U.S. ECONOMIC SANCTIONS:
An Empirical Study

Jiawen Yang
Hossein Askari
John Forrer
Hildy Teegen

Using a gravity model, we conduct an empirical analysis of the impact of U.S. economic sanctions on U.S. trade with target countries and on third countries. Our findings show that the impact on U.S. trade is very sensitive to how the sanctioned country list is identified and selected. We find no significant impact of U.S. economic sanctions on trade between the United States and countries that are subject to selective sanctions. For only countries subject to comprehensive sanctions have we found a significant reduction in bilateral trade; and these same sanctions increased trade between target countries and the EU or Japan. Using a sample that includes only the formerly planned economies that were long the target of U.S. economic sanctions in recent history, our results show that U.S. economic sanctions have a

Jiawen Yang is an Associate Professor of International Business and International Affairs at The George Washington University.

Hossein Askari is the Iran Professor of International Business and International Affairs at The George Washington University.

John Forrer is a Research Professor and Director of the Center for the Study of Globalization at The George Washington University.

Hildy Teegen is an Associate Professor of International Business and International Affairs at The George Washington University.

ISSN: 0885-3908 print/1521-0545 online. DOI: 10.1080/08853900490277341

significant impact on U.S. exports, imports, and total trade with these countries, and these effects have lingered for more than a decade after the Cold War had ended.

* * * * *

I. INTRODUCTION

The United States has relied heavily on unilateral economic sanctions as an instrument of its foreign policy. The focus of the literature on unilateral economic sanctions has been two-fold: their effectiveness and their impacts on the sender (the sanction imposing) country. Two basic research methods have been employed: case studies and econometric estimations. As to effectiveness, most studies conclude that unilateral economic sanctions are ineffective. As is pointed out in a recent study by the Center for Strategies and International Studies (CSIS), if the purpose of the unilateral sanctions is to compel other countries to change their behavior, the unfortunate reality is that they rarely work (CSIS, 1999). But that does not mean unilateral economic sanctions have no impact on the sender or the target countries. For the United States, comprehensive economic sanctions cut public and private economic interaction with the target country and constrain most forms of political engagement. In addition, unilateral sanctions place a burden on U.S. companies and workers and on the economy as a whole—to the benefit of their international competitors (CSIS, 1999). For the target countries, these sanctions cause isolation, reduction in trade and investment flows, and deterioration in their overall economic welfare.

The literature on economic sanctions seems, however, to be somewhat unbalanced. There are more case studies than econometric analysis; the studies are more focused on the sender

countries than the target countries. Hufbauer et al. (1997) is among the few empirical studies of U.S. unilateral economic sanctions using comprehensive economic (trade) data to quantify the impact of economic sanctions.

Using a so-called "gravity model," a common method in economics for analyzing bilateral flows of goods, Hufbauer et al. (1997) estimated the reduction of U.S. exports to a number of target countries, claiming that the reduction in U.S. exports in 1995 may have eliminated 200,000 high-paid jobs with an associated loss of nearly $1 billion a year in export sector wage premiums. Their findings suggest a relatively high cost of economic sanctions to the U.S. economy while sanctions are in place.

Our objective is to conduct a comprehensive empirical analysis of U.S. unilateral economic sanctions and measure the economic impact on the United States and on third countries. We follow Hufbauer et al. (1997) in adopting the gravity model for econometric estimation, but extend their study in several aspects. First, we will employ a much longer time series for our study—from 1980 to 1998. Second, we will estimate the cost of U.S. economic sanctions on U.S. exports, imports, and total trade separately. Third, we will use the European Union and Japan, the two main competitors for U.S. trade, to analyze the third-country effect of U.S. unilateral economic sanctions.

The remainder of the article is organized as follows. In Section II we provide a description of the gravity model and its application in the study of economic sanctions, particularly the Hufbauer et al. (1997) study. In Section III we lay out the empirical model and specify the data we use in our study. In the ensuing section we provide estimates from our model and discuss the impact of U.S. unilateral sanctions on the U.S. trade. Whether the European Union and Japan have served as third-country conduits for target countries and benefited from U.S.

economic sanctions is examined in Section V. In the final section we summarize our findings and provide directions for future research.

II. THE GRAVITY MODEL AND ITS APPLICATION IN ECONOMIC SANCTION STUDIES

Newton's theory of gravitation has been used for a long time in social sciences and is considered especially useful for the analysis of bilateral trade flows because it provides an empirically tractable framework. The application in international trade is based on the premise that large economic entities such as countries or cities exert pulling power on people or their products. The simplest form of the gravity model for international trade posits that the volume of exports between any two trading partners is an increasing function of their national incomes, and decreasing function of the distance between them (Wall, 1999). The idea is that countries with a larger economy tend to trade more in absolute terms, while geographical distance (a proxy for transportation costs) should depress bilateral trade (Dell'Ariccia, 1999).

The gravity equation has been used in the analysis of a variety of international trade issues. Gould (1994) used a modified gravity model to study the empirical implications of immigrant links to their home country for U.S. bilateral trade flows. Aturupane (1999) developed a model that incorporated corruption in international trade and derived a gravity equation that related exports to the degree of corruption in the importing country as well as to other factors that determined trade flows. Dell'Ariccia (1999) used a gravity model and panel data from Western Europe to analyze the effects of exchange rate volatility

on bilateral trade flows. Exchange rate uncertainty was found to have a negative effect on international trade.

The gravity model has also been a major empirical framework for studies of economic sanctions and other discriminatory trade arrangements. Oguledo and Macphee (1994) used gravity models to estimate trade flows from 162 countries into 11 major importing countries for 1976. A major innovation of their study was that both tariffs and dummy variables for discriminatory arrangements were incorporated. In his quantitative assessment of U.S. export disincentives, Richardson (1993) estimated the losses of U.S. exports based on the gravity model. He found that the most severe U.S. export disincentives appeared to be export controls on shipments to countries due to antiproliferation and Cold War considerations and by U.S. embargoes and sanctions aimed at enforcing foreign policy. The estimated forgone U.S. exports in his study ranged from $1.7 billion to $19.9 billion in 1989 for the former Soviet Union, China, and Eastern Europe, and from $2.4 billion to $3.1 billion for other countries subject to U.S. foreign policy sanctions.

The work of Hufbauer and his colleagues (Hufbauer et al., 1997) is among the most prominent empirical studies of U.S. economic sanctions. They used a gravity model to investigate the impact of U.S. economic sanctions on U.S. exports, employment, and wages. Like most other users of the model, they predicted that the amount of trade between two countries would be positively related to the size of their economic outputs, and negatively related to the distance between them. In addition to size and distance, Hufbauer et al. (1997) examined other variables and predicted that bilateral trade would increase if the two countries shared a common border or a common language, or were both members of the same trade bloc. They employed dummy variables to represent different severities of economic

sanctions (extensive, moderate, and limited sanctions) and to capture their effect on bilateral trade flows. Their data set included bilateral trade (exports plus imports) among 88 countries for 1985, 1990, and 1995, and U.S. exports to selected countries for 1995.

The Hufbauer et al. (1997) study produced a number of interesting findings. First, when economic sanctions are in place, extensive sanctions had a large impact on bilateral trade flows, consistently reducing them by around 90 percent. There was more variance in the estimated impact of moderate and limited sanctions and the results were not quite as robust, but they suggested an average reduction in bilateral trade of roughly a quarter to a third.

Second, contrary to common belief, there was only limited evidence that sanctions continue to depress trade after they have been lifted. The authors attributed this finding to the highly aggregated nature of the data they used. Long-term effects of sanctions might be expected to be relatively more severe for particular sectors, such as sophisticated equipment and infrastructure, than for exports in the aggregate.

