RESEARCH SEMINAR IN INTERNATIONAL ECONOMICS

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Ann Arbor, Michigan 48109-1220

Discussion Paper No. 520

Can Enforcement Backfire? Crime Displacement in the Context of Customs Reform in the Philippines

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September 2004

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Can Enforcement Backfire?
Crime Displacement in the Context of Customs Reform in the Philippines

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Abstract

Increased enforcement can lead crime to be displaced to alternative lawbreaking methods. In theory, crime displacement should respond positively to the size of profits threatened by enforcement. If enforcement displaces crime towards lawbreaking methods with lower variable costs, the overall crime rate need not fall. This paper examines a customs reform in the Philippines that raised enforcement 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 percent 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.

(*JEL* D73, F13, H26, K42, O23)

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1 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 substantial interest in the economics of illegal activity (Ehrlich (1973), Witte (1980), 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 (McCormick and Tollison (1984), Levitt (1997), Corman and Mocan (2000), Bar-Ilan and Sacerdote (2001), Di Tella and Schargrodsky (2004), among others).

There has been a longstanding 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, empirical analyses of enforcement's impact have addressed displacement as a mere sidenote, 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.[2]

Moreover, existing studies typically conclude that displacement is a minor phenomenon, finding either no evidence of displacement or that it is small in magnitude.[3] But in theory, increased enforcement can actually backfire, leading crime rates to be unchanged or even to increase. This perverse outcome can occur when alternative methods have higher fixed costs but lower variable costs than previously-used methods.

This paper is an empirical study of such unintended consequences of 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

[1] See Chaiken, et al (1974), McPheters, et al (1984), Ayres and Levitt (1998), Levitt (1998), Braga, et al (1999), and Di Tella and Schargrodsky (2004), among others. See also Hesseling's (1994) overview.

[2] A related line of research is the literature on marginal deterrence, which considers lawbreakers' choices among *different types* of crimes (Stigler (1970)). Shavell (1992), Wilde (1992), and Mookherjee and Png (1994) examine social welfare-maximizing punishment schedules for a set of differentially-harmful crimes.

[3] 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.

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 percent 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.

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[5] and customs corruption are rife in many countries, 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 non-OECD 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 under-reports 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 fraudulent declaration in return for bribes. Government revenue ultimately suffers. Moreover, a government having difficulty collecting trade taxes may have to resort to more distortionary methods of public finance in the long term.

The Philippine 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 indi-

[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 and Weiner (1990), Hines and Rice (1994) and Clausing (1998), 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 US tax returns.

[7] The source of these figures is World Development Indicators 2002.

vidual 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 more details on the functioning of preshipment inspection programs.)

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 period of interest—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. 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.

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, salaries of customs officials, etc.). A possible remaining worry concerns the endogeneity of treatment: certain countries might have been chosen to be included in the Philippines' PSI program because imports from these countries were *expected* to exhibit the observed changes in the use of different duty-avoidance methods (in other words, the observed changes would have occurred even without the increased enforcement). While this possibility is

difficult to rule out directly, an indirect test does not raise such concerns: there is no evidence of differential trends in the use of the different duty-avoidance methods immediately *prior* to the policy change of interest.[8]

Section 2 outlines a simple model of crime displacement, applied to import duty evasion (smuggling). Section 3 presents empirical evidence on the economics of displacement in the context of the Philippine PSI program. Section 4 concludes. The Appendix provides more detail on the functioning of PSI programs generally, and on the calculation of the revenue loss to the Philippine government due to the reform studied.

2 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.

Departing from standard crime models (such as Becker (1968)), I assume fixed costs of using particular lawbreaking methods. Enforcement can lead to no change (and even an increase) in the crime rate when enforcement targets just one of several methods of lawbreaking (the one lawbreakers currently use), and when the alternative methods have lower variable costs but higher fixed costs than the original method. Higher fixed costs can make lawbreaking less profitable for criminals when they use an alternative method, even if they are committing more crime overall. Prior to the increase in enforcement, lawbreakers may refrain from using the lower-variable-cost methods because they have higher fixed costs (and thus lower profitability). An enforcement effort can then encourage lawbreakers to bear the fixed cost of entry into new, lower-variable-cost lawbreaking methods, so that the amount of illegal activity actually increases.[9]

To keep the discussion concrete, I focus on the example of enforcement against import duty evasion, but it should be clear that the logic can apply to enforcement against other crimes whose methods have similar relative cost structures. Crucially, preshipment inspection targets smuggling methods that are usually not the *only* possible methods of avoiding import duties, and so leaves

[8] Section 3.6 below describes the results of this 'false experiment'.

[9] This finding is reminiscent of the possible perverse impact of managerial incentives in the multi-task principal-agent problem (Holmstrom and Milgrom (1991), Prendergast (2000)).

open the possibility of displacement.

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 smuggling 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 amount smuggled. In addition, legal penalties themselves may be a function of the value of smuggled goods, particularly if offending shipments are confiscated. Bribes paid could also rise in the amount smuggled because facilitating the smuggling of larger shipments is riskier for the bribe-takers.

Assume for simplicity that many identical firms 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 one is the initially-chosen method.[10] 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:

$$B_1 \equiv \tau M \gamma_1 - v_1 \gamma_1^2 - F_1 \tag{1}$$

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 curve labeled B_1 in Figure 1 displays the net benefit for smuggling method 1 as a function of the smuggling rate. The importer chooses a smuggling rate γ_1^*, the maximum point on the net benefit curve, found by maximizing equation (1) with respect to γ_1:

$$\gamma_1^* = \frac{\tau M}{2 v_1}. \tag{2}$$

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

[10] I assume here that the importer only chooses to use one smuggling method, never both simultaneously.

to choose a lower smuggling rate. Graphically in Figure 1, an increase in v_1 shifts the net benefit curve downwards and to the left (from B_1 to B_1').

But the importer will not continue using smuggling method 1. The importer also has access to smuggling method 2, with net benefit function B_2 in Figure 1. Before the rise in v_1, method 1 was the preferred smuggling method, because the peak of curve B_1 was above that of B_2. But the peak of B_1' is lower than the peak of B_2, so the importer switches to smuggling method 2, with optimal smuggling rate γ_2^*. In the case depicted, the smuggling rate rises ($\gamma_2^* > \gamma_1^*$).

