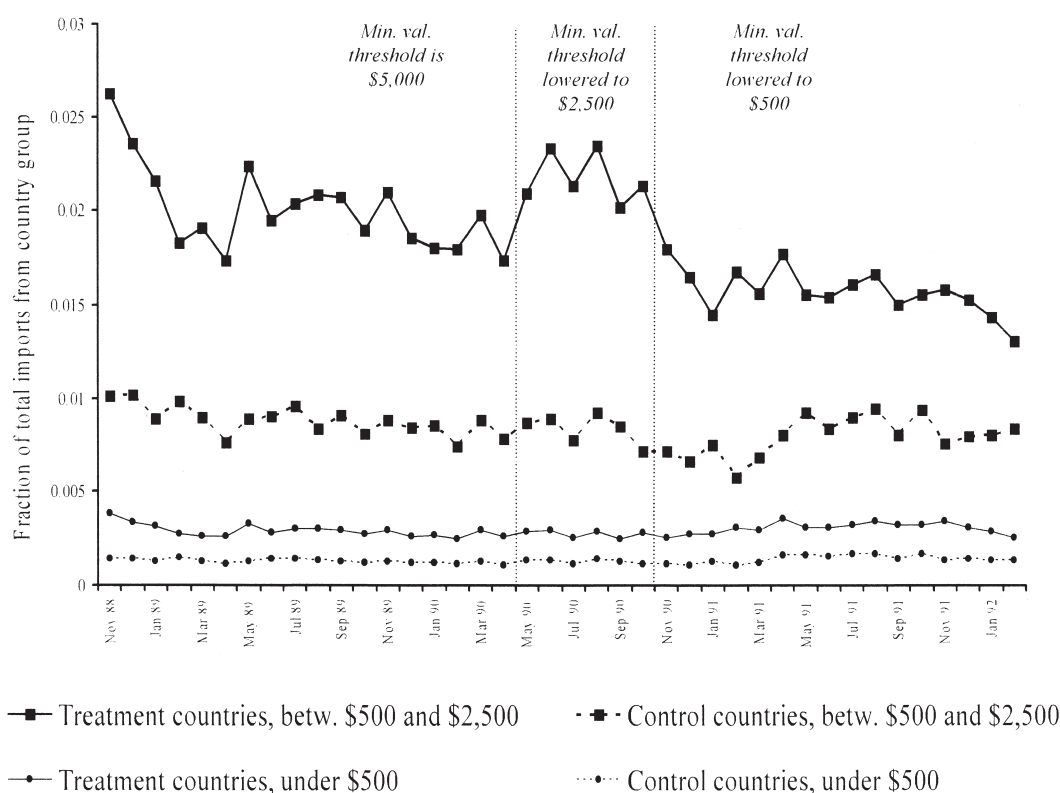
Figure 3 displays the fraction of total imports from the two country groups that are destined for export processing zones. A differential increase in export processing zone

FIGURE 1.—FRACTION OF TOTAL IMPORTS ENTERING IN SHIPMENTS VALUED BETWEEN \$2,500 AND \$5,000 (NOVEMBER 1988–FEBRUARY 1992)



Notes: Chart plots fraction of total imports by value entering in shipments valued between \$2,500 and \$5,000 in the given month, from treatment (PSI) countries and from control (non-PSI) countries. Treatment countries during the period depicted are Hong Kong, Japan, Taiwan, Brunei, Indonesia, Malaysia, Singapore, South Korea, and Thailand. All other countries are control countries. Shipments in overlapping shipment types (e.g., shipment is both “under \$500” and “destined for export processing zone”) are allocated to the low-value types (either “between \$5,000 and \$500” or “under \$500”). Data source: shipment database of the National Statistics Office of the Philippines.

FIGURE 2.—FRACTION OF TOTAL IMPORTS ENTERING IN SHIPMENTS VALUED BETWEEN \$500 AND \$2,500, AND BELOW \$500 (NOVEMBER 1988—FEBRUARY 1992)



Notes: Chart plots fraction of total imports entering in shipments valued (i) between \$500 and \$2,500, and (ii) below \$500, by country group. For all other notes, see figure 1.

shipments from treatment countries is apparent, suggesting that importers from these countries may have been encouraged to take advantage of the PSI exemption for export processing zone shipments as the minimum value