Third and most importantly, they found that U.S. economic sanctions in 1995 might have reduced U.S. exports to 26 target countries by as much as $15 billion to $19 billion. If there were no offsetting increase in exports to other markets, that would mean a reduction of more than 200,000 jobs in the relatively higher-wage export sector and consequent loss of nearly $1 billion annually in export sector wage premiums. This was, the study claimed, a relatively high cost to the U.S. economy while sanctions were in place.

While Hufbauer et al.'s (1997) work is deservedly the best-known econometric work on the subject, it is still open to a number of questions. First, U.S. sanctions can be on exports to a target country, on imports from a target country or on

both exports and imports. Moreover, the United States can be a major source of imports to a target country, a major destination of exports from a target country, or both. Thus it would be most useful to examine the impact of sanctions on exports and imports separately. Hufbauer et al. (1997) made more extensive use of total bilateral trade (exports to and imports from a target country) but examined exports separately for only one year. Second, a priori, we expect that econometric results would be highly sensitive to the sanction classification (limited, moderate, extensive) used. We, therefore, need to try a number of classification schemes to test the sensitivity of the results to sanction classification. Third, Hufbauer et al. (1997) used data for three years over the period of a decade (1985, 1990, 1995). Three years may be too limited for broad generalizations and a span of a decade may be too short to incorporate changes in international trade patterns over time.

From an empirical perspective, some explanatory variables included in the Hufbauer et al. (1997) study may present multicollinearity problems, which are not explicitly discussed in their paper. The variables representing distance, adjacency, shared language, and trading bloc may be correlated with one another. For example, adjacency (countries sharing a common border) is likely to be highly correlated with distance. It also seems to be obvious that countries that are members of the same trading bloc tend to be geographically adjacent and close in distance.

We cannot incorporate modifications to account for all of these shortcomings, but we will endeavor to incorporate a number of these elements into our estimation. Specifically, we will study the impact of U.S. economic sanctions on U.S. total bilateral trade, exports, and imports separately. We will also look into the third-country effects by examining how U.S. economic sanctions have affected EU and Japan's trade.

III. THE EMPIRICAL MODEL, DATA, AND METHODOLOGY

Following conventional wisdom, particularly the Hufbauer et al. (1997) study, we adopt the gravity model as our basic empirical framework to analyze the impact of U.S. unilateral economic sanctions. Controlling for *GDP* and distance, the model allows the user to isolate the effects of anomalies in international trade such as economic sanctions and other trade restrictions. More specifically, we have two objectives. First, we would like to investigate the impact of U.S. economic sanctions on the U.S. itself—on its total bilateral trade (exports plus imports) and its exports and imports separately. Second, we will look into the third-country effects of U.S. unilateral economic sanctions. It is believed that in the aftermath of U.S. sanctions, the sanctioned countries switch their trade from the United States to other countries. To the extent that trade is switched, these third-country effects may very well render U.S. unilateral sanctions ineffective. We have selected the European Union and Japan as our third country examples, as they are important alternate trading partners (and main U.S. competitors) in many sectors.

Besides economic size and geographical distance, we will also include two other variables that are expected to influence bilateral trade flows. One is a country's income level as measured by *GDP* per capita, and the other is an indicator that identifies whether a country belongs to a trade bloc, promoting intra-bloc trade.

Ordinary-least-squares (OLS) regression is used to estimate the gravity equations. As stated in Hufbauer et al. (1997), the main advantage of OLS analysis is that it can be used to estimate the independent effect of each factor, holding constant the effects of the other variables in the equation.

While the methodological setting of our study resembles that of the Hufbauer et al. (1997) study, our focus and coverage differ from theirs in several aspects.

First, Hufbauer et al. (1997) used different samples for their analysis of bilateral trade (exports + imports) and U.S. exports. For bilateral trade, Hufbauer et al. (1997) included 88 countries and more than three thousand country pairs, but narrowed their sample to include only the U.S. and its trade partners for their export analysis. In this study, we will focus on the United States to examine more closely the determinants of U.S. trade flows (exports, imports, as well as total trade) and the impact of U.S. economic sanctions on U.S. trade.

Second, we will use different classification or measures of the sanction variable to see if the results are sensitive to different classifications.

Third, Hufbauer et al. (1997) used 1985, 1990, and 1995 data for their analysis of bilateral trade, and only 1995 for analysis of exports. They included time lags for the sanctions variables to capture any lingering effects of U.S. economic sanctions. We will not use these lagged variables.

Instead, we will employ a much longer and continuous time series for our study. Specifically, we will use 19 years (1980–1998) of annual data for U.S. exports, imports, and bilateral trade. This longer time series of data will allow us to investigate, from a historical perspective, any trend changes in U.S. trade and any lingering effects of the impact of economic sanctions on U.S. trade.

Fourth, in their analysis of possible third-country effects, Hufbauer et al. (1997) examined OECD exports. We will include instead the European Union and Japan, as they represent two distinct geographical (or geopolitical) areas. Finally, our sample size for each year includes all countries whose trade statistics

are available in the CD version of the IMF's *Direction of Trade Statistics*. Therefore, the sample size for each year is much larger than the 88 countries included in the Hufbauer et al. (1997) study.

Our basic empirical model takes the following general format:

$$(1) \qquad \begin{aligned} \ln(TRADE_{ij}) = \alpha &+ \beta_1 \ln(GDP_i * GDP_j) \\ &+ \beta_2 \ln(GDPPC_i * GDPPC_j) \\ &+ \beta_3 \ln(DIST_{ij}) + \beta_4 SANO \\ &+ \beta_5 SANX + \varepsilon_{ij} \end{aligned}$$

where:

$TRADE_{ij}$ is the bilateral trade between country i and country j. As specified previously, there are three measures for this variable—export from country i to country j, import in country i from country j, and total trade (exports plus imports) between country i and country j. The bilateral trade data are taken from *Direction of Trade Statistics* (IMF). Our trade data sample spans 19 years from 1980 to 1998.

$GDP_i * GDP_j$ is the product of *GDP* of countries i and j. The *GDP* data are obtained from *World Development Indicators* (World Bank). Data are in current U.S. dollars. Dollar figures for *GDP* are derived from domestic currencies using single year official exchange rates. Given the gravity model prediction that two large countries trade more among each other than smaller countries do, we expect the estimated coefficient for this variable to be positive.

$GDPPC_i * GDPPC_j$ is the product of *GDP* per capita between countries i and j. This variable captures the income effect in international trade. Trade tends to rise at a faster rate than *GDP* as a country becomes richer, and at a slower rate than

GDP if the driving force behind a larger economy is simply an increase in population. One reason is that, as per capita income rises, individuals consume a wider variety of goods and services, which increases the demand for differentiated products. The hypothesis that rich countries trade more among themselves is also embedded in the intra-industry trade theories which help explain why industrial countries, with similar factor endowments, trade more among themselves than with developing countries as would be suggested by the Heckscher-Ohlin theory. In addition, wealthier countries tend to have lower trade barriers than poorer ones, which is another reason why higher incomes and higher trade levels go together (Hufbauer et al., 1997). The *GDP* per capita data are taken from *World Development Indicators* (World Bank). The data are based on purchasing power parity (PPP).

$DIST_{ij}$ is the distance between the countries i and j. Greater distance tends to decrease trade, as transport costs and convenience favor closer sources and markets. We follow the conventional wisdom in using the geographical distance between capital cities of the countries included in our sample for this variable. The data is obtained from John A. Byers, Swedish University of Agricultural Sciences at Alnarp at the following web site: *http://www.vsv.slu.se/johnb/java/lat-long.htm*.

