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Hijacking, Hold-Up, and International Trade

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Preliminary version

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Insecurity impedes trade. Using a variant of the gravity model – the workhorse of empirical international economics – Anderson and Marcouiller (1999) showed that transparent government policies and enforceable commercial contracts significantly reduce trade costs and increase trade volume. This paper asks two further questions. Does insecurity impede some types of trade more than others? Do different dimensions of insecurity affect different types of trade differently?

One dimension of insecurity is quite straightforward: shipments can be hijacked. *The New York Times* recently reported "the revival of piracy" by "bandits in the global shipping lanes" (Hitt 2000). Even more common is the theft of containers hauled by truck. Nearly one thousand hijackings were reported in Mexico alone in 1996, spurring the formation of sophisticated cargo-escorting companies and driving insurance premiums dramatically upward (Hecht 2000). Moreover, as a Salvadoran businessperson complained, the loss of a shipment imposes uninsurable costs beyond the loss of the stolen goods, since the loot is resold at a price which undercuts legitimate suppliers.

Unenforceable commercial contracts generate a different sort of insecurity, often referred to as "the hold-up problem." Fixed costs are associated with entry into international markets and with design of a product to meet the needs of a particular client (Rauch and Casella 1998, Anderson and Young 1999). In the absence of enforceable contracts, parties can be forced to renegotiate the terms of exchange after the up-front costs have been sunk. This hold-up problem may discourage or even eliminate trade when fixed costs are high.

The distinction between these two forms of insecurity motivates the working hypothesis of this paper: that, although insecurity impedes all sorts of trade, exposure to hijacking primarily affects trade in homogeneous, easily resold products, while the lack of contractual defense against the hold-up problem primarily hits trade in differentiated, client-specific products.

The paper extends the Anderson and Marcouiller structural model of aggregate bilateral trade in an insecure world (1999) to a setting in which each country produces different types of tradable commodities as well as a non-traded good. It adopts Rauch's empirical classification of traded commodities into homogeneous, reference-priced, and differentiated products (Rauch 1999). I develop a new data set matching 1995 and 1996 average Most Favored Nation tariffs, commodity by commodity, with the bilateral trade flows reported by Feenstra (2000). Data on institutional quality are drawn from surveys undertaken by the World Economic Forum (1997) and by the World Bank (1997).

Estimation of the model with allowance for left-censoring of import data, heteroskedasticity of unknown form, and correlation of residuals among observations for a single importing country, supports the following contentions: multidimensional insecurity impedes trade of all types, contractual insecurity strongly impedes trade in differentiated commodities but has little or no effect on trade in homogeneous products, and exposure to theft impedes trade in homogeneous products but has little or no effect on trade in differentiated products.

For better or worse, research on security and trade has a bit of the aura of a child's adventure story about pirates, bandits, and thieves. I would argue, however, that the implications are strictly for adults. The evidence presented here suggests that, if contracts in Latin America were to become as easily enforced as they are in the European Union, Latin American trade in differentiated products could rise by as much as 50%.[1] This effect may work through fixed costs and the hold-up problem, as argued here, or it may reflect the fact that contracts permit exchange with partners about whom one has relatively little information. Either way, the effect is large. Moreover, since the quality of institutions is empirically correlated with GDP per capita, gravity models which include GDP and population but exclude institutional quality will suffer from omitted variables bias.

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[1] Based on the coefficients presented in Table 8. The difference in the average relative enforceability measure between the EU and LA countries in the data set is slightly over .5. Multiplying by the coefficient on enforceability (.9 in the conservative classification, .8 in the liberal) gives a difference in *log* imports of .40 or .45.

1. The Model

Following Rauch (1999), this paper classifies traded goods as homogeneous (traded on an organized exchange), reference-priced (prices can be quoted without mentioning the name of the manufacturer), or differentiated (all other goods). We assume production to be internationally specialized in such a way that each country produces a non-tradable good and a unique tradable good of each of the three types $G = H, R, D$.

Prices of tradable goods sold at home are normalized to one. Extending the model developed in Anderson and Marcouiller (1999), the price in importing country *i* of country *j* 's product of group G, p_{ij}^{G}, will be marked up above its price in *j* to reflect trade costs. Let S_i index security, the quality of institutions supporting trade in country *i*. Let b_{ij} be a dummy which takes the value 1 if *i* and *j* share a common land border and let l_{ij} take the value 1 if the countries speak a common language. These variables may affect a shipper's expertise in using the importing country's institutions for the defense of trade. Let d_{ij} be the distance between the two partners, capturing transport and other distance-related trade costs. Finally, if a_{ij} takes the value 1 when the countries are associated in a free trade agreement and t_i^G is country *i*'s ad valorem tariff on imports of type *G*, then $\left(1+\left(1-a_{ij}\right)t_i^G\right)$ represents the applicable tariff. Putting these trade costs together, let:

$$(1.1) \qquad p_{ij}^{G} = \rho\left(S_i\right)^{\delta_1^G}\left(1+b_{ij}\right)^{\delta_2^G}\left(1+l_{ij}\right)^{\delta_3^G}\left(d_{ij}\right)^{\delta_4^G}\left(1+\left(1-a_{ij}\right)t_i^G\right) \qquad G = H,R,G.$$

It is convenient to work with prices relative to those in a base country *k*:

$$(1.2) \qquad \frac{p_{ij}^{G}}{p_{kj}^{G}} = \left(\frac{S_i}{S_k}\right)^{\delta_1^G}\left(\frac{1+b_{ij}}{1+b_{kj}}\right)^{\delta_2^G}\left(\frac{1+l_{ij}}{1+l_{kj}}\right)^{\delta_3^G}\left(\frac{d_{ij}}{d_{kj}}\right)^{\delta_4^G}\left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right).$$

Assume CES preferences across goods within a given category *G*. Then country *i*'s expenditure on country *j*'s export of type *G* will be:

$$(1.3) \qquad m_{ij}^{G} = \alpha_j^G\left(p_{ij}^G / P_i^G\right)^{-\sigma_G}\left(P_i^G\right)^{-1} x_i^G \qquad G = H, R, D,$$

where

$$P_i^G = \left[\sum_j \alpha_j^G \left(p_{ij}^G \right)^{1-\sigma_G} \right]^{1/(1-\sigma_G)}$$

is the CES price index for goods of type *G* in country *i*, and x_i^G is country *i*'s total expenditure on goods of class *G*. Relative to the base country *k*:

(1.4) $$\frac{m_{ij}^G}{m_{kj}^G} = \left(\frac{p_{ij}^G / P_i^G}{p_{kj}^G / P_k^G} \right)^{-\sigma_G} \left(\frac{P_i^G}{P_k^G} \right)^{-1} \left(\frac{x_i^G}{x_k^G} \right).$$

A country's total expenditure on each class of good is determined in prior stages of the budgeting process. Agents first determine the share of expenditure to devote to tradable goods (including the tradable goods produced at home). Generalizing from Anderson and Marcouiller (1999), the traded goods expenditure share is postulated to be a reduced form function of GDP, GDP per capita, and the three traded goods price indices:

(1.5) $$T_i\left(y_i, n_i, P_i^H, P_i^R, P_i^D\right) = \tau_0 \, y_i^{\tau_1} \left(y_i / n_i\right)^{\tau_2} \left(P_i^H\right)^{\tau_H} \left(P_i^R\right)^{\tau_R} \left(P_i^D\right)^{\tau_D}.$$

Traded goods expenditure is then divided among homogeneous, reference-priced, and differentiated products. Lacking good theory about preferences across types of good, it seems unjustifiable to restrict the preferences beyond quasi-concavity (homotheticity, in particular, seems too strong a restriction). Therefore, this paper postulates the traded goods expenditure to be divided across the three types of traded good $G = H, R, D$ according to the reduced form function:

(1.6) $$K_i^G\left(y_i, n_i, P_i^H, P_i^R, P_i^D\right) = \kappa_0 \, y_i^{\kappa_1^G} \left(y_i / n_i\right)^{\kappa_2^G} \left(P_i^H\right)^{\kappa_H^G} \left(P_i^R\right)^{\kappa_R^G} \left(P_i^D\right)^{\kappa_D^G} \qquad G = H, R, D.$$

This general form explicitly allows a change in the price index for one type of traded good to affect expenditure on all types of traded goods.