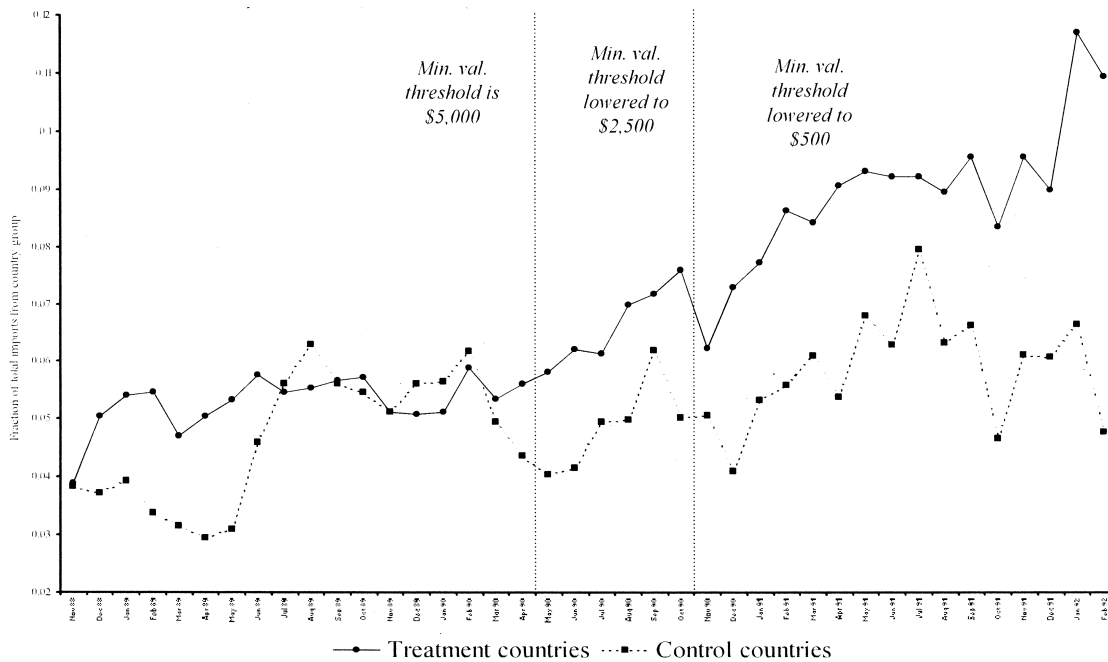
threshold was lowered. Table 1 indicates that shipments to export processing zones accounted for 4.9% of treatment country imports and 5.2% of control country imports during the before period. In the after period, ship-

TABLE 1.—PHILIPPINE IMPORTS BY SHIPMENT TYPE AND COUNTRY GROUP
Nov. 1989—Feb. 1992

	Before Period (Nov. 1989 to Apr. 1990)	After Period (Nov. 1990 to Feb. 1992)	Change (After minus before)
A. Treatment Group Imports			
Total value of shipments (US\$ millions)	2,310	7,390	5,080
Ln (Total value of shipments)	21.56	22.72	1.162
Percentage between \$5,000 and \$500	5.07%	3.67%	-1.40%
Percentage under \$500	0.25%	0.30%	0.05%
Percentage destined for export processing zone	4.89%	9.09%	4.20%
B. Control Group Imports			
Total value of shipments (US\$ millions)	3,080	8,790	5,710
Ln (Total value of shipments)	21.85	22.90	1.050
Percentage between \$5,000 and \$500	1.89%	1.92%	0.02%
Percentage under \$500	0.11%	0.14%	0.03%
Percentage destined for export processing zone	5.24%	5.73%	0.49%
C. Difference-in-Difference (Treatment Group Change Minus Control Group Change)			
Total value of shipments (US\$ millions)			-630
Ln (Total value of shipments)			0.112
Percentage between \$5,000 and \$500			-1.42%
Percentage under \$500			0.02%
Percentage destined for export processing zone			3.71%

Notes: Treatment group countries during the period of analysis are Hong Kong, Japan, Taiwan, Brunei, Indonesia, Malaysia, Singapore, South Korea, and Thailand. All other countries are control countries. Shipments in overlapping shipment types (e.g., shipment is both "under \$500" and "destined for export processing zone") are allocated to the low-value types (either "between \$5,000 and \$500" or "under \$500"). Data source: shipment database of the National Statistics Office of the Philippines.

FIGURE 3.—FRACTION OF TOTAL IMPORTS DESTINED FOR EXPORT PROCESSING ZONES (NOVEMBER 1988–FEBRUARY 1992)



Notes: Chart plots fraction of total imports destined for export processing zones in the given month, by country group. Data are smoothed to reduce noise (each data point is a three-month centered moving average). For all other notes, see figure 1.

ments of this type accounted for 9.1% of treatment country imports; by contrast, the percentage in this value range for control countries had risen only slightly, to 5.7%. The differential increase for treatment countries was therefore 3.7 percentage points.

Table 1 also indicates that total import volumes were roughly similar for both treatment and control groups in the before and after periods. In the before period, the total value of imports from treatment and control countries was roughly similar: \$2.3 billion for treatment countries, and \$3.1 billion for control countries, and both grew by between \$5 billion and \$6 billion through the (longer) after period.

C. Empirical Estimates

I estimate the following linear probability model for each of three shipment types separately, as well as a category for “any of the three shipment types” that allow avoidance of preshipment inspection.¹⁵

¹⁵ It may seem natural to model the choice among shipment types in the context of an empirical choice model such as multinomial logit. But in this context, there is no gain to multinomial logit estimation over a linear probability model, because the linear probability model and multinomial logit provide identical predicted probabilities when estimating a saturated model (where right-side variables are mutually exclusive dummy variables). Independent variables for difference-in-difference estimation in fact provide a saturated model: right-side regressors provide the predicted probabilities in mutually exclusive categories (PSI shipments in the before period, non-PSI shipments in the before period, PSI shipments in the after period, and non-PSI shipments in the after period). There is also no gain to estimating binomial logit or probit models for the shipment types separately, because these also generate exactly identical predicted probabilities as the linear probability model in the saturated case.