SANX and *SANO* are the sanction variables used as dummies in the empirical specification. All the countries in the world are divided into three categories:

(1) countries that are subject to selected or specific U.S. sanctions;
(2) countries that are subject to overall or comprehensive U.S. economic sanctions; and
(3) countries that are not subject to U.S. economic sanctions.

SANX represents selective sanctions, assuming a value of 1 for category 1 countries and 0 for all other countries, while *SANO* represents overall, or comprehensive sanctions, assuming a value of 1 for category 2 countries and 0 for all other countries.[1]

The specification of *SANX* proves to be a challenging task for the study as there is no consistent identification or classification in the literatures. We will employ three samples (or definitions) for this variable based on available information. The first sample, denoted as *SANN*, is obtained from *Sanctions.Net* and the U.S. State Department's Embargo Reference Chart.[2] This is a fairly broad list including countries that have been sanctioned by the United States in recent history. We include in this sample all countries from the source except those that are subject to U.S. embargo or overall sanctions. The latter group of countries, to be discussed shortly, are isolated to form a separate sanction variable, *SANO*. The second sample, denoted as *SANH*, is the list used in the Hufbauer et al. (1997) study. The third sample, denoted as *SANC*, is comprised of a list of "controlled countries" established by the U.S. president as required by the Export Administration Act of 1979.[3] This list includes most of what have been referred to as "former planned economies" or "communist

[1]Selective economic sanctions, by definition, are not aimed at restricting overall trade, but only on a range of goods for specific reasons. For detailed discussions of different types of sanctions and their objectives and efficacies, see Askari et al. (2003).

[2]*Sanctions.Net* was a web site on U.S. economic sanctions. It was maintained and copyrighted by James Orr Associates. The web site was no longer accessible as of 11 June 2002. See *www.pmdtc.org/country.htm* for U.S. State Department Embargo Reference Chart (accessed April 29, 2001).

[3]The list of "controlled countries" is available from the U.S. Congress: House Report 105-851 (Report of the Select Committee on U.S. National Security and Military/Commercial Concern with the People's Republic of China, submitted by Mr. Cox of California, Chairman).

countries." We believe this third sample is more representative of U.S. economic sanctions, as these economies have been subject to U.S. sanctions throughout our sample time period (1980–1998).[4]

Hufbauer et al. (1997) included 26 target countries that were divided into three groups:

(1) countries under limited financial, travel, or trade restrictions—15 countries;
(2) countries under broader trade or financial restrictions—5 countries; and
(3) countries under comprehensive trade and financial restrictions—6 countries.

The 6 countries under comprehensive sanctions fit our *SANO* variable definition and are included in our *SANO* sample. In addition, we reclassified the 5 countries in the second group into either *SANH* or *SANO*. Specifically, we put Pakistan into selected sanctions group based on our judgment that U.S. trade with Pakistan has been less restrictive than the other four countries—Angola, Myanmar, Sudan, and Syria—which will be put in the comprehensive sanction group. Moreover, although Vietnam was

[4]Countries included to form the *SANN* variable are the following (24 countries): Armenia, Azerbaijan, Belarus, Burundi, Cambodia, China (Mainland), Democratic Republic of Congo, Republic of Congo, Cyprus, The Gambia, Guatemala, Haiti, India, Indonesia, Liberia, Mauritania, Nigeria, Pakistan, Rwanda, Somalia, Tajikistan, Turkey, Ukraine, and People's Democratic Republic of Yemen. Countries included to form the *SANC* variable are the following (20 countries): Albania, Azerbaijan, Belarus, Bulgaria, Cambodia, China (Mainland), Estonia, Georgia, Kazakhstan, Kyrgyz Republic, Lao People's Democratic Republic, Latvia, Lithuania, Moldova, Mongolia, Romania, Russia, Tajikistan, Ukraine, and Uzbekistan. The original list also includes Cuba, North Korea, and Vietnam, which we put in the group of countries subject to comprehensive U.S. economic sanctions. Armenia is excluded from *SANC* group as well, as the country has been a recipient of large-scale U.S. assistance in the 1990s. Turkmenistan is another country that has been excluded from *SANC* as it is not included in any other place as a country being sanctioned by the United States.

included in the limited restrictions group by Hufbauer et al. (1997), we believe it should be included in the comprehensive sanction group—*SANO*—as Vietnam was under comprehensive trade restrictions by the United States for much of the time period that our study covers.[5]

We had also included a trade bloc variable in our preliminary analysis, as a dummy variable indicating whether a country belongs to a trade bloc with the U.S. Any country whose imports are in general eligible for "duty free" treatment from the U.S. was considered to be in a trade bloc with the U.S. and assigned a value of "1" for the variable. Twenty-nine countries were classified into this group.[6] Our preliminary empirical result showed a strong multicollinearity between the bloc and the distance variables. When the explanatory variables are highly intercorrelated, it becomes difficult to disentangle the separate effects of each of the explanatory variables on the explained

[5]Countries included to form the *SANH* variable are the following (15 countries): Bulgaria, China (Mainland), Czech Republic, Ecuador, The Gambia, Guatemala, Hungary, India, Indonesia, Nigeria, Pakistan, Peru, Poland, Romania, and Russia. Countries included to form the *SANO* variable are as follows (12 countries): Afghanistan, Angola, Cuba, Iran, Iraq, Libya, Myanmar, North Korea, Sudan, Syrian Arab Republic, Vietnam, and Yugoslavia. Trade and other economic data for some of these countries are not available from the previously mentioned sources. Therefore, subject to limited availability, data have been gathered from other sources, such as CNN's web sites, In some cases, missing data for individual years have been extrapolated from adjacent years to bridge the gap. Although these data may not necessarily be comparable to those used for other countries, they should provide the necessary information to study the impact of U.S. economic sanctions on trade between the United States and these countries.

[6]Countries included in this group belong to one of the following designations:

(1) Countries designated as least-developed beneficiary developing countries within the Generalized System of Preferences (GSP);
(2) Countries designated as beneficiary countries for purposes of the Caribbean Basin Economic Recovery Act (CBERA);
(3) Countries designated as beneficiary countries for purpose of the Andean Trade Preference Act (ATPA); and
(4) Countries that have free trade agreements with the United States.

variable (Maddala, 1992). To highlight the impact of distance in the model, we run the regressions in our subsequent analysis without the *BLOC* variable.[7]

IV. IMPACT OF U.S. ECONOMIC SANCTIONS ON U.S. TRADE

We will examine the impact of U.S. economic sanctions on the U.S. from three perspectives:

(1) bilateral trade (exports plus imports between the United States and all its trade partners,
(2) U.S. exports, and
(3) U.S. imports.

Impact of U.S. Economic Sanctions on U.S. Bilateral Trade (Exports + Imports)

The results for U.S. bilateral trade are presented in the three panels of Table I, corresponding to the three selective sanction samples (*SANN*, *SANH*, and *SANC*) respectively.[8] The coefficients for the two main factors of the gravity equation—product of trade partners' *GDP*s and distance—throughout the samples all bear the expected signs and are highly significant statistically (at the 99 percent confidence level or better), conforming to the

[7]Maddala (1992, p. 280) suggested that if multicollinearity is a serious problem, the predictions from the model would be worse than those from a model that includes only a subset of the set of explanatory variables. So dropping the trade bloc variable may provide a reasonable estimate of the effects of distances in the regressions. Our empirical results show that dropping the trade bloc variable does not materially affect our estimates for other variables except for distance. Results with the trade bloc variable are available upon request.

[8]To save space, Table I and subsequent tables report empirical results for 1980, 1985, 1990, 1995, and 1998 only. Results for all years from 1980 to 1998 are available upon request.