Total expenditure by country *i* on traded goods of class *G*, relative to expenditure by country *k* on the same class of goods, can be expressed as:

$$\frac{x_i^G}{x_k^G} = \left(\frac{y_i}{y_k} \right) \left(\frac{T_i}{T_k} \right) \left(\frac{K_i^G}{K_k^G} \right) \qquad G = H, R, D$$

or, substituting in (1.5) and (1.6):

(1.7) $$\frac{x_{ij}^G}{x_{kj}^G} = \left(\frac{y_i}{y_k} \right)^{1+\tau_1+\kappa_1^G} \left(\frac{y_i / n_i}{y_k / n_k} \right)^{\tau_2+\kappa_2^G} \left(\frac{P_i^H}{P_k^H} \right)^{\tau_H+\kappa_H^G} \left(\frac{P_i^R}{P_k^R} \right)^{\tau_R+\kappa_R^G} \left(\frac{P_i^D}{P_k^D} \right)^{\tau_D+\kappa_D^G} \qquad G = H, R, D.$$

Denote the reduced form income and income per capita elasticities as follows:

$$\varepsilon_{xy}^{G} \equiv \partial \ln\left(x_{ij}^{G} / x_{kj}^{G}\right) / \partial \ln\left(y_i / y_k\right) = 1 + \tau_1 + \kappa_1^{G}$$

$$\varepsilon_{xyn}^{G} \equiv \partial \ln\left(x_{ij}^{G} / x_{kj}^{G}\right) / \partial \ln\left(\left(y_i / n_i\right) / \left(y_k / n_k\right)\right) = \tau_2 + \kappa_2^{G}$$

Each of the price indices also affects total expenditure on each of the classes of tradable good. The elasticity of total expenditure on goods of class *G* with respect to changes in the price index of homogeneous goods is denoted:

$$\varepsilon_{xH}^{G} \equiv \partial \ln\left(x_{ij}^{G} / x_{kj}^{G}\right) / \partial \ln\left(P_i^{H} / P_k^{H}\right) = \tau_H + \kappa_H^{G} \qquad G = H, R, D.$$

Similarly, the elasticities of expenditure on class *G* with respect to changes in the price indices of reference-priced and differentiated goods are:

$$\varepsilon_{xR}^{G} \equiv \partial \ln\left(x_{ij}^{G} / x_{kj}^{G}\right) / \partial \ln\left(P_i^{R} / P_k^{R}\right) = \tau_R + \kappa_R^{G} \qquad G = H, R, D$$

$$\varepsilon_{xD}^{G} \equiv \partial \ln\left(x_{ij}^{G} / x_{kj}^{G}\right) / \partial \ln\left(P_i^{D} / P_k^{D}\right) = \tau_D + \kappa_D^{G} \qquad G = H, R, D.$$

The basic model of imports is derived by substituting (1.7) into (1.4) and taking logs. Thus:

(1.8)
$$\ln\left(\frac{m_{ij}^{G}}{m_{kj}^{G}}\right) = \varepsilon_{xy}^{G} \ln\left(\frac{y_i}{y_k}\right) + \varepsilon_{xyn}^{G} \ln\left(\frac{y_i / n_i}{y_k / n_k}\right) - \sigma_G \ln\left(\frac{p_{ij}^{G} / P_i^{G}}{p_{kj}^{G} / P_k^{G}}\right) - \ln\left(\frac{P_i^{G}}{P_k^{G}}\right)$$
$$+ \varepsilon_{xH}^{G} \ln\left(\frac{P_i^{H}}{P_k^{H}}\right) + \varepsilon_{xR}^{G} \ln\left(\frac{P_i^{R}}{P_k^{R}}\right) + \varepsilon_{xD}^{G} \ln\left(\frac{P_i^{D}}{P_k^{D}}\right)$$

for each of the three classes of tradable good $G = H, R, D$.

The non-linear price indices are a continuing issue in the gravity literature (Bergstrand 1985 and 1989, Gould 1994, Thursby and Thursby 1987). Again extending Anderson and Marcouiller (1999), this paper approximates each of the true CES price indices by a Tornqvist index,

(1.9)
$$\ln\left(\frac{P_i^{G}}{P_k^{G}}\right) = \sum_j w_j^{G} \ln\left(\frac{p_{ij}^{G}}{p_{kj}^{G}}\right),$$

where w_j represents the ratio of expenditure on traded good j of type *G* to total expenditure on all traded goods of type *G* (including the good produced at home). We cannot back out from the data an estimate of a country's expenditure on its own tradable good, since each also produces a non-traded good. However, it can be shown that:

$$(1.10)\quad w_{ij}^G = \frac{p_{ij}^G m_{ij}^G}{\sum_{j,\, j\neq i} p_{ij}^G m_{ij}^G}\left(1 - w_{ii}^G\right).$$

We use this to construct a set of weights w_j^G which sum to one and which are identical across importers. The weights are interpreted as exogenous parameters reflecting identical CES tastes (within group *G*) across countries. Any given importer's expenditure pattern may differ from the overall pattern, reflecting differences in country-specific price markups. We have also constructed a set of weights w_j on the basis of *j*'s overall output of all three types of traded good, using the relation:

$$(1.11)\quad w_{ij} = \frac{\sum_G p_{ij}^G m_{ij}^G}{\sum_G \sum_{j,j\neq i} p_{ij}^G m_{ij}^G}\left(1 - \sum_G w_{ii}^G\right).$$

Taking logs of (1.2) and substituting into (1.9) gives as the Tornqvist index:

$$(1.12)\quad \begin{aligned} \ln\left(\frac{P_i^G}{P_k^G}\right) = {} & \delta_1^G \sum_j w_j^G \ln\left(\frac{S_i}{S_k}\right) + \delta_2^G \sum_j w_j^G \ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right) + \delta_3^G \sum_j w_j^G \ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right) \\ & + \delta_4^G \sum_j w_j^G \ln\left(\frac{d_{ij}}{d_{kj}}\right) + \sum_j w_j^G \left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right) \end{aligned}$$

for all $G = H, R, D$. Note, however, that since S_i / S_k does not vary across exporters *j*:

$$(1.13)\quad \sum_j w_j^G \ln\left(\frac{S_i}{S_k}\right) = \ln\left(\frac{S_i}{S_k}\right).$$

Moreover, since there is very little variation across *j* in the relative tariff term, we assume that:

$$(1.14)\quad \sum_j w_j^G \ln\left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right) = \ln\left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right).$$

Taking logs of (1.2) again, using (1.12), (1.13), and (1.14), and substituting into (1.8) results in a very unwieldy model of relative imports. In moving toward an easily estimable model, it is helpful to consider concretely the weights w_j^G calculated using (1.10) for the 44 exporters in our data set (to be described in detail in the next section.) Empirically, the weights are highly correlated across classes of tradable goods.

The correlation creates both a problem and an opportunity. The problem is that substituting our model of price determination into the Tornqvist indices and then substituting the three indices into the model of import expenditure leaves us with a model containing three collinear weighted distance terms, three collinear weighted border terms, and three collinear weighted language terms. Consider, for example, the "remoteness" terms. The full import model contains three separate but highly correlated remoteness indices for each importer:

$$(1.15) \quad \sum_j w_j^H \ln\left(\frac{d_{ij}}{d_{kj}}\right) \approx \sum_j w_j^R \ln\left(\frac{d_{ij}}{d_{kj}}\right) \approx \sum_j w_j^D \ln\left(\frac{d_{ij}}{d_{kj}}\right).$$

Given the correlation among the weights (and, of course, the invariance of d_{ij} across classes of goods), a regression model incorporating these terms will suffer from multicollinearity.