Intuitively, for the smuggling rate to rise after the switch, smuggling method 2 must have a lower variable cost parameter than method 1 ($v_2 < v_1$). For the importer to have chosen method 1 over method 2 initially, method 2 must have a higher fixed cost ($F_2 > F_1$), so that smuggling method 1 was initially more profitable overall. Of course, a switch in smuggling methods does not *necessarily* lead to a higher smuggling rate. Smuggling method 2 could have *higher* variable costs, so that the smuggling rate would fall even with a switch of smuggling methods (in this case, the peak of curve B_2 would be to the left of γ_1^* in Figure 1).[11]

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 2 as:

$$B_2^* \equiv \frac{\tau^2 M^2}{4v_2} - F_2 \tag{3}$$

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

$$B_2^* \equiv \frac{\tau^2 M^2}{4v_2} - F_2 > 0,$$

Rearranged, this becomes:

$$\tau M > 2\sqrt{v_2 F_2}.$$

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

[11] The simple model presented here assumes away elements that are easy to consider. A fuller model of smuggling displacement is available from the author on request. 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.

$2\sqrt{v_2 F_2}$ (determined by the enforcement parameter and the fixed cost of using the alternative method).

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:

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

In addition, the fact that displacement occurs as long as τM_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:

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

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

3 Smuggling displacement in the Philippines

This section documents that in response to increased enforcement on a specific smuggling method, Philippine importers shifted dramatically to an alternative method of avoiding import duties: shipping via export processing zones. As predicted by theory, displacement is greater when the size of profits from displacement (proxied by the tariff rate and import volume at the level of the product group) are higher. The amount of displacement was so large that I cannot reject that the overall fraction of imports in shipment categories amenable to import duty avoidance was unchanged after the reform.

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.[12] 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).[13]

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.[14] 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. In terms of the theoretical model, these threshold reductions increased the variable cost of using a particular duty-avoidance method: exploiting the minimum value threshold exemption. Packaging and freight costs become much

[12]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 US$5.3 million over the entire period (0.02% of total imports).

[13]See Appendix Table 1 for a detailed description of changes in country coverage and minimum value thresholds for the Philippine PSI program.

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

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.[15]

The analysis shows that after the minimum value threshold was lowered, shipments from PSI countries shifted dramatically to an alternative method of avoiding import duties. These shifts were differential with respect to changes for shipments from non-PSI countries, helping confirm that the threshold reduction was the causal factor behind the shifts.

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 seek to avoid the transaction cost of the preshipment inspection. (The inspection fee is paid by the Philippine government, so the transactions cost arises from a potential delay in the departure of the shipment.) The empirical results in section 3.4 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.

3.1 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 dataset 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:

1. *Valuing shipments below the new minimum value threshold, \$500.*

2. *Importing shipments via an export processing zone.* Export processing zones are 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

[15] 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.

have been used as a conduit for smuggling: zone imports could simply be diverted into the domestic market.

The empirical analysis will gauge the extent to which shipments from PSI countries shift towards these alternative methods in response to the reduction in the minimum value threshold. (Of course, there are other ways to avoid import duties which 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 US dollars), and this information is used to determine whether a shipment falls into one of the first two listed categories. The dataset also indicates whether a shipment is destined for an export processing zone.[16]

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

[16]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 \$5000 and \$500' or 'under \$500'). The results are not sensitive to allocating these shipments to the export processing zone category instead.

batches, or of finding an overseas supplier willing to do so. However, the method entailed non-trivial 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. Anecdotal evidence suggests that the borders of the zones were poorly policed, so that goods brought into the zones easily found their way into the domestic market.

3.2 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 2 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 3 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 to 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 (the combination of the shipments in Figures 2 and 3). 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 4 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 5 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 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, shipments 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 were roughly similar: $2.3 billion for treatment countries, and $3.1 billion for control countries, and both grow by between $5-6 billion through the (longer) after period. (While treatment imports appear to grow by somewhat more than control imports in proportional terms, the regression estimates in Section 3.5 reveal no statistically significant difference between the overall growth rate of treatment and control imports.)

The summary statistics in Table 1, combined with Figures 2-5, provide the first indication that the minimum value threshold reductions led to substantial displacement to an alternative duty-avoidance method, shipping via export processing zones. The following sections make the same point via regression analysis, and additionally examine heterogeneity in displacement across product groups related to tariff rates and import volumes.

3.3 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.[17]

Consider the probability that imports from country g and product group h enter the country as shipment type j during period p, denoted P^j_{ghp}. 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.[18]

The simplest difference-in-difference estimate of the impact of the treatment (the reduction

[17]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-hand-side variables are mutually-exclusive dummy variables). Independent variables for difference-in-difference estimation in fact provide a saturated model: right-hand-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.

[18]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'.

of the minimum value threshold) on the probability that a shipment enters as shipment type j, P^j_{ghp}, is estimated using the following regression equation:

$$P^j_{ghp} = \beta^j_0 + \beta^j_1 \left(TREATMENT_{gh} * AFTER_p\right) + \beta^j_2 TREATMENT_{gh} + \beta^j_3 AFTER_p + \varepsilon^j_{ghp} \quad (4)$$

Time-invariant country group effects are accounted for: $TREATMENT_{gh}$ is a country group dummy, taking a value of 1 if a shipment is declared as originating in a PSI country, and 0 otherwise. The corresponding fixed effect for shipments originating in non-PSI countries is captured in the constant term, β^j_0. 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 captured in the interaction term between the treatment indicator ($TREATMENT_{gh}$) and the indicator for the after period. ε^j_{ghp} is a mean-zero error term.

The coefficient of interest will be β^j_1, 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. The identification assumption is that without the minimum value threshold reduction, changes in the observed frequency of particular shipment types over time would have been the same for imports from treatment and control countries.

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 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. It is possible that error terms in equation (4) may be serially correlated among observations from the same country, so I calculate standard errors clustered by country.

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 \$5000 and \$500', $\beta^j_1 < 0$ (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 $\beta^j_1 > 0$ for the other shipment

types (those shipment types should become differentially more common). These predictions are borne out in the results.

Table 2, Panel A presents the regression results from estimation of equation (4); each column contains coefficients 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 coefficient on the interaction between the treatment dummy and the after indicator (β_1^j), which represent the differential change between the before period and the after period in the likelihood that a dollar of imports from a treatment country entered via shipment type j. The null hypothesis is that imports from treatment countries do not shift among shipment types in response to the minimum value threshold reduction in a manner different from control-country imports. If this were true, we should find that β_1^j is not statistically significantly different from zero for any of the three shipment types.

In the first regression, the negative coefficient 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 zero, 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 zero. 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:

$$P^j_{ghp} = \beta^j_0 + \beta^j_1 \left(TREATMENT_{gh} * AFTER_p\right) + \gamma_{gh} + \theta_p + \varepsilon^j_{ghp} \tag{5}$$

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. The fact that the results are essentially unchanged after the inclusion of country/product-group fixed effects provides no reason to worry that changes in the composition of imports might be behind these differential shifts across shipment types over time.