Table I
U.S. Economic Sanctions on U.S. Total Trade
(Exports + Imports)

Panel A: *SANN*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−25.0768	0.8680	0.4174	−0.8097	−1.4937	0.3398
	0.0000	0.0000	0.0030	0.0002	0.0070	0.3456
1985	−24.6037	0.8839	0.2843	−0.7364	−1.2030	0.1625
	0.0000	0.0000	0.0073	0.0000	0.0037	0.5657
1990	−25.3515	0.8951	0.3316	−0.8951	−1.1461	0.5436
	0.0000	0.0000	0.0036	0.0000	0.0302	0.1103
1995	−27.8545	0.9572	0.2191	−0.7878	−1.1399	0.1525
	0.0000	0.0000	0.0541	0.0000	0.0176	0.5897
1998	−28.4613	0.8968	0.3525	−0.6308	−1.9659	0.2014
	0.0000	0.0000	0.0025	0.0009	0.0000	0.5024

Panel B: *SANH*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−24.6555	0.8745	0.3795	−0.8183	−1.5422	0.0826
	0.0000	0.0000	0.0059	0.0002	0.0056	0.8288
1985	−24.6373	0.8992	0.2466	−0.7429	−1.2781	−0.1965
	0.0000	0.0000	0.0182	0.0000	0.0021	0.5171
1990	−25.1418	0.9085	0.2873	−0.9031	−1.2426	0.1348
	0.0000	0.0000	0.0105	0.0000	0.0199	0.7034
1995	−27.7290	0.9608	0.2029	−0.7873	−1.1676	0.0333
	0.0000	0.0000	0.0665	0.0000	0.0149	0.9167
1998	−28.1768	0.8949	0.3416	−0.6276	−1.9844	0.1827
	0.0000	0.0000	0.0027	0.0009	0.0000	0.5889

Panel C: *SANC*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−24.9218	0.8894	0.3524	−0.8203	−1.5827	−0.6529
	0.0000	0.0000	0.0080	0.0002	0.0042	0.4456
1985	−24.8882	0.9030	0.2460	−0.7355	−1.2794	−0.9600
	0.0000	0.0000	0.0143	0.0000	0.0018	0.1571
1990	−25.5822	0.9237	0.2590	−0.8757	−1.3644	−1.5305
	0.0000	0.0000	0.0142	0.0000	0.0078	0.0022
1995	−27.7240	0.9659	0.1709	−0.7349	−1.3169	−0.9445
	0.0000	0.0000	0.1012	0.0000	0.0043	0.0004
1998	−28.3785	0.8880	0.3623	−0.5991	−1.6763	−0.5564
	0.0000	0.0000	0.0014	0.0020	0.0003	0.0596

Note: Numbers in first row for each year are estimated coefficients; numbers in second row represent levels of statistical significance (e.g., 0.01 corresponds to a 99% signficance level).

empirical findings in the literature. The explanatory power of our empirical models (R^2) is very stable, ranging mostly above 0.80.

Since all regressions are logarithmic, the coefficients on the explanatory variables can be interpreted as elasticities. Our findings yield a number of interesting results as compared with those estimated by Hufbauer et al. (1997). First, we have relatively larger estimates for the elasticity of trade with respect to the *GDP*-product variable ($GDP_i * GDP_j$). The estimates were 0.77, 0.79, and 0.81 for 1985, 1990, and 1995, respectively, in the Hufbauer et al. (1997) study. Our estimates are consistently larger than 0.85 throughout the years from 1980 to 1998. One plausible explanation for this difference may be due to the sample selection. Hufbauer et al. (1997) included 88 countries and 3,827 different country pairs in their data set. We use all 225 countries represented in the IMF *Direction of Trade Statistics* (the specific number of countries for each individual year varies in our sample due to missing values), but we limit our country pairs to only the United States and its trade partners, allowing us to focus on U.S. trade alone. The relatively larger elasticity we have obtained may reflect the fact that the United States is more open to trade than average and is the largest trading nation in the world.[9] While we may not be able to draw inferences on world trade from our samples, we are able to more closely estimate U.S. trade and thus the impact of economic sanctions.

The estimated coefficients for the second control variable in our regression model, the product of *GDP* per capita ($GDPPC_i * GDPPC_j$), are all positive and mostly significant at the 90% confidence interval or better. The estimates range from 0.18 in 1997 to 0.42 in 1980 for the *SANN* sample, from 0.18 in

[9]There are certainly different measures of openness of an economy. Tariff rates may serve as one indication. The simple average tariff rates were about 10% for the EU in 1996, and 9.4% for Japan in 1997, while that for the United States was 6.3% in 1996 (the World Trade Organization, Trade Policy Reviews, various issues).

1991 to 0.38 in 1980 for the *SANH* sample, and from 0.16 in 1991 to 0.36 in 1998 for the *SANC* sample. For the same variable—$GDPPC_i * GDPPC_j$, the estimates in Hufbauer et al. (1997) were 0.21 for 1985 and 0.09 for both 1990 and 1995. Again our estimates are consistently greater, reflecting possibly the specific characteristics of U.S. trade. The positive estimates provides further evidence that richer countries trade more with the United States in comparison with poorer countries' trade with the United States.

The coefficients for the distance variable are persistently negative and statistically significant at better than the 99% interval, ranging from -0.5896 in the *SANC* sample for 1994 to -0.9380 in the *SANH* sample for 1991. A historical trend seems to appear for the estimated coefficients for the distance variable. While geographical distance is still a major hindrance to international trade in today's modern world, as suggested by the high statistical significance of our estimates, the results seem to indicate a more or less declining trend in the importance of distance between the United States and its trade partners for bilateral trade. Indeed, as policy-inflicted trade barriers are being torn down, geographical distances between trade partners may remain a prominent natural trade barrier between nations. But technological improvements in international transportation and reduction in international transportation costs should reduce the adverse impact of distance on trade.

Our primary interest in this research is in the estimates for the sanction variables. As stated earlier, we divide all countries that are subject to U.S. economic sanctions into two groups: those with selective sanctions (*SANX*) and those with comprehensive sanctions (*SANO*). The parameter estimates for these two dummy variables are supposed to capture the direct impact of U.S. economic sanctions on bilateral trade between the United States and these two groups of countries, respectively.

A number of observations can be made through examining the results presented in Table I. First, the estimates show no statistically significant impact of U.S. economic sanctions on bilateral trade between the United States and the target countries when the *SANN* and *SANH* samples are used. For the *SANN* sample, the estimates are mostly positive—contrary to what is expected, albeit statistically insignificant except for that of 1982. Only two negative but insignificant estimates are obtained for 1992 and 1994. For the *SANH* sample, more negative estimates are obtained but none of the estimates is, no matter negative or positive, statistically significant at the 90% level or better. Based on these two samples, we conclude that selective economic sanctions imposed by the United States have no noticeable impact on the bilateral trade flows between the United States and these sanctioned countries.

This finding is in sharp contrast with those obtained in Hufbauer et al. (1997). For all the three categories of sanctions they used—limited sanctions, moderate sanctions, and comprehensive sanctions—their estimated coefficients on the dummy variables representing the presence of these sanctions in the base years 1985, 1990, and 1995 were negative with high statistical significance (at the 99 percent confidence level or better) with two exceptions, moderate sanctions in 1990, which are still significant at the 95 percent level, and limited sanctions in 1995, which are statistically significant just below the 90 percent level.