Trying to turn a vice to virtue, we take the opportunity posed by the correlation across weights to simplify the model slightly. We assume that the weights are *perfectly* correlated across commodity groups, so that:

$$(1.15') \quad \sum_j w_j^H \ln\left(\frac{d_{ij}}{d_{kj}}\right) = \sum_j w_j^R \ln\left(\frac{d_{ij}}{d_{kj}}\right) = \sum_j w_j^D \ln\left(\frac{d_{ij}}{d_{kj}}\right) = \sum_j w_j \ln\left(\frac{d_{ij}}{d_{kj}}\right).$$

While maintaining the highly flexible cross-price elasticity structure of Equation 1.7, this assumption significantly simplifies the originally quite unwieldy model of imports, allowing it to be expressed in a form closer both to Anderson and Marcouiller (1999) and to traditional gravity models:

$$
\begin{aligned}
\ln\left(\frac{m_{ij}^{G}}{m_{kj}^{G}}\right) = {} & \varepsilon_{xy}^{G}\ln\left(\frac{y_i}{y_k}\right) + \varepsilon_{xyn}^{G}\ln\left(\frac{y_i / n_i}{y_k / n_k}\right) + \left(\varepsilon_{xH}^{G}\delta_1^{H} + \varepsilon_{xR}^{G}\delta_1^{R} + \varepsilon_{xD}^{G}\delta_1^{D} - \delta_1^{G}\right)\ln\left(\frac{S_i}{S_k}\right) \\
& -\sigma_G\delta_2^{G}\ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right) - \sigma_G\delta_3^{G}\ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right) - \sigma_G\delta_4^{G}\ln\left(\frac{d_{ij}}{d_{kj}}\right) \\
& +\left(\varepsilon_{xH}^{G} + \varepsilon_{xR}^{G} + \varepsilon_{xD}^{G} - 1\right)\left(\frac{1+\left(1-a_{ij}\right)t_i^{G}}{1+\left(1-a_{kj}\right)t_k^{G}}\right) \\
& +\left(\varepsilon_{xH}^{G}\delta_2^{H} + \varepsilon_{xR}^{G}\delta_2^{R} + \varepsilon_{xD}^{G}\delta_2^{D} + \left(\sigma_G - 1\right)\delta_2^{G}\right)\sum_j w_j\ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right) \\
& +\left(\varepsilon_{xH}^{G}\delta_3^{H} + \varepsilon_{xR}^{G}\delta_3^{R} + \varepsilon_{xD}^{G}\delta_3^{D} + \left(\sigma_G - 1\right)\delta_3^{G}\right)\sum_j w_j\ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right) \\
& +\left(\varepsilon_{xH}^{G}\delta_4^{H} + \varepsilon_{xR}^{G}\delta_4^{R} + \varepsilon_{xD}^{G}\delta_4^{D} + \left(\sigma_G - 1\right)\delta_4^{G}\right)\sum_j w_j\ln\left(\frac{d_{ij}}{d_{kj}}\right)
\end{aligned}
\tag{1.16}
$$

for each of the three classes of traded good $G = H, R, D$.

The variable of most interest in this paper is the relative security index, S_i / S_k, which picks up the effect of the enabling framework in which exchange occurs. Consider the effect of an improvement in the enforceability of commercial contracts in country *i* on that country's imports of differentiated products. Because of (1.13), the rise in S_i / S_k will lower the price of each imported differentiated product, p_{ij}^{D}, in the same proportion that it lowers country *i* 's price index for all differentiated imports, P_i^{D}, leaving p_{ij}^{D} / P_i^{D} unchanged and eliminating the substitution effect in Equation 1.4. However, Equation 1.4 also reveals an elasticity $-\delta_1^{D}$ as the "real income" effect of the decrease in P_i^{D}, holding expenditure constant. Moreover, since the improvement in security also lowers P_i^{R} and P_i^{H}, Equation 1.7 points to multiple effects on the total expenditure on differentiated goods, with overall elasticity $\varepsilon_{xH}^{D}\delta_1^{H} + \varepsilon_{xR}^{D}\delta_1^{R} + \varepsilon_{xD}^{D}\delta_1^{D}$. The sum of these effects gives us the coefficient on $\ln\left(S_i / S_k\right)$ in Equation 1.16.

2. The Data

The model developed in the previous section gives us a framework within which to answer the two empirical questions asked in this paper:

- Are imports of homogeneous, reference-priced, and differentiated products similarly affected by changes in a composite measure of security?
- Do different dimensions of security affect different sorts of trade differently?

However, estimation of the model first required construction of a data set linking tariffs, commodity by commodity, to trade flows. This data set may also be of use to other researchers.

The source for bilateral trade flows disaggregated by commodity is Feenstra (2000), which in turn is based on Statistics Canada's reworking of data collected by the United Nations Statistical Office. This data set is referred to as the World Trade Analyzer (or WTA).

Tariffs are often left out of gravity models altogether. Anderson and Marcouiller (1999) use aggregate average MFN tariff data provided by the World Bank. The model developed here calls for the importer's average tariff on homogeneous products, its tariff on reference-priced products, and its tariff on differentiated products. As an intermediate step in the development of that data, for each importer we have computed average MFN tariffs for 1995 and 1996 for each of the commodity categories used in the WTA.

UNCTAD's Trade Analysis and Information System (TRAINS) provided 1995 and 1996 average MFN tariffs at the six-digit level of the Harmonized System (HS) of commodity classification (UNCTAD, 2000). TRAINS also reports the number of national tariff lines underlying each of the 6-digit HS tariff averages. As shown in Table 1, these tariff data are available for 40 "countries" in 1995, counting the European Union as a single country, and for 27 countries in 1996, again counting the EU as one. (As noted in the footnotes to Table 1, not all of these countries appear in the WTA data.)

Matching the tariff data to the trade data requires shifting goods classifications. Complete details on this rather painstaking process are given in the Appendix to this paper. The TRAINS administrator provided a concordance between the 1992 and 1996 HS classifications and Revision 3 of the Standard International Trade Classification (SITC). We then used Robert E. Lipsey's concordance between SITC revision 3 and SITC revision 2 (available at the website of the Center for International Data at the University of California, Davis). Following Feenstra (2000), the four-digit SITC revision 2 codes were rolled-up into the four-digit WTA codes. We constructed tariffs for each four-digit WTA category by averaging the corresponding HS averages, weighting by the appropriate number of lines. Again, details are provided in the Appendix.

The resulting data sets provide, at a highly disaggregated level, the WTA import values and the TRAINS MFN tariff averages for 1995 and 1996. The focus of this paper, however, is not on trade at the four-digit WTA level but on total trade in homogeneous, reference-priced, and differentiated products. Using Rauch's (1999) classification, we identify each of the WTA categories as belonging to class *H*, *R*, or *D*. Goods in category *H* are traded on organized exchanges. Goods in class *R* have a reference price which can be quoted without naming the manufacturer. A good falls into class *D* if neither of these conditions is met. Rauch provides both a conservative classification, which has the effect of maximizing the number of commodities classified as differentiated, and a liberal classification, which maximizes the number of commodities associated with organized exchanges or reference prices. Once the WTA codes are matched to the Rauch codes, it is straightforward to calculate total trade and average tariffs for each pair of trading partners and each class of good. This paper uses 1996 trade data. It uses 1996 tariff data where available; otherwise we use 1995 tariff data.

Table 2 presents descriptive statistics about the average tariffs for the 38 importing countries used in this paper. Both average tariffs and the standard variation of the average across importers decline as one moves from homogeneous through reference-priced to differentiated goods. Table 3 provides summary statistics on trade and tariffs by type of good, averaging over the 1597 observations used in the estimations to be presented in Sections 4 and 5.

The security indices used in this paper – indices of the quality of institutional support to protect trade from predation through hijacking or hold-up – have two basic sources. The first is a survey of business executives undertaken by the World Economic Forum in early 1997 (WEF, 1997). Respondents were asked to register on a scale from one to seven their agreement with each of the following statements (among others):

- Government economic policies are impartial and transparent;
- Government regulations are precise and fully enforced;
- Tax evasion is minimal;
- Irregular additional payments are not common in business and official transactions;
- The legal system is effective in enforcing commercial contracts ;
- Agreements and contracts with the government are not often modified due to budget cutbacks, changes in government or changes in government priorities;
- Private businesses can readily file lawsuits at independent and impartial courts if there is a breach of trust on the part of the government;
- New governments in your country honor the commitments and obligations of previous regimes;
- Citizens of your country are willing to adjudicate disputes rather than depending on physical force or illegal means;
- Your country's police are effective in safeguarding personal security so that this is not an important consideration in business activity;
- Organized crime does not impose significant costs on business in your country.

Anderson and Marcouiller (1999) composed a broadly-based composite security index by extracting the first principal factor of the country mean responses to these questions. That index, reported in Table 4, is used again here. This paper also uses directly the WEF's country mean responses to the assertions that "the legal system is effective in enforcing commercial contracts" and that "organized crime does not impose significant costs on business" (both rescaled to run between zero and one).

The second source of security information is data collected by the World Bank in the preparation of the *World Development Report 1997* (World Bank 1997). In this survey of 3685 firms in 69 countries, respondents were asked among other things to judge on a scale from 1 to 6 how problematic crime and theft are for doing business.