An alternative estimate of the treatment effect of the minimum value threshold reduction can be obtained when the unit of analysis is taken to be all imports from a particular country in a particular month (disregarding information on product group). Such estimates are presented in Appendix Table 2 (in a format that parallels that of Table 2). Aside from the change in unit of analysis, the country/product-group fixed effects in Panel B are replaced by simple country fixed effects. The coefficients in Appendix Table 2 on the (Treatment country)*(After) term in columns (a) and (c) are of the same signs and levels of statistical significance as those in Table 2. The main difference is that each coefficient of interest is slightly larger in absolute value.

Country/product-group fixed effects are substantially more conservative than mere country fixed effects. So in all analyses to follow, I return to the specification where the analysis is conducted at the country/product-group level.

3.4 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 2 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 already high: the cross-partial derivative should be negative.

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

$$\begin{aligned} P^j_{ghp} \;=\; & \alpha^j_0 + \alpha^j_1 \left(TREATMENT_{gh} * AFTER_p\right) \\ & + \alpha^j_2 \left(\tau_h * TREATMENT_{gh} * AFTER_p\right) + \alpha^j_3 \left(\ln M_h * TREATMENT_{gh} * AFTER_p\right) \\ & + \alpha^j_4 \left(\tau_h * \ln M_h * TREATMENT_{gh} * AFTER_p\right) \\ & + \alpha^j_5 \left(\tau_h * AFTER_p\right) + \alpha^j_6 \left(\ln M_h * AFTER_p\right) \\ & + \alpha^j_7 \left(\tau_h * \ln M_h * AFTER_p\right) \\ & + \gamma_{gh} + \theta_p + \varepsilon^j_{ghp} \end{aligned} \tag{6}$$

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 $\tau_h * \ln M_h$, on the one hand, and $TREATMENT_{gh} * AFTER_p$ on the other: α^j_2, α^j_3, and α^j_4. Interactions between τ_h, $\ln M_h$, and $\tau_h * \ln M_h$ and $AFTER_p$ are also included, to account for changes over time in the frequency of various 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*

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

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.

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

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. 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.[20]

Table 3 presents characteristics of the HS 1988 product groups. The mean of M_h across the 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 '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 4. 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 $\tau_h * TREATMENT_{gh} * AFTER_p$ and $\ln M_h * TREATMENT_{gh} * AFTER_p$ are both positive, and the coefficient on $\tau_h * \ln M_h * TREATMENT_{gh} * AFTER_p$ is negative; all are statistically significantly different from zero at conventional levels.

[20]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.

These 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 an increase in displacement to export processing zones amounting to 1.6 percentage points of total imports.

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 zero. This pattern is sensible, and supports the notion that displacement is occuring *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 preshipment 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.

3.5 Impact on total imports

An outcome of potential interest (and one that is in a sense more fundamental than the dependent variables of Tables 2-4) is the total value of imports originating in treatment and control countries. It makes sense to examine this outcome for two reasons. First, increased enforcement in the form of a reduction in the minimum value threshold could discourage imports from treatment countries, and lead traders to import from control countries instead. Second, the minimum value threshold reduction also creates incentives to *misreport* the origin of shipments: importers from treatment countries might find ways to make it *appear* that their shipments actually originated from control countries.

Both these types of responses to the minimum value threshold reduction would lead the observed total value of imports to *decline* differentially for treatment countries with respect to control countries. Appendix Table 3 examines whether there is any evidence for such a differential change. In column (a) of the table, the regression is analogous to those in Panel A of Table 2, with the difference that the outcome is the natural log of the total value of imports in the country/product-group cell in a given month. In column (b) of the table, the regression is

analogous to those in Panel B of Table 2, and the outcome is again the natural log of imports.

The regression results provide no indication that import volumes declined differentially due to the minimum value threshold reduction: the coefficient on the (Treatment country)*(After) variable is not statistically significantly different from zero (and the coefficient is actually positive in sign). There is therefore no evidence that the country origins of Philippine imports changed due to the reform (whether due to misreporting or true shifting of import sources). Displacement to shipping via export processing zones may have provided importers from treatment countries sufficient opportunity to preserve the illicit profits of duty avoidance, so that it was not additionally necessary to source imports from elsewhere or to misreport the source countries of imports.

3.6 Test for pre-existing differential trends

Interpreting the differential changes just described as being due to the PSI minimum value threshold reductions requires an identification assumption: that, in the absence of the changes in the minimum value thresholds, 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 is impossible to test directly, a partial test is possible: I test for the existence of analogous changes in the frequency of the different shipment types *before* the reform actually occurred.

In this 'false experiment', I estimate regressions analogous to those in Table 2, but where the 'before' period refers to November 1988 to April 1989, and the after period refers to November 1989 to April 1990. Appendix Table 4 presents the regression results. There is no evidence of shifts to alternative duty-avoidance methods corresponding to those found in the actual period of analysis: the coefficients on the (Treatment country)*(After) variable are small and not statistically significantly different from zero. (Figures 2 through 5 also provide no indication of the existence of pre-existing trends.) There is also no pre-existing differential trend in the total value of imports from treatment and control countries (last column of Appendix Table 4).

3.7 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 5 presents estimates of revenue gains and losses from the threshold reductions in the after period (December 1990 to February 1992); see Appendix Section 5.2 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, additional inspections of shipments valued between $500 and $5,000 would have amounted to $28.0 million. 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.[21]

4 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, leading the amount of crime to 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 subsets of imports, so that other import categories serve as comparison groups. Increased enforcement on shipments from a subset

[21] While in retrospect the minimum value threshold reductions were clearly uneconomic from the standpoint of raising import duties net of fees, it is not obvious that the Philippine government could have known this in advance. At the time of the changes, Philippine customs was not computerized, the number of shipments in the $500 to $5,000 value range might not have been known exactly, and so it might have been difficult to estimate the cost of the additional inspections. It was also unclear *ex ante* what fraction of shipments under $5,000 were declared as being in that value range purely to avoid the PSI requirement. Finally, the large displacement to export processing zones was probably unanticipated.

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.

5 Appendix

5.1 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

[22] In the drug trade, for example, more frequent searches of arriving passengers have discouraged smuggling via single air travelers (a low-fixed-cost, high-variable-cost method). An alternative method is shipping drugs within 20- or 40-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 U.S. Drug Enforcement Administration (2001, 2003) and Abt Associates (2001).

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-a-vis a corrupt customs officer, potentially reducing customs clearance times.[23]

Almost all PSI contracts specify that certain product categories and types of shipment 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 50 developing countries have implemented customs PSI programs for some period of time.[24] As of mid-2002, such programs remained active in nearly 40 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 non-customs purposes.