The difference between our results for the *SANN* and *SANH* samples and those in Hufbauer et al. (1997) may be due to two reasons. First, as mentioned before, the data set used in Hufbauer et al. (1997) included country pairs among 88 countries while ours include only the United States and its trade partners. Second and maybe more importantly, there is a significant discrepancy between our *SANN* sample and their sample in target country identification, although some overlapping does

exist. Countries subject to selective U.S. sanctions in our sample (*SANN* variable) corresponds more or less to countries subject to limited and moderate U.S. sanctions in the Hufbauer et al. (1997) sample. Both samples included Angola, Burma, China, Guatemala, India, Indonesia, Nigeria, Pakistan, and The Gambia (9 countries). Bulgaria, Czech Republic, Ecuador, Hungary, Peru, Poland, Romania, and Russia (8 countries) were included in the Hufbauer et al. (1997) sample, but are not included in our *SANN* sample. On the other hand, Armenia, Azerbaijan, Belarus, Burundi, Cambodia, Congo, Cyprus, Haiti, Liberia, Mauritania, Rwanda, Somalia, Tajikistan, Turkey, Ukraine, Yemen, and Zaire (17 countries) are included in our sample, but were not included in theirs. What is perplexing is that we cannot get a result close to theirs even when we use the same sample they had used in their study. It seems that the estimated impact of economic sanctions on bilateral trade depends crucially on the selection or identification of the target countries and the datasets being used.

Second, our *SANC* sample, however, has produced results that are more in line with our expectations. As shown in Table I, the estimates for this variable are consistently negative throughout the years, and are statistically significant at the 90% level or better for 1987 to 1997. The estimates vary substantially from year to year, ranging among the statistically significant estimates from -0.5564 in 1998 to -2.04 in 1992, indicating a trade reduction of about 42% to 87% for these two years, respectively.[10]

[10]The reduction in trade flows due to sanctions can be calculated by taking the exponent of the coefficient value for the sanction dummy and subtracting 1. For example, if the estimated coefficient is -0.5, the value of the natural number e taken to the power of -0.5 is 0.61. This indicates that bilateral trade was only 61% of what it should be in the normal case. In other words, the economic sanction causes a 39% reduction in the bilateral trade flow.

Our estimates for the impact of U.S. comprehensive economic sanctions (*SANO*) are consistent across samples. They are all negative and statistically significant except for 1987 and 1992 for the *SANN* and *SANH* samples, ranging among the statistically significant estimates from −0.96 (for 1987) to −3.48 (for 1989) in Sample *SANC*. These estimates are more compatible with those obtained by Hufbauer et al. (1997) for their extensive sanctions group—−2.424, −2.288, and −2.510 for 1985, 1990, and 1995, respectively. These estimates represent severe impact of U.S. economic sanctions on trade between the United States and the sanctioned countries. For example, estimated coefficients of −0.96 and −3.48 suggest a trade reduction of about 61% and 97%, respectively. Our results show that, for 1988, 1989, and 1993 for which our estimates are close or greater than −2.5 in absolute magnitude, U.S. economic sanctions had effectively wiped out more than 90% of trade between the United States and the sanctioned countries. This result should not be surprising. After all the goal of a total trade embargo is clearly to reduce trade to zero; if it did not, then the laws were not being enforced and it would not qualify as a total trade embargo.

Impact of U.S. Economic Sanctions of U.S. Exports

The empirical estimates for the gravity model for U.S. exports are presented in Table II for the three selective sanction samples. The findings are essentially consistent with those for U.S. bilateral trade (exports plus imports). The estimated coefficients for the product of *GDP* variable are all positive and statistically significant at the 99 percent level or better. Like the estimates for U.S. bilateral trade, the estimates for U.S. exports are very stable and are in general higher than the estimate of 0.86 for 1995 obtained in Hufbauer et al. (1997).

Table II
U.S. Economic Sanctions on U.S. Exports

Panel A: *SANN*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−26.6336	0.9354	0.3449	−0.9867	−1.9496	0.2077
	0.0000	0.0000	0.0085	0.0000	0.0002	0.5374
1985	−23.4069	0.9270	0.1615	−0.9997	−1.0814	0.1027
	0.0000	0.0000	0.1279	0.0000	0.0096	0.7196
1990	−23.0540	0.8607	0.3640	−1.1127	−0.9371	0.2444
	0.0000	0.0000	0.0008	0.0000	0.0617	0.4481
1995	−25.4805	0.9369	0.2347	−1.0643	−0.9654	0.0486
	0.0000	0.0000	0.0327	0.0000	0.0368	0.8584
1998	−24.7769	0.8679	0.3748	−1.0285	−1.9733	−0.0406
	0.0000	0.0000	0.0007	0.0000	0.0000	0.8862

Panel B: *SANH*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−26.3393	0.9354	0.3304	−0.9905	−1.9648	0.1297
	0.0000	0.0000	0.0101	0.0000	0.0002	0.7163
1985	−23.5557	0.9448	0.1232	−1.0066	−1.1595	−0.2751
	0.0000	0.0000	0.2377	0.0000	0.0055	0.3694
1990	−23.0209	0.8699	0.3392	−1.1168	−0.9945	−0.0111
	0.0000	0.0000	0.0015	0.0000	0.0476	0.9735
1995	−25.5722	0.9447	0.2196	−1.0666	−0.9969	−0.1374
	0.0000	0.0000	0.0395	0.0000	0.0306	0.6538
1998	−24.8168	0.8674	0.3782	−1.0289	−1.9660	−0.0176
	0.0000	0.0000	0.0005	0.0000	0.0000	0.9560

Panel C: *SANC*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−26.4547	0.9442	0.3131	−0.9937	−1.9925	−0.1143
	0.0000	0.0000	0.0118	0.0000	0.0002	0.8866
1985	−23.5824	0.9389	0.1377	−0.9995	−1.1288	−0.5866
	0.0000	0.0000	0.1738	0.0000	0.0064	0.3942
1990	−23.2616	0.8765	0.3250	−1.0932	−1.0685	−1.2155
	0.0000	0.0000	0.0014	0.0000	0.0281	0.0103
1995	−25.4161	0.9421	0.1997	−1.0124	−1.1170	−0.9245
	0.0000	0.0000	0.0471	0.0000	0.0116	0.0003
1998	−24.7576	0.8684	0.3565	−0.9818	−2.0954	−0.8039
	0.0000	0.0000	0.0005	0.0000	0.0000	0.0027

The estimated coefficient for the product of *GDP* per capita ($GDPPC_i * GDPPC_j$) are similar to those for U.S. bilateral trade, all positive and mostly significant at the 90% confidence interval or better. The results seem to demonstrate two interesting characteristics. First, they are generally smaller than those obtained for U.S. bilateral trade. This is consistent with the results for the product of *GDP* variable. It seems that although per capita income and *GDP* size have a positive and significant impact on U.S. exports, their impact is smaller than that on U.S. total trade. Second, all the estimates are higher than what Hufbauer et al. (1997) obtained (0.14) for the same variable for U.S. exports in 1995. In fact their estimate was not statistically significant.

Our estimates for the distance variable in the regressions are all negative and statistically significant at the 99% confidence level or better, ranging around −1.0. These numbers are generally higher in absolute terms than those obtained for U.S. bilateral trade, which are mostly under 0.90 (see Table I). This result indicates that U.S. exports are more distance-sensitive than is overall U.S. bilateral trade.

Our estimates show that selective U.S. economic sanctions have no obvious impact on U.S. exports based on the results obtained for the *SANN* and *SANH* samples (see Panels A and B in Table II). As one reviewer of this article points out, this finding addresses an important policy issue. Several governments of targeted countries claim that U.S. selective sanctions harm their economic development. That claim may not be substantiated by our empirical results.