The rest of the data come from standard sources. GDP and population come from the World Bank's *World Development Indicators*. We calculated the great circle distance between the capital cities of trade partners using geographic coordinates found in Fitzpatrick and Modlin (1986). We used an electronic atlas to identify adjacent countries. We coded trading partners as speaking a common language if both listed among their official languages Arabic, Chinese, English, French, German, Malay, Portuguese, Spanish, or Swedish, and we created a dummy variable to indicate common membership in ASEAN, the EU, Mercosur, or NAFTA.

3. Estimation

The model to be estimated is given in Equation 3.1, a log-linear version of Equation 1.16.

$$\begin{aligned}\ln\left(\frac{m_{ij}^G}{m_{kj}^G}\right) &= \beta_0^G + \beta_1^G \ln\left(\frac{y_i}{y_k}\right) + \beta_2^G \ln\left(\frac{y_i / n_i}{y_k / n_k}\right) + \beta_3^G \ln\left(\frac{S_i}{S_k}\right) + \beta_4^G \ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right) \\ &+ \beta_5^G \ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right) + \beta_6^G \ln\left(\frac{d_{ij}}{d_{kj}}\right) + \beta_7 \ln\left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right) \\ &+ \beta_8^G \left[\sum_j w_j \ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right)\right] + \beta_9^G \left[\sum_j w_j \ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right)\right] + \beta_{10}^G \left[\sum_j w_j \ln\left(\frac{d_{ij}}{d_{kj}}\right)\right] + \eta_i + \upsilon_{ij}\end{aligned} \quad (3.1)$$

The equation is estimated separately over commodity types $G = H, R, D$; the only cross-type constraint for (3.1) suggested by the theory is that the coefficient on the tariff term should be equal across types.

Focusing on the variable of immediate interest, we expect the coefficient β_3^G to be positive. In terms of Equation 1.16, this coefficient estimates:

$$\varepsilon_{xH}^G \delta_1^H + \varepsilon_{xR}^G \delta_1^R + \varepsilon_{xD}^G \delta_1^D - \delta_1^G .$$

If the impact of enhanced security is to lower the price markup on the particular good in question, $-\delta_1^G > 0$. If the impact of enhanced security is to lower all three of the price indexes and if the net effect of this is to increase expenditure on traded goods, then $\varepsilon_{xH}^{G}\delta_1^{H} + \varepsilon_{xR}^{G}\delta_1^{R} + \varepsilon_{xD}^{G}\delta_1^{D} > 0$.

The stochastic element of Equation 3.1 has two parts. The first, η_i, represents that portion of the error which is common to *i*'s imports from all exporters j. The second element, υ_{ij}, represents a disturbance specific to the trading pair. The possibility of heteroskedasticity suggests use of the Huber-White method for calculating robust standard errors, while the two-part error term requires that the calculation of variance be "clustered" by importer. The clustering option roughly *doubles* the estimated standard errors, indicating that there is in fact substantial importer-specific correlation of residuals.

The dependent variable is censored. The lowest trade value reported at the four-digit commodity classification level in the WTA is 5000 dollars. If country *i*'s imports from country *j* fall short of $5000 in each of the WTA categories in one of the commodity groups $G = H, R, D$, then no imports by *i* from *j* will be reported for that group. Of course, the dependent variable of the regression is not $\ln\left(m_{ij}^{G}\right)$ but $\ln\left(m_{ij}^{G} / m_{kj}^{G}\right)$, the minimum value of which depends on the value of m_{kj}^{G}. Stata's procedure for interval regression permits tobit-like estimation with non-constant censoring points, while also allowing calculation of robust standard errors with clustering by importer.

4. Does insecurity affect all trade?

Working with aggregate bilateral imports, Anderson and Marcouiller (1999) found that insecurity impedes trade and showed that the exclusion of security variables biases upward the estimated coefficient on income per capita. The first question asked by this paper is whether the Anderson and Marcouiller result is driven primarily by the effect of insecurity on imports of just one of the three classes $G = H, R, D$, or whether, in fact, all sorts of trade are discouraged by security-related costs.

To answer this first question, one would like to stay as close to the original data set as possible. Anderson and Marcouiller used trade data from the IMF's

Direction of Trade Statistics. Switching to the commodity-specific trade data of the WTA eliminates the Czech Republic, the Slovak Republic, Russia, and Ukraine. All four countries were in the lowest third of the distribution of the composite security index, and Russia and Ukraine were the least secure countries in the sample. Elimination of trade involving these four (possibly influential) countries leaves us with 44 importers. Matching importers with their 43 possible partners gives a total of 1892 possible import observations for each class of good $G = H, R, D$.

However, we lose an additional six importers when shifting from the aggregate average MFN tariffs used by Anderson and Marcouiller (1999) to the disaggregated tariffs drawn from TRAINS. This is true even if we use 1995 tariffs when 1996 tariffs are unavailable. The countries lost are India, Jordan, Peru, South Africa, Switzerland, and Zimbabwe. Of course, Equation 3.1 does not require tariff information from the exporting country, and we can use imports by the other 38 countries from these six. This leaves 38 importers and 43 exporters, for a total of 1634 possible import observations for each class of good.

Finally, we have no data on the base country *k*'s purchases of its own tradable goods. In terms of Equation 3.1, we lack a measure of m_{kk}^G. Lacking the denominator of the dependent variable $\ln\left(m_{ik}^G / m_{kk}^G\right)$, we are unable to use any of the observations of m_{ik}^G. This excludes a further 37 observations, leaving a total of 1597 possible observations for each class of good.

Table 5 shows the result of estimating Equation 3.1 over these 1597 pairs, using the USA as a convenient base country *k*. As described in the previous section, the estimation technique allows for censoring, for heteroskedasticity, and for importer-specific correlation of residuals. Simply for the sake of comparison, Table 6 shows the results with the simple Huber-White calculation of robust standard errors, *without* clustering by importer. As can be seen from a comparison of the two tables, the clustering roughly doubles the standard errors, evidence of significant correlation of residuals within importer-specific groups.

What does Table 5 show? In spite of having lost the least secure countries from the sample, the claim that security encourages trade is confirmed for all three types of trade. In each case the coefficient on the composite security index is positive and significant at the 5% level; in the case of trade in differentiated products, the coefficient is significant at the 1% level.

The point estimate of the coefficient in the case of conservatively classified differentiated goods is .29. This implies that a country whose composite security factor rose from the average of the Latin American countries in the sample (-.82) to the average of the members of the EU (.53) would could expect to see its imports of differentiated products rise by some 40%, other things equal (the predicted change in the log of imports would be .29*(.82+.53)=.39).

Then answer to the first question of the paper is, “Yes.” Insecurity impedes trade of all types. The result holds not only for total bilateral trade but for trade broken into Rauch’s three groups of homogeneous, reference-priced, and differentiated products.

5. Do different types of insecurity affect trade differently?

A good deal of space was devoted in Section 1 to dealing with troublesome price indices. It may be helpful to re-emphasize now another point made in that section: that insecurity affects imports by raising the prices of traded goods. Suppose that the composite security index masks two distinct elements of insecurity, indexed for importer *i* by U_i and V_i. The price of *j*’s export of type *G* in importer *i*, relative to the price of the same good in importer *k*, would then be, by analogy to Equation 1.2:

$$\text{(5.1)} \qquad \frac{p_{ij}^G}{p_{kj}^G} = \left(\frac{U_i}{U_k}\right)^{\delta_{1U}^G} \left(\frac{V_i}{V_k}\right)^{\delta_{1V}^G} \left(\frac{1+b_{ij}}{1+b_{kj}}\right)^{\delta_2^G} \left(\frac{1+l_{ij}}{1+l_{kj}}\right)^{\delta_3^G} \left(\frac{d_{ij}}{d_{kj}}\right)^{\delta_4^G} \left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right).$$

This implies a slight variation on Equation 3.1 as the equation to be estimated:

$$\ln\left(\frac{m_{ij}^G}{m_{kj}^G}\right) = \beta_0^G + \beta_1^G \ln\left(\frac{y_i}{y_k}\right) + \beta_2^G \ln\left(\frac{y_i / n_i}{y_k / n_k}\right) + \beta_{3U}^G \ln\left(\frac{U_i}{U_k}\right) + \beta_{3V}^G \ln\left(\frac{V_i}{V_k}\right)$$