5.2 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, and the resulting displacement to alternative methods of duty avoidance. Results of the calculations described here are in Table 5, and the values of all parameters are at the bottom of Table 5.

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 is from 1992 UNCTAD Trains dataset (1991 data is unavailable).

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

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

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. \$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]

[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.

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

$$N * \$225,$$

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:

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

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) 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.)

6 References

Abt Associates, *Measuring the Deterrent Effect of Enforcement Operations on Drug Smuggling, 1991-1999.* U.S. Office of National Drug Control Policy, August 2001.

Andreoni, James, 'Reasonable Doubt and the Optimal Magnitude of Fines: Should the Penalty Fit the Crime?' *RAND Journal of Economics*, Vol. 22, No. 3, Autumn 1991, pp. 385-395.

Andreoni, J., B. Erard, and J. Feinstein, 'Tax Compliance,' *Journal of Economic Literature*, Vol. 36, June 1998, pp. 818-860.

Ayres, Ian and Steven Levitt, 'Measuring Positive Externalities from Unobservable Victim Precaution: An Empirical Analysis of Lojack,' *Quarterly Journal of Economics*, February 1998, pp. 43-77.

Bar-Ilan, Avner and Bruce Sacerdote, 'The Response to Fines and Probability of Detection in a Series of Experiments,' NBER Working Paper No. 8638, Cambridge, MA, December 2001.

Becker, Gary, 'Crime and Punishment: An Economic Approach,' *Journal of Political Economy*, Vol. 76, 1969, pp. 169-217.

Bernard, Jean-Thomas and Robert J. Weiner, 'Multinational Corporations, Transfer Prices, and Taxes: Evidence from the US Petroleum Industry,' in Assaf Razin and Joel Slemrod, eds., *Taxation in the Global Economy.* Chicago: University of Chicago Press, 1990, pp. 123-154.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan, 'How Much Should We Trust Difference-in-Difference Estimates?', *Quarterly Journal of Economics*, Vol. 119, No. 1, February 2004, pp. 249-275.

Bhagwati, Jagdish, 'On the Underinvoicing of Imports,' *Bulletin of the Oxford University Institute of Statistics*, Nov. 1964.

Braga, Anthony, David Weisburd, Elin Waring, Lorraine Green Mazerolle, William Spelman, and Francis Gajewski, 'Problem-Oriented Policing in Violent Crime Places: A Randomized Controlled Experiment,' *Criminology*, Vol. 37, No. 3, 1999, pp. 541-580.

Chaiken, Jan M., Michael W. Lawless, and Keith A. Stevenson, *The Impact of Police Activity on Crime: Robberies on the New York City Subway System*, New York City: Rand Institute, 1974.

Clausing, Kimberly, 'The Impact of Transfer Pricing on Intrafirm Trade,' in James R. Hines, Jr., ed., *International Taxation and Multinational Activity.* Chicago: University of Chicago Press, 2001, pp. 173-199.

Corman, Hope and H. Naci Mocan, 'A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City,' *American Economic Review*, Vol. 90, No. 3, June 2000, pp. 584-604.

De Wulf, Luc, 'Statistical Analysis of Under- and Overinvoicing of Imports,' *Journal of Development Economics*, Vol. 8, 1981, p. 303-323.

DiNardo, John and Thomas Lemieux, 'Alcohol, Marijuana, and American Youth: The Unintended Consequences of Government Regulation,' *Journal of Health Economics*, Vol. 20, 2001, pp. 991-1010.

Di Tella, Rafael and Ernesto Schargrodsky, 'Do Police Reduce Crime? Estimates Using the Allocation of Police Forces After a Terrorist Attack,' *American Economic Review*, forthcoming, 2004.

Ehrlich, Isaac, 'Participation in Illegitimate Activities: A Theoretical and Empirical Investigation,' *Journal of Political Economy*, Vol. 81, No. 3, 1973, pp. 521-565.

Fisman, Raymond and Shang-Jin Wei, 'Tax Rates and Tax Evasion: Evidence from 'Missing Imports' in China,' *Journal of Political Economy*, Vol. 112, No. 2, April 2004.

Freeman, Richard, 'Why Do So Many Young American Men Commit Crimes and What Might We Do About It?' *Journal of Economic Perspectives*, Vol. 10, No. 1, Winter 1996, pp. 25-42.

Hesseling, Rene, 'Displacement: A Review of the Literature,' in Ronald V. Clarke, ed., *Crime Prevention Studies, Vol. 3*, Monsey, NY: Criminal Justice Press, 1994.

Hines, James R., Jr., and Eric Rice, 'Fiscal Paradise: Foreign Tax Havens and American Business,' *Quarterly Journal of Economics*, Vol. 109, No. 1, pp. 149-182.

Holmstrom, Bengt and Paul Milgrom, 'Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design,' *Journal of Law, Economics, and Organization*, Vol. 7, 1991, pp. 553-581.

Jenkins, Glenn, 'Economic Reform and Institutional Innovation,' *Bulletin of the International Bureau of Fiscal Documentation*, December 1992, pp. 588-596.

Klepper, Steven, and Daniel Nagin, 'The Anatomy of Tax Evasion,' *Journal of Law, Economics, and Organization*, Vol. 5, No. 1, Spring 1989, pp. 1-24.

Levitt, Steven, 'Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime,' *American Economic Review*, Vol. 87, No. 3, June 1997, pp. 270-290.

Levitt, Steven, 'Why Do Increased Arrest Rates Appear to Reduce Crime: Deterrence, Incapacitation, or Measurement Error?' *Economic Inquiry*, Vol. 36, July 1998, pp. 353-372.

Low, Patrick, 'Preshipment Inspection Services,' *World Bank Discussion Paper*, No. 278, 1995.

McCormick, Robert and Robert Tollison, 'Crime on the Court,' *Journal of Political Economy*, Vol. 92, No. 2, April 1984, pp. 223-235.

McPheters, Lee, Robert Mann, and Don Schlagenhauf, 'Economic Response to a Crime Deterrence Program: Mandatory Sentencing for Robbery With a Firearm,' *Economic Inquiry*, Vol. 22, No. 4, 1984, pp. 550-570.

Mookherjee, Dilip, and I. P. L. Png, 'Marginal Deterrence in Enforcement of Law,' *Journal of Political Economy*, Vol. 102, No. 5, 1994, pp. 1039-1066.

Morgenstern, Oskar, 'Foreign Trade Statistics,' in *The Accuracy of Economic Observations*. Princeton: Princeton University Press, 1950.