In contrast, the *SANC* sample presents very different findings (see Panel C of Table II): The parameter estimates are consistently negative and statistically significant at the 90% level or better for 1987 through 1998. The estimates range from −0.67 in 1996 to −2.25 in 1989, indicating, respectively, an average

export reduction of 49% and 89% for 1996 and 1989, respectively, from what they should have been if no sanctions were in place. This finding differs from Hufbauer et al. (1997) who found limited evidence that sanctions continue to depress trade after they had been lifted. The difference in our finding illustrates the importance of different classifications of the target groups of U.S. economic sanctions. Our findings are, however, consistent with those of Richardson (1993) who found "the former communist bloc" to be a large negative outliers in U.S. exports.

The empirical literature on economic sanctions has emphasized the magnitude of export losses because of sanctions. Our estimated losses of U.S. exports to targeted countries of U.S. selective economic sanctions for years 1987 through 1998, for which the estimated coefficients for the sanction variable *SANC* are statistically significant, are presented in Table III. For the 20 countries that are included in the *SANC* sample, the total losses vary widely across years, ranging from $4.3 billion in 1987 to $20.5 billion in 1989. Russia and China are the two countries for which U.S. export losses have been the largest among the countries in the group. This is, again, consistent with Richardson's (1993) estimates.

U.S. export losses to target countries subject to U.S. comprehensive economic sanctions (*SANO*) are calculated in the same way and the results are presented in Table IV. The export loss to this group of countries ranges from $1.8 billion in 1992 to $5.6 billion in 1997. U.S. export losses to Iran and Cuba are the largest in this group. Two caveats should be noted in interpreting these estimates. First, the estimates do not present a full assessment of the losses, as they do not include Myanmar for the entire time series or several other countries for most of the time period due to missing values in the dataset. Second, as mentioned in Hufbauer et al. (1997), the estimated coefficients for the sanction

Table III
Estimated Loss of U.S. Exports to Targets of Selected Sanctions (Millions of U.S. Dollars)

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Albania	—	—	—	39	17	17	17	29	34	32	30	44
Azerbaijan	147	163	213	142	112	99	42	37	30	26	34	41
Belarus	446	492	809	641	541	686	365	314	269	223	292	352
Bulgaria	456	364	477	353	159	229	144	147	188	117	131	177
Cambodia	7	9	9	8	10	19	12	17	19	15	17	17
China, P.R.	1,640	1,620	2,761	1,862	2,129	3,081	2,117	3,829	4,821	3,498	5,294	4,774
Estonia	—	—	—	172	115	126	69	72	85	71	84	113
Georgia	—	—	—	1	115	87	36	31	35	43	55	62
Kazakhstan	575	663	977	768	509	634	353	309	302	253	314	324
Kyrgyz Repub.	49	59	84	41	30	38	40	33	32	15	16	19
Lao People's Rep.	—	5	7	7	7	12	9	12	13	11	11	10
Latvia	144	163	246	215	142	125	63	71	61	55	66	91
Lithuania	187	228	339	—	—	—	97	98	112	110	147	190
Moldova	—	—	—	—	—	64	57	37	40	19	23	22
Mongolia	—	—	—	—	—	—	6	7	9	8	8	11
Romania	632	624	889	625	389	504	323	398	455	354	443	499
Russia	—	—	12,273	8,067	6,566	7,428	4,069	4,186	4,255	3,671	4,870	2,980
Tajikistan	45	52	67	55	40	42	24	19	17	12	14	17
Ukraine	—	834	1,318	1,103	823	1,328	643	556	492	440	460	380
Uzbekistan	—	—	—	—	—	265	163	190	191	143	182	155
Total	**4,328**	**5,276**	**20,469**	**14,099**	**11,704**	**14,784**	**8,649**	**10,392**	**11,460**	**9,116**	**12,491**	**10,278**

Note: See description of calculation at end of Table IV.

Table IV
Estimated Loss of U.S. Exports to Targets of Comprehensive Sanctions
(Millions of U.S. Dollars)

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Afghanistan	—	—	—	—	—	—	—	—	—	160	186	158
Angola	67	81	124	92	156	56	73	42	54	94	96	97
Cuba	—	—	—	—	—	—	919	690	838	1,153	1,483	1,099
Iran	1,173	1,136	1,682	1,044	1,368	982	1,125	734	783	1,230	1,606	1,547
Iraq	—	—	—	—	—	—	—	—	—	147	325	623
Libya	345	352	515	460	717	469	610	415	446	683	733	615
North Korea	—	—	—	—	—	—	—	—	—	225	237	188
Sudan	142	114	166	91	129	49	90	73	67	85	124	118
Syria	119	127	156	132	201	137	216	178	196	259	265	268
Vietnam	166	102	55	20	84	57	115	111	142	198	244	232
Yugoslavia	—	—	—	—	—	—	—	—	—	250	308	293
Total	**2,012**	**1,912**	**2,698**	**1,839**	**2,655**	**1,750**	**3,148**	**2,243**	**2,526**	**4,484**	**5,607**	**5,238**

Note: Calculation of losses of U.S. exports due to U.S. economic sanctions.
Using the predicted values and parameter estimates, we can calculate the losses of U.S. exports due to U.S. economic sanctions as follows:

$$LE_{i,t} = NE_{i,t} - PE_{i,t} = e^{N_{i,t}} - e^{P_{i,t}} = e^{P_{i,t}} \left(\frac{1}{e^{\beta_{SANC,t}}} - 1 \right)$$

where:

$LE_{i,t}$: Estimated loss of U.S. exports to country i in time t;
$NE_{i,t}$: Estimated U.S. exports to country i in time t if no sanctions were in place;
$PE_{i,t}$: Predicted value of U.S. exports to country i in time t based on regression with sanctions;
e: The base for natural logarithm;
$N_{i,t}$: Estimated value in logarithm of U.S. exports to country i in time t if no sanctions were in place;
$P_{i,t}$: Predicted value in logarithm of U.S. exports to country i in time t from regressions with sanctions; and
$\beta_{SANC,t}$: Parameter estimate for $SANC$ variable for time t.

variables represent averages, so caution should be exercised in interpreting the country-by-country results.

Table V provides a summary of the U.S. export losses due to both selective and comprehensive U.S. economic sanctions. The average annual loss of U.S. exports since 1989 is more than $15 billion. These estimates are very comparable to those obtained by Hufbauer et al. (1997) despite the differences in the datasets used and the time periods covered in the two studies. Hufbauer et al. (1997) suggested that U.S. exports were $15 billion to $19 billion lower than they would have been if not for the sanctions in place in 1995. Although our estimate for the U.S. export loss for 1995 is slightly lower at $14 billion, our estimates for some other years are higher (for example, $23.2 billion for 1989, $16.5 billion for 1992 and $18.1 billion for 1997).

Table V
Estimated Loss of U.S. Exports to U.S. Economic Sanctions (Millions of U.S. Dollars)

Year	Due to Comprehensive Sanctions	Due to Selective Sanctions	Total
1987	2,012	4,328	6,340
1988	1,912	5,276	7,188
1989	2,698	20,469	23,167
1990	1,839	14,099	15,938
1991	2,655	11,704	14,359
1992	1,750	14,784	16,534
1993	3,148	8,649	11,797
1994	2,243	10,392	12,635
1995	2,526	11,460	13,986
1996	4,484	9,116	13,600
1997	5,607	12,491	18,098
1998	5,238	10,278	15,516
Average	**3,009**	**11,087**	**14,097**
Average since 1989	**3,219**	**12,344**	**15,563**

Impact of U.S. Economic Sanctions of U.S. Imports

The estimated impact of U.S. economic sanctions on U.S. imports is presented in Table VI for the three sanction samples. Estimates of the *GDP* product coefficients are all positive and statistically significant at the 99% level or better. The estimates present a clear upward trend for the elasticity of U.S. imports with respect to the economic size of U.S. import sources, contrary to that for U.S. exports. They are on average larger than the estimates for U.S. bilateral trade and U.S. exports, indicating U.S. imports are more sensitive to the size of the partner's economy.