(5.2)
$$+ \beta_4^G \ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right) + \beta_5^G \ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right) + \beta_6^G \ln\left(\frac{d_{ij}}{d_{kj}}\right) + \beta_7 \ln\left(\frac{1+\left(1-a_{ij}\right)t_i^G}{1+\left(1-a_{kj}\right)t_k^G}\right)$$

$$+ \beta_8^G \left[\sum_J w_j \ln\left(\frac{1+b_{ij}}{1+b_{kj}}\right)\right] + \beta_9^G \left[\sum_J w_j \ln\left(\frac{1+l_{ij}}{1+l_{kj}}\right)\right] + \beta_{10}^G \left[\sum_J w_j \ln\left(\frac{d_{ij}}{d_{kj}}\right)\right] + \eta_i + \upsilon_{ij}$$

for all $G = H, R, D$. Going back to Equation 1.16, the coefficient on the relative *U* index, β_{3U}^G, would have the interpretation $\varepsilon_{xH}^G \delta_{1U}^H + \varepsilon_{xR}^G \delta_{1U}^R + \varepsilon_{xD}^G \delta_{1U}^D - \delta_{1U}^G$, the sum of *U*'s effect on the price of any particular good in class *G* plus its effect through all three price indices on the share of total expenditure devoted to all goods of type *G*. Similarly, the coefficient on the *V* index would have the interpretation $\varepsilon_{xH}^G \delta_{1V}^H + \varepsilon_{xR}^G \delta_{1V}^R + \varepsilon_{xD}^G \delta_{1V}^D - \delta_{1V}^G$.

Suppose that a good of type *D* is so client-specific that it has no value to anyone other than the client for whom it was designed. With no resale value, it would not be an attractive target for hijacking. Since theft is not a problem for this good, protection against theft has no impact on its price. If U_i indexes security from theft, then the exponent δ_{1U}^D ought to be zero. In this extreme case, the sum:

$$\varepsilon_{xH}^G \delta_{1U}^H + \varepsilon_{xR}^G \delta_{1U}^R + \varepsilon_{xD}^G \delta_{1U}^D - \delta_{1U}^G = \varepsilon_{xH}^G \delta_{1U}^H + \varepsilon_{xR}^G \delta_{1U}^R$$

might even be negative, if protection from theft lowers the prices of homogeneous and referenced-priced goods and this lowers expenditure on differentiated products.

The producer of a perfectly client-specific good may not face a threat of hijacking, but such a producer faces the hold-up problem in its most extreme form. Contracts could solve the problem, but only if they are relatively complete, verifiable, and enforceable. If V_i indexes the ability of institutions in country *i* to enforce contracts, then we would expect the exponent δ_{1U}^D to be significantly negative; improvement in the index should lower the price markup. As argued in Section 4, in this case we would expect the coefficient on contract enforcement, interpreted as $\varepsilon_{xH}^G \delta_{1V}^H + \varepsilon_{xR}^G \delta_{1V}^R + \varepsilon_{xD}^G \delta_{1V}^D - \delta_{1V}^G$, to be positive.

Actual trade data will not break quite so neatly into goods exposed to hold-up risk and goods exposed to hijacking. The working hypothesis of this paper is that hijacking particularly impedes trade in homogeneous products while hold-up particularly impedes trade in differentiated products. Given separate indices of these two dimensions of security, we expect the former to have an especially strong positive effect on trade in homogeneous goods and the latter to have an especially strong positive effect on trade in differentiated goods.

One of the WEF survey questions directly addresses contracts and, implicitly, the hold up problem; respondents were asked to rate their agreement with the statement, “The legal system is effective in enforcing commercial contracts.” Country mean scores on this question, rescaled to run from zero to one, are used to index contract enforceability.

None of the WEF questions directly addresses the issue of hijacking. As a first cut at the issue, in order to stay within the data set and maintain the full number of observations, we use as an index of exposure to theft the country mean response to the assertion, “Organized crime does not impose significant costs on business in your country.” This is an imperfect but not entirely implausible index of exposure to theft, if extensive networks of hijackers and black marketeers are classified as “organized crime.”

Figure 1 plots each importer’s score on contract enforceability (a higher score means better enforcement) against its score on organized crime (a higher score means that organized crime imposes *lower* costs on business). The scores are positively correlated but far from perfectly so (correlation coefficient for the 1597 cases is .63). Colombia and Egypt have similar 1996 scores on contract enforceability but very different scores on organized crime. Argentina and Ireland have similar scores on organized crime but very different scores on contract enforceability.

Using these separate indices of different elements of security, Equation 5.2 was estimated using the previously described corrections for left-censoring, for unknown heteroskedasticity and for importer-specific correlation of residuals. The results are shown in Table 7.

The positive coefficient on contract enforceability increases dramatically in significance as one moves from homogeneous products to differentiated products; the coefficient for homogeneous goods in the liberal classification is not significant at all. Conversely, the positive coefficient on protection from the effects of organized crime moves from significance at the 10% level for homogeneous goods to no significance at all for differentiated products.

These encouraging results motivated the search for a more focused index of exposure to hijacking. One was found in the survey data compiled by the World Bank in the preparation of *World Development Report 1997*. In that survey, businesspeople were asked to judge on a scale from 1 to 6 the importance of “crime and theft” as an obstacle to doing business. We used scores rescaled to run from 0 to 1, with 1 representing the highest level of security against theft. Figure 2 plots this index against the World Economic Forum’s index of contract enforceability. Using this index drives down the number of possible observations, since it is unavailable for 16 of the 38 importers with which we have been working.

The results are most striking in the case of the liberal classification of goods. The measure of contract enforceability there has no effect on imports of homogeneous products, but a very large and significant effect on imports of differentiated products. Conversely, freedom from exposure to crime and theft has a very strong and significant effect on imports of homogeneous goods but no significant effect on imports of differentiated products. The same pattern is present but less pronounced when goods are aggregated according to the Rauch’s conservative classification.

6. Conclusion

This paper began with two questions: Does insecurity reduce all types of trade? Do different dimensions of security affect different types of trade differently? The working hypothesis has been that, although insecurity impedes all sorts of trade, exposure to hijacking primarily affects trade in homogeneous, easily resold products, while the lack of contractual protection against the hold-up problem primarily hits trade in differentiated, client-specific products.

The work has proceeded in several steps. The paper first extended the model of Anderson and Marcouiller (2000) to allow each country to produce traded goods of different types. We then composed a new data set matching TRAINS tariffs and WTA import flows commodity by commodity. We aggregated the tariff and trade information using Rauch's classification of goods into homogeneous, reference-priced, and differentiated products, and then added appropriate security indices from the World Economic Forum and from the World Bank. We then estimated the model allowing for censoring of the trade variable, heteroskedasticity and particularly correlation of residuals within importer-specific groups.

The empirical work shows that increases in the composite security index do lead to increases in import levels, other things equal; security does affect all types of trade. However, contractual insecurity strongly impedes trade in differentiated commodities but has little or no effect on trade in homogeneous products, and exposure to theft impedes trade in homogeneous products but has little or no effect on trade in differentiated products. QED -- or, at least, we seem to be on the right track.

References

Anderson, James E. and Douglas Marcouiller (2000), "Insecurity and the Pattern of Trade: An Empirical Investigation," August 2000 revision of NBER Working Paper #7000, "Trade, Insecurity, and Home Bias: An Empirical Investigation."

Anderson, James E. and Leslie Young, (1999), "Trade and Contract Enforcement." Boston College.

Bergstrand, Jeffrey H. (1985), "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence," *Review of Economics and Statistics* 67:3, August, pp. 474-81.

Bergstrand, Jeffrey H. (1989), " The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade," *Review of Economics and Statistics* 71:1, February, pp. 143-53.

Feenstra, Robert C. (2000), *World Trade Flows, 1980-1997* Davis: University of California, Davis, Center for International Data.

Feenstra, Robert C., James A. Markusen and Andrew Rose, "Using the Gravity Equation to Differentiate Among Alternative Theories of Trade," *Canadian Journal of Economics*, forthcoming.

Fitzpatrick, Gary L., and Marilyn J. Modlin (1986), *Direct-Line Distances: International Edition*, Metuchen: Scarecrow Press.

Gould, David M. (1994), "Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows," *Review of Economics and Statistics* 76:2, May, pp.302-316.

Hecht, John (2000), "Security Alert," *Business Mexico* 10:8, August, pp. 32-40.

Hitt, Jack (2000), "Bandits in the Global Shipping Lanes," *The New York Times*, Sunday Magazine, August 17.