Naya, Seiji and Theodore Morgan, 'The Accuracy of International Trade Data: The Case of Southeast Asian Countries,' *Journal of the American Statistical Association*, June 1969.

Prendergast, Canice, 'The Tenuous Tradeoff Between Risk and Incentives,' NBER Working Paper 7815, July 2000.

Pritchett, Lant and Geeta Sethi, 'Tariff Rates, Tariff Revenue, and Tariff Reform: Some New Facts,' *World Bank Economic Review*, Vol. 8, No. 1, 1994, pp. 1-16.

Rege, Vinod, *Preshipment Inspection: Past Experiences and Future Directions*, London: Commonwealth Secretariat, 2001.

Reppetto, Thomas, 'Crime Prevention and the Displacement Phenomenon,' *Crime & Delinquency*, April 1976, pp. 166-177.

Shavell, Steven, 'A Note on Marginal Deterrence,' *International Review of Law and Economics*, Vol. 12, 1992, pp. 345-355.

Slemrod, Joel and Shlomo Yitzhaki, 'Tax Avoidance, Evasion, and Administration,' in Alan Auerbach and Martin Feldstein, eds., *Handbook of Public Economics*, North-Holland, 2002.

Stigler, George, 'The Optimum Enforcement of Laws,' *Journal of Political Economy*, Vol. 78, 1970, pp. 526-536.

U.S. Drug Enforcement Administration, *Southeast Asian Heroin Smuggling Methods: Containerized Cargo*. Washington, D.C., September 2001.

U.S. Drug Enforcement Administration, *Drug Trafficking in the United States*. Washington, D.C., 2003.

Wilde, Louis, 'Criminal Choice, Nonmonetary Sanctions, and Marginal Deterrence: A Normative Analysis,' *International Review of Law and Economics*, Vol. 12, 1992, pp. 333-344.

Witte, Ann Dryden, 'Estimating the Economic Model of Crime with Individual Data,' *Quarterly Journal of Economics*, Vol. 94, February 1980, pp. 57-84.

Table 1: Philippine imports by shipment type and country group
Nov 1989 - Feb 1992

A. Treatment group imports

	Before period (Nov 1989 to Apr 1990)	After period (Nov 1990 to Feb 1992)	Change (After minus before)
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 $5000 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

	Before period (Nov 1989 to Apr 1990)	After period (Nov 1990 to Feb 1992)	Change (After minus before)
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 $5000 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 $5000 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 $5000 and $500" or "under $500"). Data source: shipment database of the National Statistics Office of the Philippines.

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.

A. Basic difference-in-difference estimate

	Dependent variable: Fraction of imports …			
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories
	(a)	(b)	(c)	(a)+(b)+(c)
(Treatment country)*(After)	-0.017	0.0002	0.027	0.01
	(0.006)***	(0.002)	(0.010)**	(0.013)
"Treatment country" indicator	0.03	0.0011	-0.002	0.029
	(0.012)**	(0.001)	(0.013)	(0.018)
"After" indicator	0.003	0.0023	0.002	0.007
	(0.002)	(0.002)	(0.008)	(0.008)
Constant	0.026	0.0021	0.05	0.078
	(0.004)***	(0.0003)***	(0.012)***	(0.014)***
R-squared	0.02	0	0.01	0.02
Number of observations	11,303	11,303	11,303	11,303

B. Detailed country/product-group and month fixed effects

	Dependent variable: Fraction of imports …			
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories
	(a)	(b)	(c)	(a)+(b)+(c)
(Treatment country)*(After)	-0.016	0.0004	0.027	0.012
	(0.006)***	(0.003)	(0.010)***	(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 table presents coefficients (standard errors in parentheses) in a separate weighted least squares regression. Standard errors 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 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.

Table 3: Characteristics of major product groups

Harmonized System section	Mean monthly import volume in "before" period (US$ millions)	Ln(mean monthly import volume)	Mean tariff rate (%)	Description
1	24.70	17.02	28.18	Live animals; animal products
2	42.20	17.56	36.02	Vegetable products
3	2.04	14.53	35.68	Animal or vegetable oils, fats, or waxes
4	28.60	17.17	40.97	Prepared foods, beverages, and tobacco
5	156.00	18.87	14.75	Mineral products (including oil and petroleum)
6	89.20	18.31	16.42	Chemicals and related products (pharmaceuticals, cosmetics, etc.)
7	40.90	17.53	27.89	Plastics, rubber, and articles thereof
8	5.41	15.50	32.02	Goods of leather or animal skin
9	3.41	15.04	31.22	Wood, cork, straw, and articles thereof
10	18.70	16.74	32.67	Pulp; paper, paperboard, and articles thereof
11	81.10	18.21	40.81	Textiles and textile articles
12	2.04	14.53	45.00	Footwear, headgear, umbrellas, walking sticks; articles of feathers, down or hair
13	6.09	15.62	35.26	Articles of stone, plaster, ceramics, glass, etc.
14	1.62	14.29	44.44	Pearls, precious or semiprecious stones, precious metals, jewelry, coin
15	73.20	18.11	21.76	Base metals and articles thereof
16	243.00	19.31	24.22	Machinery, mechanical appliances; electrical equipment; electronic appliances
17	65.30	17.99	25.50	Vehicles, aircraft, vessels and associated transport equipment
18	16.10	16.59	19.41	Precision instruments and apparatus; timekeeping devices; musical instruments
19	0.24	12.37	48.89	Arms and ammunition; parts and accessories thereof
20	1.82	14.41	39.18	Miscellaneous manufactured articles
21	1.83	14.42	16.67	Works of art, antiques
Mean	43.02	16.39	31.28	
Std. Dev.	60.93	1.86	10.06	

NOTES-- Import volume variable is mean monthly imports in the before period in the Harmonized System (1988 version) section. "Before" period is Nov 1989 to Apr 1990. Tariff rate is simple average 1989 tariff across all individual items in the Harmonized System section.