Consider the probability that imports from country g and product group h enter the country as shipment type j during period p , denoted P_{ghp}^j . I will consider two time periods: the before period (November 1989–April 1990), during which the minimum value threshold for PSI inspection was \$5,000, and the after period (December 1990–February 1992), when the minimum value threshold was \$500.¹⁶

The simplest difference-in-difference estimate of the impact of the treatment (the reduction of the minimum value threshold) on the probability that a shipment enters as shipment type j , P_{ghp}^j , is estimated using the following regression equation:

$$P_{ghp}^j = \beta_0^j + \beta_1^j(TREATMENT_{gh} \times AFTER_p) + \beta_2^j TREATMENT_{gh} + \beta_3^j AFTER_p + \epsilon_{ghp}^j \quad (4)$$

Time-invariant country group effects are accounted for: $TREATMENT_{gh}$ is a country group dummy, taking a value of 1 if a shipment originates in a PSI country, and 0 otherwise. The change between the before and after periods common to shipments from all countries is accounted for via the inclusion of $AFTER_p$, the indicator for the after period.

The differential change since the before period in the probability of shipments of type j for PSI countries is

¹⁶ Changes in PSI rules apply for shipments whose letters of credit are opened after the rule change, and the arrival date in the country could be some weeks later. Therefore, shipments arriving during the month when the threshold was first lowered to \$500 may not yet have been subject to the new PSI rules. I therefore exclude November 1990 from the after period.

captured in the interaction term between the treatment indicator ($TREATMENT_{gh}$) and the indicator for the after period. ε_{ghp}^j is a mean-zero error term.

The coefficient of interest will be β_1^j , the differential change for shipments from treatment countries in the likelihood of observing shipment type j , in response to a change in the enforcement environment (the reduction of the minimum value threshold) that makes it more difficult to smuggle by valuing a shipment between \$500 and \$5,000.

For each potential method of duty avoidance, I estimate weighted least squares regressions as in equation (4), where the dependent variable is the fraction of the total value of imports entering as the shipment type in question. The unit of observation is imports in a country/product-group cell in a certain month; product groups are the 21 Harmonized System (version 1988) sections. Each observation is weighted by mean monthly imports (by value) in the before period (Nov. 1989 to Apr. 1990) for the country/product-group cell, so that coefficients can be interpreted as reflecting the probability that a particular *dollar* of imports falls into a certain category.¹⁷ It is possible that error terms in equation (4) may be serially correlated among observations from the same country, so I present standard errors clustered by country.

Interpreting a coefficient β_1^j as the causal effect of the minimum value threshold changes requires an identification assumption: if the changes in the minimum value threshold had not occurred, the changes in the frequencies of the shipment types would have been identical for shipments from treatment and control countries. While this parallel-trend assumption cannot be tested directly, it is possible to test for changes in the frequency of the different shipment types *before* the reform actually occurred. I find no evidence of differential changes in the frequency of the various shipment types for imports from treatment countries in the eighteen months prior to April 1990.¹⁸

Because the reduction in the minimum value threshold to \$500 makes it more difficult to evade duties on shipments valued above that threshold, we should expect that when the shipment type in question is “shipments valued between \$5,000 and \$500,” $\beta_1^j < 0$ (that shipment type should become differentially less common). If displacement occurs to alternative duty-avoidance methods associated with the other shipment types, we should expect that $\beta_1^j > 0$ for the other shipment types (those shipment types should become differentially more common).

Table 2, panel A presents the regression results from estimation of equation (4); each column contains coeffi-

icients and standard errors for a specific shipment type j . The second row of the table displays coefficients on the treatment group indicator (β_2^j), and the third row the coefficient on the after indicator (β_3^j). The coefficients of interest are in the first row, the coefficients on the interaction between the treatment dummy and the after indicator (β_1^j).

In the first regression, the negative coefficients on (Treatment country)×(After) indicates that between the before period and the after period it became differentially less likely that a dollar of imports from a treatment country entered in a shipment valued between \$5,000 and \$500. This change is highly statistically significantly different from 0, providing strong evidence that the additional inspection requirement for low-value shipments discouraged importers from using duty-avoidance methods involving valuation in this value range. A dollar of imports from PSI countries became 1.7 percentage points differentially less likely to be in a shipment valued between \$5,000 and \$500 between the before and after periods.

The positive coefficients on (Treatment country)×(After) in the following two regressions suggest that importers from PSI countries switched to alternative methods of duty avoidance in response to the minimum value threshold reductions. In the regression where the fraction of imports destined for export processing zones is the dependent variable, the coefficient is statistically significantly different from 0. A dollar of imports from a treatment country became 2.7 percentage points differentially more likely to be in a shipment destined for an export processing zone between the before and after periods.

The coefficient on the (Treatment country)×(After) variable in the last column of the table (representing the change in the net use of all three potential methods of duty avoidance) is not statistically significant, although it is positive in sign. I simply conclude that I cannot reject the null hypothesis that the combined use of all three methods of avoiding import duties was unchanged in response to the minimum value threshold reduction.