The estimates for the *GDP* per capita variable, *GDPPC*, are as robust as the *GDP* aggregate variable. They are all positive but statistically significant for only about half of the cases. It seems that U.S. imports are not affected by the income level of the source countries as much as U.S. exports and total trade are. The results for the distance and the BLOC variables in the U.S. import case follow very much the same patterns as those for U.S. total trade and U.S. exports. Estimates for the distance variable are consistently negative and statistically significant.

The identification of sanctioned countries is again a crucial factor in evaluating the impact of U.S. economic sanctions on U.S. imports. For the *SANN* and *SANH* samples, the parameter estimates for the selective sanction variable have mixed signs and only one of the negative estimates (the expected sign) show statistical significance at the 90% level. The estimates for the *SANC* sample are, however, consistently negative and statistically significant at the 90% level or better for years 1987 to 1997 (except for 1991). The magnitude of the estimates for these years ranges from -0.69 in 1997 to -2.60 in 1992, indicating that U.S. imports from these sanctioned countries were only 50% and less that 8% of what they would have been if these sanctions were

Table VI
U.S. Economic Sanctions on U.S. Imports

Panel A: *SANN*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−26.5216	0.9436	0.2302	−0.8147	−0.7553	−0.2835
	0.0000	0.0000	0.2395	0.0050	0.3561	0.5688
1985	−33.5853	0.9552	0.4701	−0.5989	−1.9651	−0.0802
	0.0000	0.0000	0.0081	0.0284	0.0068	0.8631
1990	−31.4791	0.9971	0.2733	−0.7848	−1.8158	0.7284
	0.0000	0.0000	0.0859	0.0016	0.0215	0.1200
1995	−31.8469	1.0637	0.1071	−0.8450	−1.4730	0.0125
	0.0000	0.0000	0.5054	0.0009	0.0441	0.9750
1998	−37.9399	1.0522	0.2946	−0.4720	−0.9211	0.2493
	0.0000	0.0000	0.0540	0.0645	0.1467	0.5291

Panel B: *SANH*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−27.0356	0.9508	0.2372	−0.8131	−0.7581	−0.3054
	0.0000	0.0000	0.2138	0.0050	0.3544	0.5586
1985	−33.7796	0.9617	0.4627	−0.5999	−1.9809	−0.1719
	0.0000	0.0000	0.0083	0.0280	0.0064	0.7299
1990	−31.0551	1.0099	0.2200	−0.7944	−1.8994	0.2953
	0.0000	0.0000	0.1605	0.0015	0.0171	0.5440
1995	−31.5821	1.0504	0.1262	−0.8388	−1.4332	0.2981
	0.0000	0.0000	0.4193	0.0010	0.0491	0.5035
1998	−37.4014	1.0403	0.2957	−0.4647	−0.9069	0.4355
	0.0000	0.0000	0.0469	0.0683	0.1503	0.3282

Panel C: *SANC*

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−27.4352	0.9624	0.2221	−0.8058	−0.7654	−1.7174
	0.0000	0.0000	0.2225	0.0050	0.3435	0.1386
1985	−34.1217	0.9693	0.4561	−0.5921	−1.9924	−1.1329
	0.0000	0.0000	0.0070	0.0293	0.0056	0.3093
1990	−31.6820	1.0344	0.1735	−0.7596	−2.0601	−1.9676
	0.0000	0.0000	0.2407	0.0018	0.0075	0.0042
1995	−31.7738	1.0658	0.0780	−0.7888	−1.6310	−0.9205
	0.0000	0.0000	0.6046	0.0017	0.0229	0.0148
1998	−37.7870	1.0612	0.2506	−0.4374	−1.0775	−0.5367
	0.0000	0.0000	0.0844	0.0861	0.0861	0.1569

not in place in the respective years. The different results across samples also indicate that U.S. economic sanctions on formally planned economies have a consistent impact on U.S. imports from these countries.

Finally, the estimates for the comprehensive sanction variable, *SANO*, are all negative and statistically significant at the 99% level or better for most years. The magnitude of some estimates for several years is well over -2.5 in absolute values, representing virtually over 90% reduction of U.S. imports from the countries being sanctioned.

V. U.S. ECONOMIC SANCTIONS: Impact on the EU and Japan

Since the *SANC* variable is statistically more significant in measuring the impact of U.S. economic sanctions on U.S. trade (bilateral trade, exports and imports), we use only this variable in our empirical analyses for the impact of U.S. economic sanctions on trade for the European Union (EU) and Japan. As specified before, the *SANC* variable represents a list of countries that have often been referred to as former planned economies, or what are now called "economies in transition."

The estimated coefficients for the two pillars of the gravity model (product of *GDP* and geographical distances) for the EU and Japan are consistent with those for the United States in terms of the expected signs and statistical significance (see Tables VII and VIII). While the estimates for the *GDP* variable are generally smaller as compared with those for the United States, the numbers for Japan are on average larger than those obtained for the EU, indicating economic size of trading partners has a relatively greater impact on Japan's trade than on that for the EU. Comparison of the estimates between the two economic entities also seems to suggest that this impact has a declining

Table VII
U.S. Economic Sanctions on EU Trade

Panel A: Total Trade

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−16.5583	0.7546	0.2063	−0.5690	−0.1868	−0.6808
	0.0000	0.0000	0.0048	0.0000	0.5646	0.1848
1985	−16.6754	0.7852	0.1602	−0.6669	−0.3971	−0.5716
	0.0000	0.0000	0.0172	0.0000	0.1733	0.2461
1990	−18.0218	0.8015	0.1357	−0.6197	0.0097	−1.2552
	0.0000	0.0000	0.0102	0.0000	0.9677	0.0000
1995	−19.1285	0.8230	0.1111	−0.6271	0.0885	−0.5665
	0.0000	0.0000	0.0462	0.0000	0.7068	0.0002
1998	−20.8360	0.8146	0.2001	−0.5647	−0.3828	−0.2092
	0.0000	0.0000	0.0011	0.0000	0.0812	0.1868

Panel B: Exports

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−14.5891	0.7465	0.1405	−0.7266	0.0648	−0.5616
	0.0000	0.0000	0.0886	0.0000	0.8609	0.3367
1985	−15.2527	0.7649	0.1460	−0.7789	−0.3115	−0.1727
	0.0000	0.0000	0.0352	0.0000	0.3005	0.7339
1990	−15.6501	0.7687	0.1079	−0.7286	−0.0693	−1.1348
	0.0000	0.0000	0.0456	0.0000	0.7780	0.0000
1995	−18.7106	0.7919	0.1694	−0.6912	0.0462	−0.5137
	0.0000	0.0000	0.0059	0.0000	0.8582	0.0018
1998	−19.8531	0.7950	0.2222	−0.6969	−0.4470	−0.1998
	0.0000	0.0000	0.0011	0.0000	0.0669	0.2560

Panel C: Imports

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−21.9727	0.8249	0.2172	−0.4624	−0.7165	−0.8354
	0.0000	0.0000	0.0272	0.0000	0.1043	0.2288
1985	−20.8063	0.8430	0.1509	−0.5970	−0.5684	−1.1157
	0.0000	0.0000	0.0883	0.0000	0.1413	0.0884
1990	−23.9583	0.8806	0.1426	−0.5122	0.0606	−1.4124
	0.0000	0.0000	0.0545	0.0000	0.8577	0.0000
1995	−22.6935	0.9088	−0.0061	−0.5935	0.1765	−0.5447
	0.0000	0.0000	0.9360	0.0000	0.5838	0.0076
1998	−25.2788	0.8774	0.1617	−0.4449	−0.3187	−0.1862
	0.0000	0.0000	0.0437	0.0000	0.2724	0.3750