Table 4: 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 $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories
	(a)	(b)	(c)	(a)+(b)+(c)
Right-hand-side variables:				
(Treatment group)*(After)	0.6648	0.2495	-1.2506	-0.3363
	(0.2442)***	(0.2072)	(0.6085)**	(0.5655)
Interactions with (Treatment group)*(After):				
Tariff rate	-0.0250	-0.0066	0.0384	0.0068
	(0.0090)***	(0.0060)	(0.0184)**	(0.0179)
Log import volume	-0.0375	-0.0135	0.0717	0.0208
	(0.0133)***	(0.0111)	(0.0338)**	(0.0310)
(Tariff rate)*(Log import volume)	0.0014	0.0004	-0.0022	-0.0005
	(0.0005)***	(0.0003)	(0.0010)**	(0.0010)
Interactions with "After" indicator:				
Tariff rate	0.0018	0.0002	-0.0138	-0.0118
	(0.0058)	(0.0021)	(0.0109)	(0.0127)
Log import volume	0.0008	0.0000	-0.0081	-0.0074
	(0.0090)	(0.0032)	(0.0183)	(0.0188)
(Tariff rate)*(Log import volume)	-0.0001	0.0000	0.0009	0.0008
	(0.0003)	(0.0001)	(0.0006)	(0.0007)
Country-product group fixed effects	Y	Y	Y	Y
Month fixed effects	Y	Y	Y	Y
Num. of obs.:	11,303	11,303	11,303	11,303

* significant at 10%; ** significant at 5%; *** significant at 1%
NOTES-- Each column of table presents coefficients (standard errors in parentheses) from a separate weighted least squares estimation. Standard errors clustered by country. Unit of observation is imports in a country/product-group cell in a particular month. Tariff rate variable is simple average 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.

Table 5: 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 gain (loss)	**$**	**(36,766,434)**

NOTE -- Figures are in nominal US$. See Appendix for explanation of details behind calculation, and below for inputs to calculations.

Addendum: Inputs to calculations

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-$5000		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 to Addendum--
(2) From Dec 1990 - Feb 1992.
(3) Weights are imports by HS section from Dec 1990 - Feb 1992. Tariff data is from 1992 UNCTAD Trains dataset (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).

Appendix Table 1: Changes in Philippine preshipment inspection (PSI) program

Date	Countries added to program	Minimum value threshold for inspection
April 1, 1987 (start of program)	Hong Kong Japan Taiwan	$5,000
October 1, 1989	Brunei Indonesia Malaysia Singapore Thailand South Korea	
May 2, 1990	Macau	Lowered to $2,500
November 1, 1990		Lowered to $500
March 16, 1992	All remaining countries	

NOTE-- Shipments with invoiced value below minimum value threshold are not required to undergo preshipment inspection.

Appendix Table 2: Displacement of treatment-country imports to alternative duty-avoidance methods
(Data aggregated to country level)
(Weighted least squares estimates)

Before period: Nov 1989 - Apr 1990. After period: Dec 1990 - Feb 1992.

A. Basic difference-in-difference estimate

	Dependent variable: Fraction of imports …			
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories
	(a)	(b)	(c)	(a)+(b)+(c)
(Treatment country)*(After)	-0.024	0.0007	0.035	0.012
	(0.008)***	(0.001)	(0.014)**	(0.018)
"Treatment country" indicator	0.035	-0.003	-0.001	0.031
	(0.012)***	(0.005)	(0.012)	(0.017)*
"After" indicator	0.007	-0.0003	0.004	0.01
	(0.005)	(0.001)	(0.008)	(0.008)
Constant	0.02	0.0056	0.048	0.074
	(0.004)***	(0.005)	(0.010)***	(0.013)***
R-squared	0.04	0	0.03	0.03
Number of observations	1,466	1,466	1,466	1,466

B. Detailed country and month fixed effects

	Dependent variable: Fraction of imports …			
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories
	(a)	(b)	(c)	(a)+(b)+(c)
(Treatment country)*(After)	-0.023	0.0028	0.035	0.014
	(0.008)***	(0.003)	(0.015)**	(0.019)
Country fixed effects	Y	Y	Y	Y
Month fixed effects	Y	Y	Y	Y
R-squared	0.23	0.48	0.45	0.47
Number of observations	1,466	1,466	1,466	1,466

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

NOTES-- Notes to Table 2 apply, except as follows. Unit of observation is imports at the origin country level in a given month. Each observation weighted by mean monthly imports (by value) in before period (Nov 1989 to Apr 1990) for specific country. Standard errors clustered by country.

Appendix Table 3: Impact of enforcement on total imports from treatment and control countries
(Weighted least squares estimates)
Before period: Nov 1989 - Apr 1990. After period: Dec 1990 - Feb 1992.

Dependent variable: Ln(total value of imports)

	(a)	(b)
(Treatment country)*(After)	0.124	0.097
	(0.142)	(0.112)
"Treatment country" indicator	0.324	
	(0.618)	
"After" indicator	-0.052	
	(0.123)	
Constant	15.802	
	(0.435)***	
Country fixed effects	-	Y
Month fixed effects	-	Y
R-squared	0.01	0.87
Number of observations	11,303	11,303

* significant at 10%; ** significant at 5%; *** significant at 1%
NOTES-- Notes to Table 2 apply, except that dependent variable is natural log of total imports (in current US$) in the country/product-group cell in the given month.

Appendix Table 4: Displacement of treatment-country imports to alternative duty-avoidance methods
('False experiment' in pre-period)
(Weighted least squares estimates)

False before period: Nov 1988 - Apr 1989. False after period: Nov 1989 - Apr 1990.

A. Basic difference-in-difference estimate

	Dependent variable: Fraction of imports …				*Dependent variable:*
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories	Ln(total value of imports)
	(a)	(b)	(c)	(a)+(b)+(c)	
(Treatment country)*(After)	0.000	-0.0039	-0.007	-0.011	-0.029
	(0.004)	(0.006)	(0.014)	(0.015)	(0.158)
"Treatment country" indicator	0.03	0.005	0.005	0.04	0.353
	(0.013)**	(0.006)	(0.017)	(0.023)*	(0.674)
"After" indicator	-0.009	-0.0009	0.016	0.005	0.473
	(0.002)***	(0.0005)*	(0.013)	(0.013)	(0.114)***
Constant	0.035	0.003	0.034	0.072	15.329
	(0.006)***	(0.0006)***	(0.014)**	(0.020)***	(0.438)***
R-squared	0.04	0	0	0.02	0.02
Number of observations	5,934	5,934	5,934	5,934	5,934

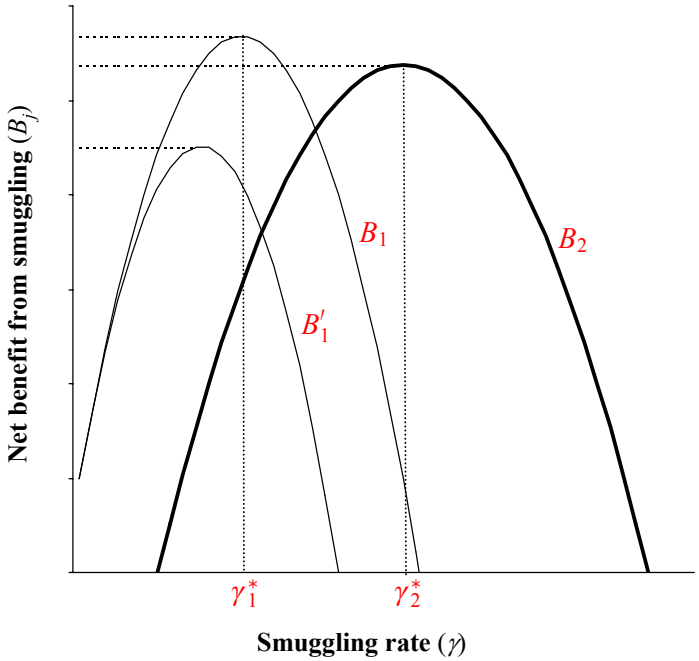
B. Detailed country/product-group and month fixed effects