Rauch, James E. (1999), "Networks versus Markets in International Trade," Journal of International Economics 48:1, June, pp. 7-36.

Rauch, James. E, and Alessandra Casella (1998), "Overcoming Informational Barriers to International Resource Allocation," NBER Working Paper No. 6628, June.

Thursby, Jerry G. and Marie C. Thursby (1987), "Bilateral Trade Flows, the Linder Hypothesis, and Exchange Risk," *Review of Economics and Statistics* 69:3, August, pp. 488-495.

United Nations Conference on Trade and Development (2000), *Trade Analysis and Information System* (TRAINS), Version 7.0.

World Bank (1997), "WDR 1997 Business Survey Data Set," available on-line at www.worldbank.org/wbi/governance/pubs.htm.

World Economic Forum (1997), *The Global Competitiveness Report 1997* (Geneva: World Economic Forum).

Appendix: Disaggregated Trade and Tariff Data

Trade data for 1995 and 1996 come from Feenstra (2000).

TRAINS provided 1995 and 1996 average MFN ad valorem tariff rates at the 6-digit HS level, along with the number of national tariff lines underlying each 6-digit code. Some of the data were reported using what TRAINS refers to as 1992 HS codes, other data according to the 1996 HS codes. TRAINS also provided concordances between the HS (92 and 96) and revision 3 of the SITC.

A few details should be mentioned:

- The 1992 concordance links both HS 151920 and 151930 with both SITC 43131 and 51217. We link 151920 to 43131 and 151930 to 51217. By 1996, neither HS code was used.
- In the 1996 concordance, HS 710820 is identified simply as "I. Gold, Monetary" and 711890 is "II. Gold coin and other current coin." We have assigned both the SITC number 95000.
- The 1996 concordance links HS 090190 with two SITC codes: 07132 and 07133. We have linked 090190 to 07132.
- The 1992 file links the single HS code 271000 with eight distinct SITC revision 3 codes in the 334 group. The 1996 file links 271000 only with 33400, a 3-digit aggregate. We adopt the latter correspondence, although this introduces ambiguities which require careful handling.
- Nine of the five-digit SITC revision 3 codes appearing in the TRAINS concordances are actually aggregates rather than true 5-digit SITC codes: 27410, 33400, 67300, 67600, 67610, 67620, 67810, 75990, and 89860. These, too, require careful handling.
- In general, where an HS code appears in both the 92 and 96 concordances, it is mapped into the same SITC code in each case.

Robert E. Lipsey of the NBER developed a concordance between Revision 3 of the SITC and Revision 2 of the SITC. The file is available at the website of the Center for International Data at UC Davis. We used this file to associate 5-digit SITC revision 2 codes with the TRAINS HS codes, then turned the 5-digit SITC revision 2 codes into 4-digit codes. Questions arise in the nine cases in which TRAINS uses a code which is actually an aggregate code: 27410, 33400, 67300, 67600, 67610, 67620, 67810, 75990, and 89860. In five cases the problem is easily resolved because the aggregate code maps into a single 4-digit code anyway:

- 27410 maps to 2741,
- 67610 maps to 6731,
- 67620 maps to 6732,
- 67810 maps to 6770, and
- 89860 maps to 8983.

The other four cases are more complex:

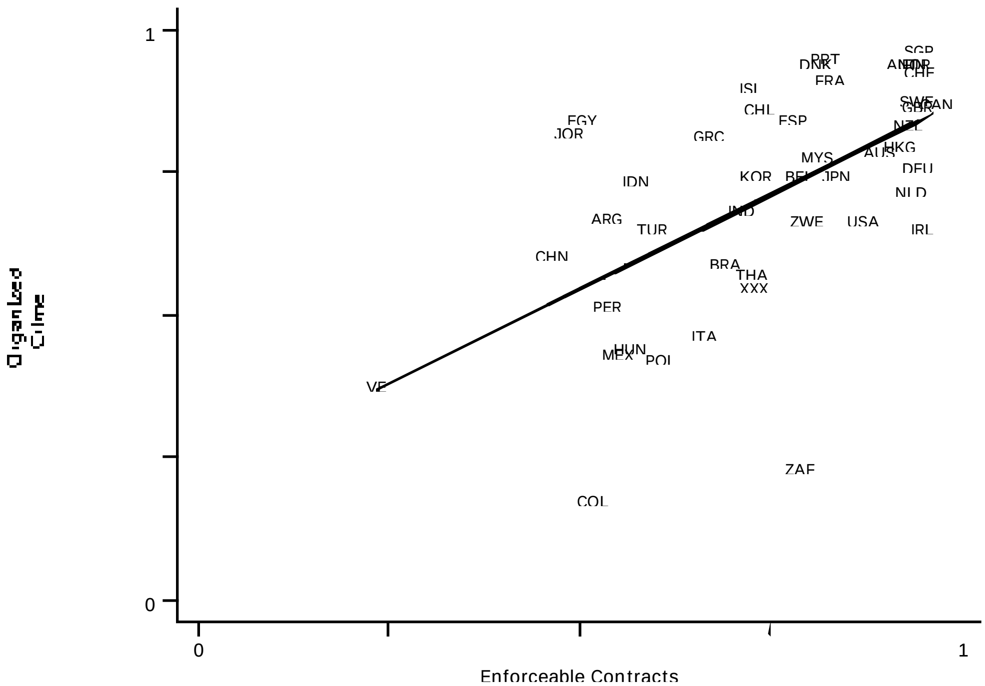
- 33400 maps to 3341, 3342, 3343, 3344, and 3345.
- 67300 maps to 6727, 6744, 6745, 6746, and 6749.
- 67600 maps to 6731, 6732, and 6733.
- 75990 maps to 7591 and 7599.

Our solution was this: if in the TRAINS data a country reports, say, 20 national tariff lines in the 67300 group, we associated 4 of those lines with 6727, four with 6744, four with 6745, four with 6746, and four with 6749.

The 4-digit SITC revision codes do not correspond exactly to the WTA codes, for reasons spelled out in Feenstra (2000). Appendix C of Feenstra's paper gives the roll-ups to be applied particularly where WTA uses an aggregate code (ending in A) or assigns trade to a residual category (ending in X). Note that the codes 515A, 655A, and 726A actually appear in the WTA data in place of the codes 515X, 655X, and 726X which appear in Feenstra's Appendix C. (When all trade within a 3-digit group is assigned to an X category, the corresponding A notation is used.)

The goal of this process is to associate an average ad valorem MFN tariff with each 4-digit SITC group in the WTA data. Having associated each HS code with a WTA code, we "collapsed" the TRAINS data by WTA code. For each importing country, we averaged TRAINS' average MFN tariffs over all HS codes within a WTA group, weighting each TRAINS observation by the appropriate number of lines. Where a residual category not in Feenstra's Appendix C appears in the WTA, we assign to that category the average MFN tariff of the next highest level of aggregation. In other words, where the WTA code is NNNX, representing trade within the NNN group which cannot be allocated to a specific 4-digit subgroup, we assign the average tariff corresponding to the NNN group. Associating these tariffs with the WTA trade values is then straightforward.

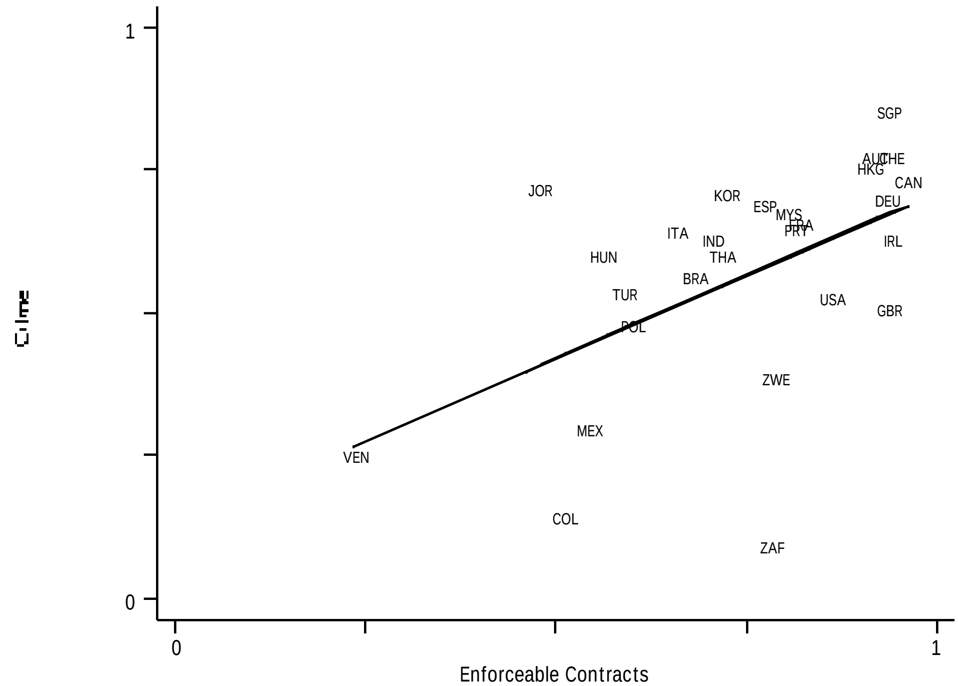
Figure 1. World Economic Forum Scores:
Contract Enforceability and Organized Crime



Note: Higher scores indicate greater security: contracts are *more* enforceable and organized crime imposes *lower* costs on business.