The results of panel A, table 2 are for the simplest possible difference-in-difference estimate of the impact of the minimum value threshold reductions. A potential worry might be that simply capturing time-invariant heterogeneity across treatment and control imports with the treatment country indicator is too crude; for example, one could imagine that changes in the fractions of imports in the different shipment categories might simply reflect a change in the composition of imports (at the country or product level) within the treatment and control groups over time.

Such concerns motivate the following regression equation:

$$P_{ghp}^j = \beta_0^j + \beta_1^j(TREATMENT_{gh} \times AFTER_p) + \gamma_{gh} + \theta_p + \varepsilon_{ghp}^j, \quad (5)$$

¹⁷ The results to come are not sensitive to alternative weighting schemes, such as weighting by mean imports in the after period or in the interim (May 1990 to Nov. 1990) period. This is not surprising, as the minimum value threshold reductions do not have any large or statistically significant effects on import volumes at the country/product-group level (results available from the author on request).

¹⁸ For space considerations, these results are not included in the published paper but are available from the author on request.

TABLE 2.—DISPLACEMENT OF TREATMENT-COUNTRY IMPORTS TO ALTERNATIVE DUTY-AVOIDANCE METHODS (WEIGHTED LEAST SQUARES ESTIMATES)
BEFORE PERIOD: NOV. 1989–APR. 1990. AFTER PERIOD: DEC. 1990–FEB. 1992.

<i>Dependent variable: Fraction of imports . . .</i>				
A. Basic Difference-in-Difference Estimate	. . . between \$5,000 and \$500 (a)	. . . under \$500 (b)	. . . destined for export processing zone (c)	. . . in any of the previous three categories (a)+(b)+(c)
(Treatment country) × (After)	−0.017 (0.006)***	0.0002 (0.002)	0.027 (0.010)**	0.01 (0.013)
“Treatment country” indicator	0.03 (0.012)**	0.0011 (0.001)	−0.002 (0.013)	0.029 (0.018)
“After” indicator	0.003 (0.002)	0.0023 (0.002)	0.002 (0.008)	0.007 (0.008)
Constant	0.026 (0.004)***	0.0021 (0.0003)***	0.05 (0.012)***	0.078 (0.014)***
R-squared	0.02	0	0.01	0.02
Number of observations	11,303	11,303	11,303	11,303

<i>Dependent variable: Fraction of imports . . .</i>				
B. Detailed Country/Product-Group and Month Fixed Effects	. . . between \$5,000 and \$500 (a)	. . . under \$500 (b)	. . . destined for export processing zone (c)	. . . in any of the previous three categories (a)+(b)+(c)
(Treatment country) × (After)	−0.016 (0.006)***	0.0004 (0.003)	0.027 (0.010)***	0.012 (0.012)
Country/product-group fixed effects	Y	Y	Y	Y
Month fixed effects	Y	Y	Y	Y
R-squared	0.38	0.16	0.65	0.58
Number of observations	11,303	11,303	11,303	11,303

*significant at 10%; **significant at 5%; ***significant at 1%

Notes: Each column of the table presents coefficients (standard errors in parentheses) in a separate weighted least squares regression. Standard errors are clustered by country. Unit of observation is imports in a country/product-group cell in a given month. Data are monthly from Nov. 1989 to Feb. 1992 (excluding May–Nov. 1990 transition period). Dependent variables are fraction of a month's imports that fall into given category (e.g., fraction of imports destined for export processing zone). Independent variables in panel B are fixed effects for each country/product-group combination and fixed effects for each time period (individual months). “After” indicates observation occurs in Dec. 1990 or after. Each observation is weighted by mean monthly imports (by value) in before period (Nov. 1989 to Apr. 1990) for the country/product-group. Product group is Harmonized System section.

During before period (Nov. 1989–Apr. 1990), minimum value threshold for PSI inspection was \$5,000. During after period (Dec. 1990–Feb. 1992), minimum value threshold for PSI inspection was \$500. Each category of shipments indicated is a potential method of avoiding import duties. Reduction in PSI minimum value threshold makes it more difficult to smuggle from treatment countries via shipments valued between \$5,000 and \$500. Avoiding import duties via valuation under \$500 and via shipping to export processing zones is possible in both before and after periods. Treatment group (those whose shipments required PSI) is shipments from Hong Kong, Taiwan, Japan, South Korea, Brunei, Indonesia, Malaysia, Singapore, and Thailand. Sample excludes shipments from Macau.

where γ_{gh} denotes fixed effects for the country/product-group cell (of which there are 740), and θ_p denotes fixed effects for the month (of which there are 21).

Panel B of table 2 presents coefficient estimates on the (Treatment country)×(After) variable, corresponding to those in panel A. The coefficients are essentially the same as those in panel A, and attain similar levels of statistical significance.