	Dependent variable: Fraction of imports …				*Dependent variable:*
	…between $5000 and $500	…under $500	...destined for export processing zone	...in any of the previous three categories	Ln(total value of imports)
	(a)	(b)	(c)	(a)+(b)+(c)	
(Treatment country)*(After)	0.000	-0.0038	-0.002	-0.006	-0.086
	(0.004)	(0.006)	(0.013)	(0.014)	(0.167)
Country/product-group fixed effects	Y	Y	Y	Y	Y
Month fixed effects	Y	Y	Y	Y	Y
R-squared	0.48	0.21	0.64	0.59	0.84
Number of observations	5,934	5,934	5,934	5,934	5,934

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

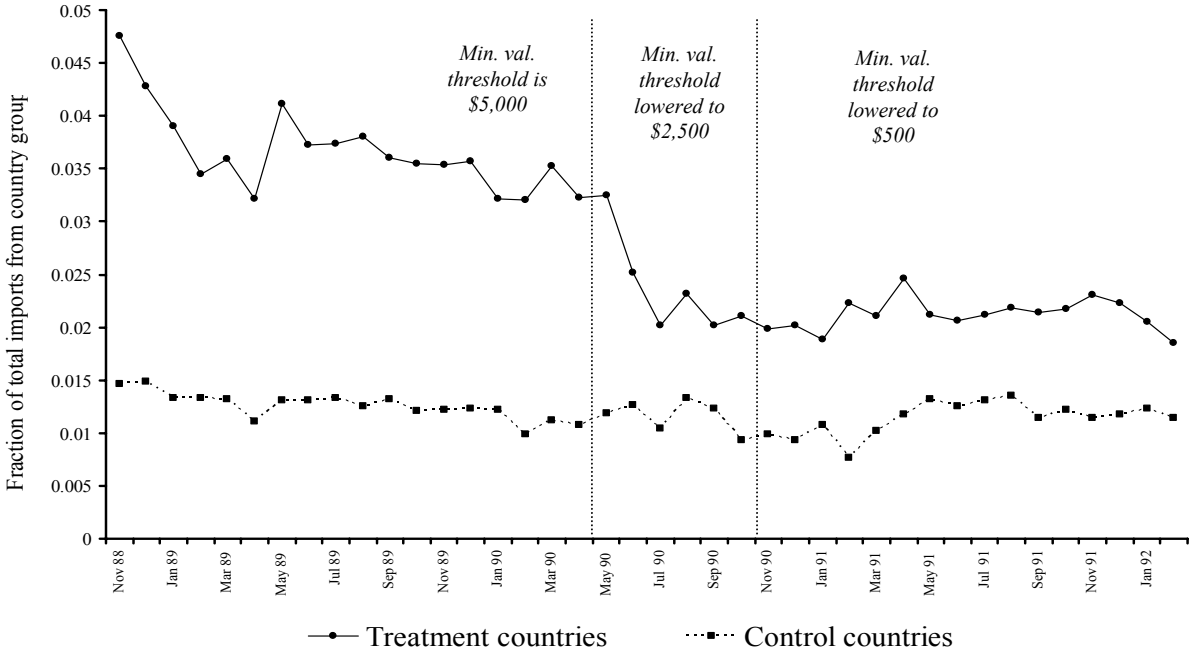
NOTES-- All notes to Table 2 apply, except that "Before" indicates that observation occurs in Nov 1988 - Apr 1989, and "After" indicates that observation occurs in Nov 1989 - Apr 1990.

Figure 1: Impact of increased enforcement in smuggling displacement model



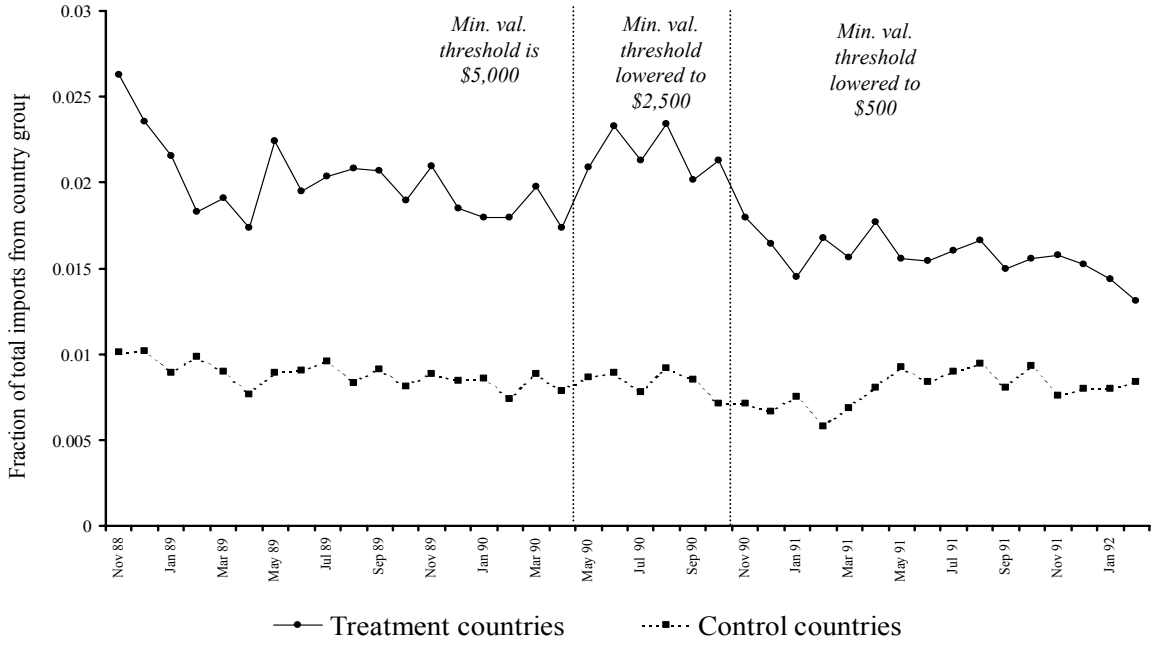
NOTE-- Figure displays graphs of equation (1) in text. τ= 0.15 and M=1 for all curves. For curve B_1: v=0.6, F=0.002. For curve B_1': v=0.8, F=0.002. For curve B_2: v=0.3, F=0.012.