Figure 2. WEF and World Bank Scores:

Contract Enforceability and Crime



Note: Again, higher scores indicate greater security: contracts are *more* enforceable ; crime and theft are *less* of an obstacle to business.

Table 1. Importers with TRAINS Tariff Data

Importer	1995	1996	Importer	1995	1996	Importer	1995	1996
Argentina	x	x	Estonia	x	.	Morocco	x	.
Australia	.	x	European Union	x	x	New Zealand	x	x
Belize	.	x	Gabon	x	.	Nicaragua	x	.
Bhutan	.	x	Guatemala	x	.	Norway	x	x
Bolivia	x	.	Hong Kong	x	.	Paraguay	x	x
Brazil	x	x	Hungary	x	x	Philippines	x	.
Cameroon	x	.	Iceland	.	x	Poland	x	x
Canada	x	x	Indonesia	.	x	Singapore	x	.
Central Afr. Rep.	x	.	Jamaica	.	x	Taiwan	.	x
Chile	x	.	Japan	x	x	Thailand	x	.
China	x	x	Korea, Rep.	x	x	Trinidad-Tobago	x	x
Colombia	x	.	Kyrgyzstan	x	.	Tunisia	x	.
Costa Rica	x	.	Latvia	.	x	Turkey	x	.
Czech Republic	.	x	Lithuania	x	.	United States	x	x
Dominica	.	x	Madagascar	x	.	Uruguay	x	x
Ecuador	x	.	Malaysia	.	x	Venezuela	x	.
El Salvador	x	.	Mexico	x	.			
Egypt	x	.	Moldova	.	x			

Source: UNCTAD, 2000.

Note: Czech Republic, Dominica, Estonia, Kyrgyzstan, Latvia, Lithuania and Moldova are available in TRAINS but not available in the WTA trade data, in which they appear in combination with other members of the former Czechoslovakia and the former USSR or, in the case of Dominica, in combination with several other Caribbean nations.

Table 2. Average Overall MFN Tariffs and Tariffs by Commodity Type

	Mean	Std.Dev.	Min.	Max
Overall Average MFN Tariff (%)	10.19	6.16	0.00	28.10
Conservative Classification:				
Average Tariff, Homogeneous Goods	12.43	8.96	0.00	38.71
Average Tariff, Reference-Priced	10.88	7.31	0.00	41.61
Average Tariff, Differentiated	9.86	6.47	0.00	32.36
Liberal Classification				
Average Tariff, Homogeneous Goods	11.60	10.41	0.00	53.30
Average Tariff, Reference-Priced	10.80	6.48	0.00	34.80
Average Tariff, Differentiated	9.80	6.62	0.00	32.77

Notes: Average percentage ad valorem tariff.
Based on TRAINS data and classification from Rauch (1999).
Averages taken over the 38 importers used in this paper.

Table 3. Summary Statistics on Trade and Tariffs

	Observations	Mean	Std. Deviation
Conservative Classification			
Homogeneous imports (000)	1454	214552	901146
Reference-priced imports (000)	1555	432452	1567949
Differentiated imports (000)	1571	1609194	5965466
Homogeneous tariff factor	1597	1.124	0.088
Reference-priced tariff factor	1597	1.109	0.072
Differentiated tariff factor	1597	1.099	0.064
Liberal Classification			
Homogeneous imports (000)	1504	267371	1042241
Reference-priced imports (000)	1552	435138	1547965
Differentiated imports (000)	1569	1551948	5796691
Homogeneous tariff factor	1597	1.116	0.103
Reference-priced tariff factor	1597	1.108	0.064
Differentiated tariff factor	1597	1.098	0.065

Note: Summary over the 1597 cases underlying Tables 5,6,and 7.

Table 4. Composite Security index

IMPORTER	Score	IMPORTER	Score	IMPORTER	Score
Russia	-2.614	Italy	-0.362	France	0.689
Ukraine	-2.377	Indonesia	-0.284	Australia	0.704
Venezuela	-2.218	India	-0.264	Sweden	0.779
Colombia	-2.098	Zimbabwe	-0.240	Austria	0.807
Greece	-1.195	Peru	-0.235	Denmark	0.857
Poland	-0.858	Korea	-0.217	Ireland	0.864
Thailand	-0.796	China	-0.184	Germany	0.931
Jordan	-0.794	Belgium-Luxembourg	0.055	New Zealand	0.997
Hungary	-0.791	Egypt	0.227	United Kingdom	1.034
Mexico	-0.749	Spain	0.382	Netherlands	1.036
South Africa	-0.602	Portugal	0.391	Canada	1.050
Argentina	-0.579	Iceland	0.451	China: Hong Kong	1.134
Turkey	-0.539	Malaysia	0.499	Norway	1.142
Slovak Republic	-0.524	Japan	0.562	Switzerland	1.159
Brazil	-0.521	United States	0.651	Finland	1.173
Czech Republic	-0.452	Chile	0.680	Singapore	1.241

Source: Anderson and Marcouiller 1999.

Based on survey data from World Economic Forum 1997.

Table 5. Imports and the Composite Security Index

Standard Errors *with* Clustering by Importer

	Conservative Classification			Liberal Classification		
	Homog.	Ref. Price	Diff.	Homog.	Ref. Price	Diff.
GDP	1.315	1.052	0.901	1.265	1.015	0.898
	(0.111)	(0.085)	(0.065)	(0.112)	(0.083)	(0.059)
GDP Per Capita	-0.191	-0.300	-0.260	-0.278	-0.265	-0.254
	(0.182)	(0.132)	(0.152)	(0.148)	(0.141)	(0.145)
Security	0.390	0.271	0.294	0.339	0.271	0.279
	(0.191)	(0.121)	(0.103)	(0.166)	(0.130)	(0.101)
Common Border	-0.914	-0.236	0.560	-0.909	-0.060	0.449
	(0.408)	(0.184)	(0.256)	(0.333)	(0.217)	(0.268)
Com. Language	-0.266	0.929	0.427	-0.166	0.908	0.446
	(0.204)	(0.106)	(0.134)	(0.167)	(0.115)	(0.131)
Distance	-2.013	-1.226	-1.147	-1.765	-1.279	-1.208
	(0.128)	(0.079)	(0.098)	(0.112)	(0.084)	(0.104)
Tariffs	-0.731	-3.505	-5.862	-1.724	-3.144	-5.612
	(2.192)	(1.552)	(2.395)	(1.503)	(1.640)	(2.383)
Weighted Border	-1.499	-0.276	-0.130	-0.677	-0.364	-0.089
	(0.857)	(0.643)	(0.364)	(0.832)	(0.532)	(0.374)
Weighted Lang.	0.564	0.210	0.228	0.462	0.244	0.300
	(0.434)	(0.287)	(0.200)	(0.415)	(0.269)	(0.200)
Weighted Distance	0.053	0.032	0.119	0.079	0.043	0.139
	(0.090)	(0.054)	(0.039)	(0.080)	(0.050)	(0.040)
Constant	0.395	0.349	-0.231	0.492	0.291	-0.242
	(0.440)	(0.322)	(0.221)	(0.424)	(0.316)	(0.210)
Obs	1597	1597	1597	1597	1597	1597
Left-censored	143	42	26	93	45	28
Log Likelihood	-3605	-3016	-2781	-3537	-2979	-2787

Notes:

Robust standard errors (Huber-White) with clustering by importer in parentheses.