D. Displacement, Tariffs, and Import Volumes

The above results describe average displacement across all products. The model of smuggling displacement makes predictions as to the relationship between the amount of displacement, on the one hand, and a product's tariff rate and import volume on the other. This subsection thus examines how the magnitude of displacement to alternative methods differs according to these characteristics. In addition, testing whether displacement responds to the tariff rate can help confirm that the shifts are being motivated by avoidance of import duties (and not merely by avoidance of the preshipment inspection itself).

When the government makes it more difficult to exploit the minimum value threshold, importers can either cease smuggling or switch to an alternative method. As discussed in section II above, we should expect more displacement for products with higher tariffs (τ) and higher import volumes,

and that the impact of tariffs (import volume) on displacement should be lower when import volume (tariffs) is (are) already high: the cross-partial derivative should be negative.

An extension of equation (5) that can test these hypotheses is

$$\begin{aligned}
 P_{ghp}^j = & \alpha_0^j + \alpha_1^j(TREATMENT_{gh} \times AFTER_p) \\
 & + \alpha_2^j(\tau_h \times TREATMENT_{gh} \times AFTER_p) \\
 & + \alpha_3^j(\ln M_h \times TREATMENT_{gh} \times AFTER_p) \quad (6) \\
 & + \alpha_4^j(\tau_h \times \ln M_h \times TREATMENT_{gh} \times AFTER_p) \\
 & + \alpha_5^j(\tau_h \times AFTER_p) + \alpha_6^j(\ln M_h \times AFTER_p) \\
 & + \alpha_7^j(\tau_h \times \ln M_h \times AFTER_p) \\
 & + \gamma_{gh} + \theta_p + \varepsilon_{ghp}^j.
 \end{aligned}$$

τ_h is a tariff rate for product group h , and $\ln M_h$ is the log of import volume for that product group. The coefficients of interest are those on the interaction terms between τ_h , $\ln M_h$, and $\tau_h \times \ln M_h$, on the one hand, and $TREATMENT_{gh} \times AFTER_p$ on the other: α_2^j , α_3^j , and α_4^j . Interactions between τ_h , $\ln M_h$, $\tau_h \times \ln M_h$, and $AFTER_p$ are also included, to account for changes over time in the frequency of various

TABLE 3.—HETEROGENEITY IN IMPACT OF INCREASED ENFORCEMENT ON TREATMENT-COUNTRY IMPORTS (WEIGHTED LEAST SQUARES ESTIMATES)
BEFORE PERIOD: NOV. 1989–APR. 1990. AFTER PERIOD: DEC. 1990–FEB. 1992.

	Dependent variable: Fraction of imports . . .			
	. . . between \$5,000 and \$500 (a)	. . . under \$500 (b)	. . . destined for export processing zone (c)	. . . in any of the previous three categories (a)+(b)+(c)
Right-side variables:				
(Treatment group)×(After)	0.6648 (0.2442)***	0.2495 (0.2072)	-1.2506 (0.6085)**	-0.3363 (0.5655)
Interactions with (Treatment group)×(After):				
Tariff rate	-0.0250 (0.0090)***	-0.0066 (0.0060)	0.0384 (0.0184)**	0.0068 (0.0179)
Log import volume	-0.0375 (0.0133)***	-0.0135 (0.0111)	0.0717 (0.0338)**	0.0208 (0.0310)
(Tariff rate)×(Log import volume)	0.0014 (0.0005)***	0.0004 (0.0003)	-0.0022 (0.0010)**	-0.0005 (0.0010)
Interactions with “After” indicator:				
Tariff rate	0.0018 (0.0058)	0.0002 (0.0021)	-0.0138 (0.0109)	-0.0118 (0.0127)
Log import volume	0.0008 (0.0090)	0.0000 (0.0032)	-0.0081 (0.0183)	-0.0074 (0.0188)
(Tariff rate)×(Log import volume)	-0.0001 (0.0003)	0.0000 (0.0001)	0.0009 (0.0006)	0.0008 (0.0007)
Country-product group fixed effects	Y	Y	Y	Y
Month fixed effects	Y	Y	Y	Y
Number of observations:	11,303	11,303	11,303	11,303

*significant at 10%; **significant at 5%; ***significant at 1%.

Notes: Each column of the table presents coefficients (standard errors in parentheses) from a separate weighted least squares estimation. Standard errors are clustered by country. Unit of observation is imports in a country/product-group cell in a particular month. Tariff rate variable is simple average of 1989 tariff across all individual items in the Harmonized System (1988 version) section. Import volume variable is log of mean monthly imports in the before period in the Harmonized System section. See table 2 for other notes.

shipment types that may be associated with a product’s tariff rate or import volume.¹⁹

A difficulty with working with tariff data is that importers may be able to misdeclare the product category of a shipment to take advantage of a lower tariff rate. To take an extreme example, imagine that only honest importers ever declare that they are importing high-tariff products, while dishonest importers shift among smuggling methods so that they can always declare that they only import low-tariff products. We might then *observe* more displacement occurring for low-tariff than for high-tariff products, even if the products being displaced were *in reality* high-tariff products.

On the other hand, importers are unlikely to be able to misdeclare the contents of their shipments across very aggregated product categories. They might be able, for example, to misdeclare that a certain shipment of high-quality (and high-tariff) textiles actually contained another type of low-quality, low-tariff cloth, but would have difficulty claiming the shipment contained lower-tariff chemicals or machinery.