Figure 2: Fraction of total imports entering in shipments valued between $2,500 and $5,000 (November 1988 – February 1992)



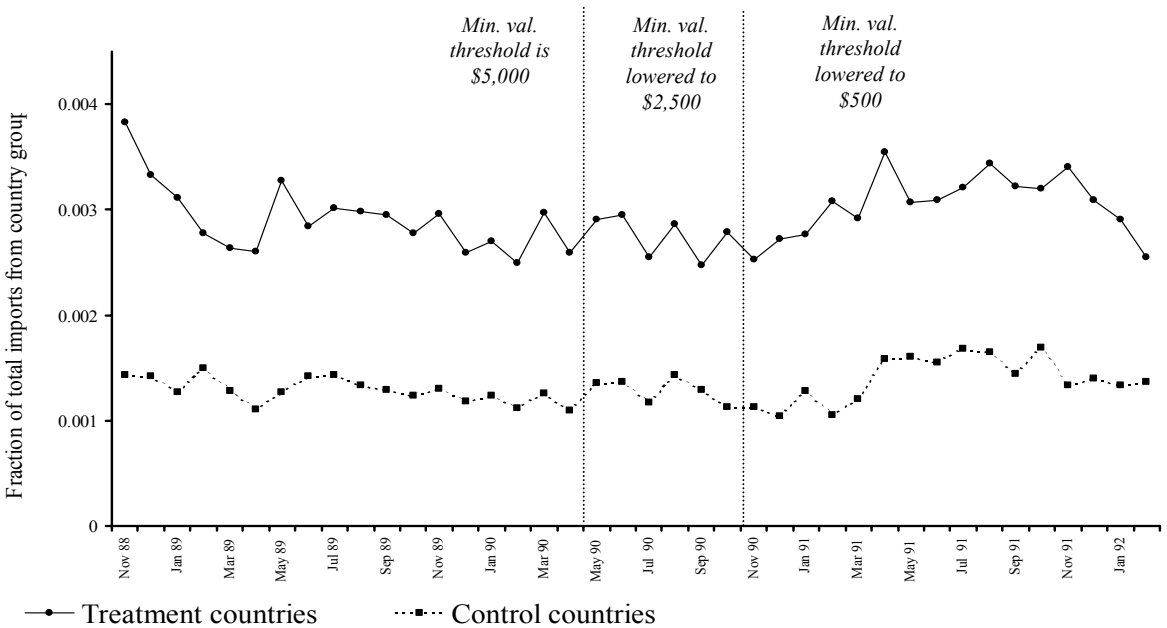
NOTES-- Chart plots fraction of total imports by value entering in shipments valued between $2,500 and $5,000 in the given month, from treatment (PSI) countries and from control (non-PSI) countries. Treatment countries are Hong Kong, Japan, Taiwan, Brunei, Indonesia, Malaysia, Singapore, South Korea, 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 $5000 and $500" or "under $500"). Data source: shipment database of the National Statistics Office of the Philippines.

Figure 3: Fraction of total imports entering in shipments valued between $500 and $2,500 (November 1988 – February 1992)



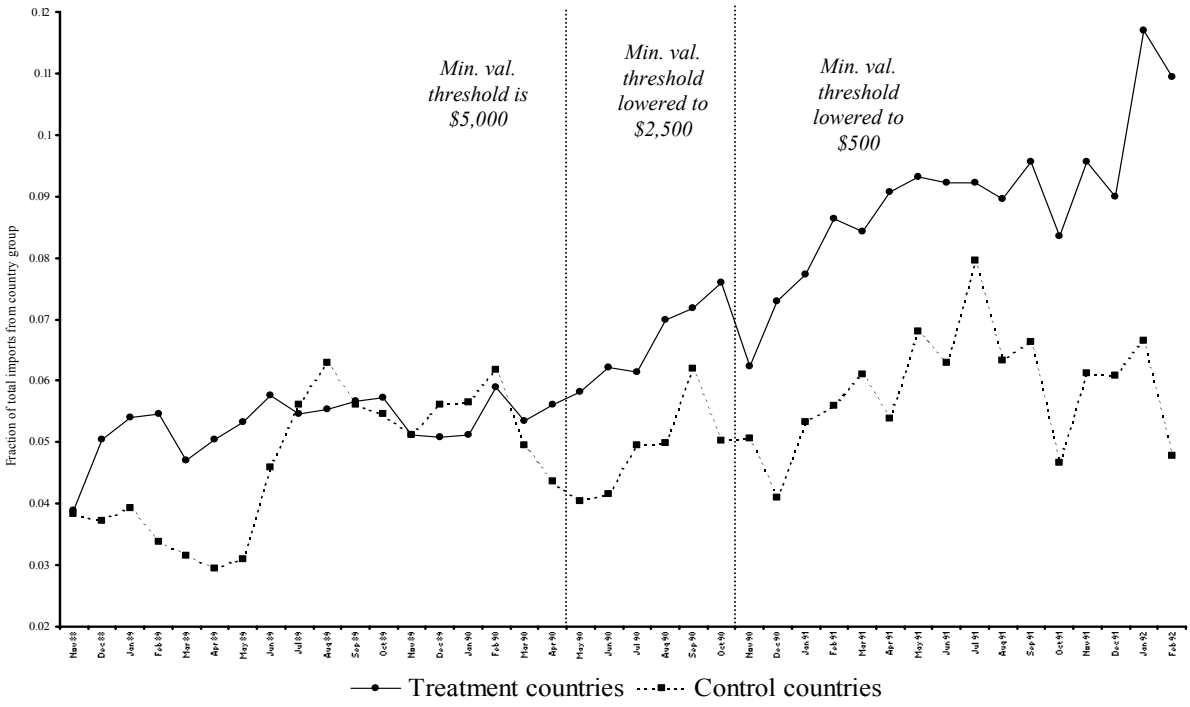
NOTES-- Chart plots fraction of total imports entering in shipments valued between $500 and $2,500 in the given month, by country group. For all other notes, see Figure 2.

Figure 4: Fraction of total imports entering in shipments valued below $500 (November 1988 – February 1992)



NOTES-- Chart plots fraction of total imports entering in shipments valued below $500 in the given month, by country group. For all other notes, see Figure 2.

Figure 5: Fraction of total imports destined for export processing zones (January 1989 – 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 2.