Observations on m_{ij}^{G} are left-censored at 5000;

the dependent variable $\ln\left(m_{ij}^{G} / m_{kj}^{G}\right)$ is left-censored with cut-off depending on the value of m_{kj}^{G}.

Estimated as a simple interval regression.

Table 6. Imports and the Composite Security Index

Standard Errors *without* Clustering by Importer

	Conservative Classification			Liberal Classification		
	Homog.	Ref. Price	Diff.	Homog.	Ref. Price	Diff.
GDP	1.315	1.052	0.901	1.265	1.015	0.898
	(0.051)	(0.035)	(0.032)	(0.047)	(0.035)	(0.032)
GDP Per Capita	-0.191	-0.300	-0.260	-0.278	-0.265	-0.254
	(0.113)	(0.068)	(0.081)	(0.094)	(0.069)	(0.082)
Security	0.390	0.271	0.294	0.339	0.271	0.279
	(0.119)	(0.073)	(0.063)	(0.108)	(0.071)	(0.063)
Common Border	-0.914	-0.236	0.560	-0.909	-0.060	0.449
	(0.393)	(0.229)	(0.230)	(0.346)	(0.228)	(0.232)
Com. Language	-0.266	0.929	0.427	-0.166	0.908	0.446
	(0.207)	(0.134)	(0.108)	(0.188)	(0.134)	(0.108)
Distance	-2.013	-1.226	-1.147	-1.765	-1.279	-1.208
	(0.099)	(0.056)	(0.054)	(0.089)	(0.057)	(0.054)
Tariffs	-0.731	-3.505	-5.862	-1.724	-3.144	-5.612
	(1.032)	(0.741)	(1.117)	(0.730)	(0.847)	(1.125)
Weighted Border	-1.499	-0.276	-0.130	-0.677	-0.364	-0.089
	(0.388)	(0.228)	(0.180)	(0.356)	(0.220)	(0.180)
Weighted Lang.	0.564	0.210	0.228	0.462	0.244	0.300
	(0.196)	(0.118)	(0.108)	(0.175)	(0.118)	(0.108)
Weighted Distance	0.053	0.032	0.119	0.079	0.043	0.139
	(0.049)	(0.029)	(0.025)	(0.043)	(0.029)	(0.025)
Constant	0.395	0.349	-0.231	0.492	0.291	-0.242
	(0.198)	(0.129)	(0.114)	(0.182)	(0.127)	(0.113)
Obs	1597	1597	1597	1597	1597	1597
Left-censored	143	42	26	93	45	28
Log Likelihood	-3605	-3016	-2781	-3537	-2979	-2787

Notes:

Robust standard errors (Huber-White) without clustering by importer in parentheses.

Observations on m_{ij}^{G} are left-censored at 5000;
the dependent variable $\ln\left(m_{ij}^{G} / m_{kj}^{G}\right)$ is left-censored with cut-off depending on the value of m_{kj}^{G}.

Estimated as a simple interval regression.

Table 7. Trade, Contracts, and Organized Crime

Standard Errors with Clustering

	Conservative Classification			Liberal Classification		
	Homog.	Ref. Price	Diff.	Homog.	Ref. Price	Diff.
GDP	1.309	1.040	0.888	1.262	1.001	0.886
	(0.103)	(0.076)	(0.057)	(0.105)	(0.072)	(0.053)
GDP Per Capita	-0.345	-0.436	-0.329	-0.393	-0.419	-0.313
	(0.179)	(0.128)	(0.118)	(0.173)	(0.122)	(0.112)
Contract Enforce.	1.378	1.310	1.178	1.019	1.489	1.103
	(0.633)	(0.497)	(0.362)	(0.765)	(0.432)	(0.343)
Organized Crime	0.641	0.172	0.149	0.594	0.102	0.124
	(0.352)	(0.247)	(0.190)	(0.338)	(0.225)	(0.188)
Common Border	-0.916	-0.260	0.572	-0.911	-0.089	0.461
	(0.402)	(0.184)	(0.241)	(0.329)	(0.216)	(0.253)
Com. Language	-0.242	0.945	0.439	-0.150	0.925	0.456
	(0.201)	(0.105)	(0.132)	(0.164)	(0.115)	(0.129)
Distance	-2.019	-1.227	-1.156	-1.767	-1.280	-1.216
	(0.129)	(0.079)	(0.099)	(0.112)	(0.085)	(0.106)
Tariffs	-0.568	-3.691	-5.305	-1.675	-3.349	-5.067
	(1.944)	(1.436)	(2.128)	(1.429)	(1.458)	(2.136)
Weighted Border	-1.283	-0.155	-0.052	-0.505	-0.243	-0.023
	(0.841)	(0.646)	(0.370)	(0.819)	(0.542)	(0.381)
Weighted Lang.	0.583	0.180	0.246	0.502	0.188	0.321
	(0.410)	(0.285)	(0.193)	(0.394)	(0.265)	(0.196)
Weighted Distance	0.071	0.041	0.126	0.090	0.054	0.144
	(0.086)	(0.053)	(0.040)	(0.076)	(0.048)	(0.041)
Constant	0.520	0.436	-0.090	0.610	0.369	-0.103
	(0.375)	(0.282)	(0.182)	(0.372)	(0.263)	(0.173)
Obs	1597	1597	1597	1597	1597	1597
Left-censored	143	42	26	93	45	28
Log Likelihood	-3597	-3004	-2773	-3531	-2963	-2780

Notes:

Robust standard errors (Huber-White) with clustering by importer in parentheses.

Observations on m_{ij}^{G} are left-censored at 5000;
the dependent variable $\ln\left(m_{ij}^{G} / m_{kj}^{G}\right)$ is left-censored with cut-off depending on the value of m_{kj}^{G}.

Estimated as a simple interval regression.

Table 8. Trade, Contracts, and "Crime and Theft"

Standard Errors with Clustering

	Conservative Classification			Liberal Classification		
	Homog.	Ref. Price	Diff.	Homog.	Ref. Price	Diff.
GDP	1.123	0.906	0.849	1.082	0.883	0.848
	(0.146)	(0.101)	(0.066)	(0.134)	(0.098)	(0.069)
GDP Per Capita	0.263	0.020	-0.008	0.165	0.020	0.029
	(0.289)	(0.236)	(0.199)	(0.258)	(0.230)	(0.218)
Contract Enforce.	0.781	0.949	0.902	0.435	1.218	0.838
	(0.341)	(0.273)	(0.190)	(0.384)	(0.260)	(0.203)
Crime and Theft	1.268	0.629	0.346	1.210	0.432	0.303
	(0.331)	(0.248)	(0.179)	(0.302)	(0.247)	(0.192)
Common Border	-0.671	-0.133	0.612	-0.724	0.003	0.574
	(0.567)	(0.197)	(0.293)	(0.412)	(0.262)	(0.296)
Com. Language	-0.115	1.138	0.532	-0.010	1.098	0.538
	(0.250)	(0.105)	(0.204)	(0.235)	(0.142)	(0.201)
Distance	-1.996	-1.237	-1.147	-1.777	-1.272	-1.193
	(0.161)	(0.083)	(0.119)	(0.136)	(0.099)	(0.125)
Tariffs	-0.018	-2.344	-3.310	-0.968	-2.207	-2.913
	(1.408)	(1.167)	(3.080)	(1.258)	(1.103)	(3.223)
Weighted Border	-2.461	-1.276	-0.885	-1.712	-1.308	-0.874
	(0.800)	(0.551)	(0.356)	(0.741)	(0.533)	(0.375)
Weighted Lang.	-0.171	-0.344	0.009	-0.165	-0.352	0.074
	(0.338)	(0.295)	(0.217)	(0.323)	(0.296)	(0.253)
Weighted Distance	0.262	0.189	0.184	0.312	0.161	0.194
	(0.093)	(0.066)	(0.047)	(0.107)	(0.063)	(0.048)
Constant	0.431	0.425	0.080	0.566	0.362	0.067
	(0.396)	(0.314)	(0.172)	(0.443)	(0.288)	(0.175)
Obs	925	925	925	925	925	925
Left-censored	72	18	13	42	19	13
Log Likelihood	-2023	-1664	-1514	-1988	-1657	-1521

Notes:

Robust standard errors (Huber-White) with clustering by importer in parentheses.

Observations on m_{ij}^G are left-censored at 5000;
the dependent variable $\ln\left(m_{ij}^G / m_{kj}^G\right)$ is left-censored with cut-off depending on the value of m_{kj}^G.

Estimated as a simple interval regression.