For this reason, I work with tariff rates and product groups at a relatively high level of aggregation. The tariff variable τ_h in equation (6) is the simple average 1989 tariff rate across all individual items within the Harmonized System (v. 1988) section, of which there are 21.

While the import volume that is relevant in the theoretical discussion above is at the level of the individual importer,

importer-level data is unfortunately not available. Therefore I simply proxy importer-level trade volumes for a given product with the overall import volume of said product.²⁰ The import volume variable M_h is also at the HS section level, and is the log of mean monthly imports in the before period in the HS 1988 section.²¹

The mean of M_h across HS 1988 product groups is \$43.02 million, ranging from a low of \$0.24 million for “arms and ammunition. . .” (HS 19) to a high of \$243 million for “machinery, mechanical appliances” (HS 16). The mean and standard deviation of $\ln M_h$ are 16.39 and 1.86, respectively. The mean of τ_h across the product groups is 31.28, ranging from a low of 14.75 for “mineral products” (HS 5) to a high of 48.89 for “arms and ammunition” (HS 19).

Coefficients from estimation of equation (6) are presented in table 3. Focus first on the results for export processing zone shipments, in column c. The theoretical predictions are that the coefficients α_2^j and α_3^j should be positive, reflecting the fact that higher tariffs and higher import volumes should make it more attractive to displace shipments to alternative methods of duty avoidance; in addition, the fact that the decision to displace simply requires that potential evaded tariffs be above a certain threshold indicates that the cross-partial derivative of displacement should be negative (α_4^j should be negative). These predictions turn out to be exactly right: the coefficients on $\tau_h \times TREATMENT_{gh} \times AFTER_p$ and

²⁰ The results in this section remain qualitatively the same if the import variable is respecified as import volume at the country-product level.

²¹ Both the tariff rate and the import volume are as measured prior to the after period to avoid confounding the empirical estimates via possible endogeneity of these variables with respect to the treatment of interest.

¹⁹ It is not necessary to include interactions of tariff and volume with $TREATMENT_{gh}$ in the regression, because these would be absorbed by the country/product-group fixed effects, γ_{gh} .

$\ln M_h \times TREATMENT_{gh} \times AFTER_p$ are both positive, and the coefficient on $\tau_h \times \ln M_h \times TREATMENT_{gh} \times AFTER_p$ is negative; all are statistically significantly different from 0 at conventional levels.

It is now of interest to turn to the results for shipments valued between \$5,000 and \$500, in column a. The coefficients on the interaction terms are of *opposite* signs as the respective coefficients for export processing zone shipments, in column c; all are highly statistically significantly different from 0. This pattern is sensible, and supports the notion that displacement is occurring *out of* shipments valued between \$5,000 and \$500, and *into* shipments to export processing zones. These results indicate that, prior to the reduction in the minimum value threshold, the products that were most likely to be valued below \$5,000 to avoid the pre-shipment inspection were those with high tariffs or high import volumes (but that the impact of either of these variables singly was lower, the higher the level of the other variable). Once the minimum value threshold was lowered, importers shifted these same products out of the “valuation between \$5,000 and \$500” method of duty avoidance and into duty-avoidance methods that involved shipping via export processing zones.

The estimates imply that for a product group such as HS 10, “pulp; paper, paperboard, and articles thereof” (whose $\ln M_h$ is 16.74, near the mean across product groups), a tariff rate increase of 10 percentage points from its previous level would have led to a reduction in shipments valued between \$5,000 and \$500 amounting to 1.6 percentage points of total imports, and an increase in displacement to export processing zones amounting to 1.6 percentage points of total imports for that product group.

E. Implications for Philippine Government Revenue

Conservative estimates of tariff revenue gains and losses (net of PSI fees) suggest that the minimum value threshold reductions were a starkly uneconomic proposition, leading to significant losses in net revenue for the Philippine government. Table 4 presents estimates of revenue gains and losses from the threshold reductions in the after period (December 1990 to February 1992); see appendix section 2 for details of the calculations.

The minimum value threshold reductions led to two types of revenue gains. First, because importers were no longer able to avoid the PSI requirement by valuing shipments between \$5,000 and \$500, import duty collections should have increased on shipments that would not have been inspected before. Second, shipments were not subject to PSI (thus saving inspection fees) if they were shifted to valuation under \$500 or to export processing zones. I estimate that total revenue gains from these two sources amounted to roughly \$24.6 million.

These revenue gains were considerably overshadowed by two kinds of costs to the Philippine government. First, the cost of additional inspections of shipments valued between \$500 and \$5,000 would have amounted to \$28.0 million.

TABLE 4.—IMPLICATIONS OF MINIMUM VALUE THRESHOLD REDUCTION FOR PHILIPPINE CUSTOMS REVENUE DURING AFTER PERIOD (DEC. 1990–FEB. 1992)

Revenue gains	
Increase in import duties due to reduction in minimum value threshold smuggling	\$21,912,359
Avoided inspection fees due to:	
Shifts to valuation under \$500	\$1,248,377
Shifts to export processing zones	\$1,445,303
Gross revenue gains	\$24,606,039
Revenue losses	
Additional inspection fees for shipments valued between \$500 and \$5,000	\$28,043,775
Loss of import duties due to:	
Shifts to valuation under \$500	\$49,303
Shifts to export processing zones	\$33,279,394
Gross revenue losses	\$61,372,472
Net revenue gains (losses)	\$(36,766,434)
<i>Addendum: Inputs to calculations</i>	
Total imports from PSI countries in after period	\$6,935,429,990
Weighted average tariff, 1992 (3)	17.8%
Percentage-point increase in true value reported for shipments \$500–\$5,000	90%
Reduction in minimum value threshold smuggling as share of PSI-country imports (5)	–0.016
Increase in valuation under \$500 as share of PSI-country imports (5)	0.0004
Increase in shipments to export processing zones as share of PSI-country imports (5)	0.027
Assumed original value of shipments under \$500	\$500.00
PSI fee as percentage of declared shipment value	0.6%
Minimum charge per inspection	\$225.00
PSI fee as % of declared value of export processing zone shipments (6)	0.77%
Total number of shipments from PSI countries valued between \$500 and \$5,000 (2)	124,639
Fraction of value underreported solely due to avoidance of PSI via origin switching (4)	10.0%

Notes: Figures are in nominal US\$. See the appendix for explanation of details behind calculations, and below for inputs to calculations.

Notes to addendum:

(2) Dec. 1990–Feb. 1992.

(3) Weights are imports by HS section from Dec. 1990 to Feb. 1992. Tariff data is from 1992 UNCTAD Trains data set (1991 data unavailable).

(4) Conservative assumptions.

(5) From relevant row of table 2.

(6) Inferred PSI fees divided by total value of shipments, between Dec. 1990 and Feb. 1992. PSI fees inferred using distribution of shipments by size under this shipment type and PSI fee structure (0.6% of declared value, with \$225 minimum charge per shipment).

Second, losses in import duties due to shifts to the other methods of duty avoidance would have totaled \$33.3 million.

These gross revenue losses balanced against gross revenue gains imply that the minimum value threshold reductions led to a net loss of \$36.8 million for the Philippine government. Given the magnitude of the estimated gross losses relative to the gross gains, the overall conclusion should be robust to relatively large changes in the assumptions used for the calculation.

IV. Conclusion

In a wide variety of contexts, governments seeking to discourage an undesirable activity face the possibility that increased enforcement could simply push the activity to alternative channels. This paper provides evidence that enforcement-induced crime displacement—as predicted by theory—responds to the size of illicit profits threatened by enforcement. In addition, it documents that crime displacement can be very large when the enforcement targets just a subset of law-

breaking methods, so that the amount of crime may be essentially unchanged after the increase in enforcement.

Empirical evidence comes from an increase in enforcement in Philippine customs, in the context of a widespread customs reform known as preshipment inspection (PSI). Identification exploits policies increasing enforcement (by requiring PSI) on only a subset of imports, so that other import categories serve as comparison groups. Increased enforcement on shipments from a subset of countries stimulated displacement to another observed duty-avoidance method, shipping to export processing zones. Displacement was greatest for product groups with higher tariffs and higher import volumes.

Import duty collection is not likely to be the only context in which crime displacement can be substantial in the wake of increased enforcement. Collection of income taxes is the most obviously related area. There are a number of ways to evade taxes—including hiring a crooked accountant, setting up offshore bank accounts, or shifting to economic activities that leave few documentary traces—and many of these methods should involve high fixed costs but low variable costs.

More generally, crimes that are carried out by organized groups may be especially susceptible to displacement to high-fixed-cost methods, because such groups should be less liquidity-constrained. Examples of such crimes may include political corruption, money laundering, illegal gambling operations, or the illegal drug trade.²² Valuable future work could seek evidence—in these and other crimes—of enforcement-induced displacement to high-fixed-cost, low-variable-cost lawbreaking methods.

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²² In the drug trade, for example, more frequent searches of arriving passengers has discouraged smuggling via single air travelers (a low-fixed-cost, high-variable-cost method). An alternative method is shipping drugs within twenty- or ten-foot shipping containers filled with a legal commodity used simply to conceal the illicit cargo (a high-fixed-cost, low-variable-cost method). For a discussion of displacement to alternative drug smuggling methods, see Abt Associates (2001).

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APPENDIX

1. Description of Preshipment Inspection

PSI programs are typically initiated and supervised by a country's finance ministry (or occasionally its central bank), often upon the recommendation of multilateral funding institutions. When governments institute PSI programs, importers are required to have their incoming shipments inspected by a certified firm before they leave the country of origin. Importers inform the PSI firm's local office of the pending shipment, and the PSI firm arranges for its own or affiliated agents in the origin country to inspect the shipment before departure.

Shipments are typically inspected at the premises of the exporting firm or at the port of departure. PSI firms assess the tariff classification, quantity, and total value of individual shipments, and send their assessments to the client government. Many programs require that tamper-resistant seals be placed on shipping containers after inspection. In nearly all PSI programs, the PSI firm does not collect the import duties; rather, actual duty collection remains the responsibility of customs officials in the shipment's destination country. Upon the shipment's arrival in the destination country, the client government can use the PSI firm's assessment to keep importers (and potentially complicit customs officials) from misreporting the contents of shipments when they pass through customs. It follows that PSI does not assist in collecting duties for shipments that enter the destination country outside of formal customs channels (shipments "smuggled outright").

While PSI clearly can be seen as a policy for combating certain types of smuggling and customs corruption, it could also help facilitate the imports of *honest* importers by streamlining customs clearance. A primary tactic used by corrupt customs officials to extract bribes from importers is to delay the clearance of shipments from customs, often on the pretext that there is some discrepancy between the customs declaration and the shipment's actual contents. A preshipment inspection generates independent information on the contents of a shipment that could increase an honest importer's bargaining power vis-à-vis a corrupt customs officer, potentially reducing customs clearance times.²³

Almost all PSI contracts specify that certain product categories and types of shipments are exempt from the inspection requirement. Also, shipments below a minimum value threshold are typically exempted from PSI. Data on the share of imports for which PSI is required is not generally available, but when it has been reported the percentage is usually in the 80%–90% range (see Rege, 2001).

In return for their services, PSI firms typically charge a fee of about 1% of the value of imports inspected, usually with a minimum charge per shipment in the realm of \$250. The client government pays the fee in most PSI programs, but in some countries importers pay the fee. In the Philippine program, the government paid a fee of 0.6% of imports inspected, with a minimum charge of \$225 per shipment.

In 1985, Indonesia became the first country to require preshipment inspection of imports for customs purposes. The Philippine program followed soon afterwards and was active from April 1987 to March 2000. In total, over fifty developing countries have implemented customs PSI programs for some period of time.²⁴ As of mid-2002, such programs remained active in nearly forty of these countries.

²³ Low (1995, pp. 68–73) and Jenkins (1992) provide suggestive evidence along these lines. They cite survey evidence that PSI was accompanied by dramatic reductions in customs clearance times in Indonesia.

²⁴ A small number of countries retain preshipment inspection firms to verify national quality or safety standards, to help enforce foreign exchange restrictions, or for other noncustoms purposes.

2. Calculation of Impact on Philippine Government Revenue

This section outlines the details of the calculation of the change in Philippine import duty revenue generated by the 1990 reduction in the PSI minimum value threshold. Parameter values and results of the calculations are reported in table 4.

Increase in import duties due to the reduction in minimum value threshold smuggling is estimated as

$$\frac{\beta_1^1 M^p \tau}{0.9},$$

where β_1^1 is the coefficient in the regression for valuation between \$5,000 and \$500 in table 2, M^p is total imports from PSI countries during the after period, τ is the weighted average tariff rate, and 0.9 is the assumed fraction of true import values reported prior to the reform for shipments in the \$5,000 to \$500 value range. The weights for calculation of the tariff rate are HS sections during the after period. Tariff data are from 1992 UNCTAD Trains data set (1991 data are unavailable).

Avoided inspection fees due to shifts to valuation under \$500 are estimated as

$$\left(\frac{\beta_1^2 M^p}{\$500} \right) \times \$225,$$

where β_1^2 is the coefficient in the regression for valuation under \$500 in table 2, and \$500 is the assumed original value of each affected shipment before it was shifted to valuation under \$500. (\$500 is a lower bound on the actual original value of shipments shifted to valuation under \$500, so using \$500 as the denominator here will overstate the original number of shipments and the savings due to avoided inspections.) The term in parentheses is the inferred number of shipments that were shifted to valuation under \$500, and \$225 is the avoided inspection fee for each such shipment.

Avoided inspection fees due to shifts to export processing zones are calculated as follows:

$$\beta_1^3 M^p \eta,$$

where β_1^3 is the coefficient in the regression for export processing zones in table 2, and η is the PSI fee as a percentage of the declared value of an export processing zone shipment (0.77%).²⁵

Additional inspection fees for shipments valued between \$500 and \$5,000 are simply

$$N \times \$225,$$

where N is the total number of shipments from PSI countries valued between \$500 and \$5,000 in the after period, and \$225 is the inspection cost per shipment in that value range.

Loss of import duties due to shifts to valuation under \$500 is estimated as

$$\beta_1^2 M^p \tau \times (0.1),$$

where β_1^2 is the coefficient in the regression for valuation under \$500 in table 2, and 0.1 is the rate of underinvoicing (fraction of total shipment value unreported) that importers are assumed to be able to achieve.

Loss of import duties due to shifts to export processing zones is estimated as

$$\beta_1^3 M^p \tau,$$

where β_1^3 is the coefficient in the regression for export processing zones in table 2. (This expression is not multiplied by a rate of underinvoicing because all shipments to export processing zones are exempt from import duties.)

²⁵ η is calculated by inferring total PSI fees payable for all shipments to export processing zones during the after period, taking into account the distribution of shipments by size and the PSI fee structure (0.6% of declared value, with \$225 minimum charge per shipment), and then dividing by the total value of shipments in the same period.