Table VIII
U.S. Economic Sanctions on Japan's Trade

Panel A: Total Trade

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−19.2477	0.9322	0.1307	−1.2577	−0.4294	−1.2728
	0.0000	0.0000	0.2437	0.0000	0.4035	0.1251
1985	−16.9761	0.8438	0.2892	−1.3506	−0.7285	−0.6524
	0.0000	0.0000	0.0045	0.0000	0.1045	0.3991
1990	−12.1581	0.7719	0.2997	−1.5730	−0.5429	−1.8257
	0.0000	0.0000	0.0006	0.0000	0.1743	0.0000
1995	−16.3625	0.8632	0.1600	−1.4275	−0.3622	−2.2009
	0.0000	0.0000	0.1561	0.0000	0.4522	0.0000
1998	−18.1237	0.8207	0.3280	−1.3119	−0.9571	−2.0308
	0.0000	0.0000	0.0021	0.0000	0.0161	0.0000

Panel B: Exports

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−17.8642	0.8886	0.1564	−1.2750	−0.4040	−1.0974
	0.0000	0.0000	0.1392	0.0000	0.3995	0.1560
1985	−14.7959	0.7907	0.3221	−1.4206	−0.4930	−0.3135
	0.0000	0.0000	0.0007	0.0000	0.2326	0.6603
1990	−11.0698	0.7385	0.2945	−1.5547	−0.6377	−2.1243
	0.0000	0.0000	0.0002	0.0000	0.0806	0.0000
1995	−17.5160	0.8675	0.1283	−1.3269	−0.5658	−2.6707
	0.0000	0.0000	0.2705	0.0000	0.2564	0.0000
1998	−20.4974	0.8259	0.3148	−1.1043	−1.1633	−2.1480
	0.0000	0.0000	0.0021	0.0000	0.0024	0.0000

Panel C: Imports

Year	α	β_1	β_2	β_3	β_4	β_5
1980	−22.4158	1.0057	0.0124	−1.2371	−0.7800	−1.3051
	0.0002	0.0000	0.9403	0.0013	0.3003	0.2820
1985	−22.6261	1.0044	0.0840	−1.3804	−1.8901	−1.2828
	0.0001	0.0000	0.5966	0.0003	0.0073	0.2861
1990	−20.5714	0.9588	0.2510	−1.7840	−1.1962	−1.2508
	0.0006	0.0000	0.1495	0.0000	0.1389	0.1305
1995	−23.2124	0.9744	0.2106	−1.5701	−0.9769	−1.6131
	0.0000	0.0000	0.2163	0.0000	0.1777	0.0013
1998	−23.5616	0.9509	0.3038	−1.5832	−1.0275	−1.7320
	0.0000	0.0000	0.0659	0.0000	0.0939	0.0005

trend for Japan but an increasing trend for the EU. A plausible explanation for this observation may be that Japan has gradually diversified its trade to developing countries, particularly those within Asia. On the other hand, integration among the EU countries has increased trade among members whose economic size is among the largest in the world. As Pollard (2001) points out, the European Union is the most highly integrated regional trade area. In 1980, 57 percent of the total merchandise trade (exports plus imports) of the European Union was within the region. This share increased to 66 percent in 1990 but has declined somewhat since then (partly as a result of increased trade with the former Soviet block countries).

Estimates for the distance variable also show a remarkable difference between the EU and Japan. For Japan, the estimates for all types of trade (total, exports, and imports) are greater than 1 in absolute value for all years. This indicates that geographical distance has major impact on Japan's trade. This finding may also be attributed to the fact that Japan trades relatively more with neighboring Asian economies. The estimates for the EU, on the other hand, vary within the -0.50 and -0.70 range, indicating that EU's trade is much less affected by physical distance with its trade partners.

The *GDP* per capita variable, *GDPPC*, has shown mixed results for both Japan and the EU. For the EU, this factor seems to affect its exports and total trade more significantly than its imports. But it seems the opposite is true for Japan—the estimates for its imports and total trade have shown greater statistical significance than its exports.

One of our objectives in this study is to see if U.S. economic sanctions have caused a shift in trade from the U.S. to other major trading nations in the world. Our findings do not support this common belief. The estimates for the *SANC* variable are consistent for both the EU and Japan and across all trade

measures: total trade, exports and imports—all negative and mostly statistically significant at the 90% level or better for years since the late 1980s. The magnitude of the estimates is also compatible with those obtained for the United States. The impact seems to be more striking for the EU in 1992. All its exports, imports, and total trade with the sanctioned countries for that year are estimated at about only 8% of what they would have been if the sanctions were not in place.

An interesting finding in our results is that the overall sanction variable, *SANO*, does not show a consistent sign, and is no longer statistically significant for Japan or the EU, in all measures of trade. In fact, for some years, the estimated coefficients are significantly positive. This is an indication that U.S. comprehensive economic sanctions have some third-country effects. That is, while U.S. comprehensive economic sanctions have caused significant reduction of trade between the United States and the target countries, these same sanctions have caused expansion of trade between the EU or Japan and the target countries.

The difference in the third country effects between the *SANC* and *SANO* groups is due to lingering effects of multilateral economic sanctions imposed on the *SANC* countries during the Cold War. Some U.S. economic sanctions against the *SANC* countries have been historically part of some multilateral arrangements in which the EU member countries and Japan had also participated.[11] Although the EU countries and Japan have lifted most of these sanctions since the end of the Cold War, trade flows between the EU countries or Japan with the *SANC* countries have not reached their normal levels as suggested by the gravity

[11] One example of such multilateral arrangements was the Coordinating Committee on Multilateral Export Controls (COCOM), which was the primary multinational organization to control exports to proscribed countries—mainly the *SANC* countries until its dissolution in 1994.

model. As one of the reviewers of this article points out, some *SANC* economies often had trouble absorbing external resources. The persistence of related internal structures even after the collapse of command system, such as state-owned enterprises, may explain why trade appears lower than the gravity model would predict. In the case of some *SANO* countries, such as Iran, U.S. economic sanctions are unilateral in nature, allowing for third-country effects.

VI. SUMMARY OF FINDINGS AND FUTURE RESEARCH

Our empirical study yields a number of interesting and important findings. First, our results render robust support for the gravity model. The estimated coefficients for the $GDP_i * GDP_j$ variable are positive and statistically significant throughout different samples for all years covered in our study, showing that two large countries, all else equal, have a higher volume of trade than two small countries. This is not only the case for U.S. bilateral trade flows (exports plus imports), but it is also true for U.S. exports and U.S. imports separately. The results for the $GDPPC_i * GDPPC_j$ variable are also positive and statistically significant in most cases, indicating that countries with higher per capita income tends to trade more than countries with lower per capital income. The distance variable is consistently negative and statistically significant. The impact of economic size and geographical distance on trade varies across the U.S., EU, and Japan in their trade with other countries and also varies between bilateral trade, exports, and imports for each of these three countries or groups of countries.

Second, the impact of U.S. economic sanctions on U.S. trade (bilateral trade, exports alone, or imports alone) is very sensitive to how the sanctioned country list is identified and

selected. This is particularly true for countries specified as targets of U.S. selective economic sanctions. For the three different classifications we have used in our study, two of them show no consistent statistical significance. Many countries in these groups have been subject to some form of U.S. export controls (for example, Indonesia faces restrictions on U.S. military equipment exports but is not restricted otherwise and even benefits from U.S. GSP). This may provide an explanation for the weak overall effect of selective sanctions—they simply are in too narrow a range of products to have much impact on overall imports, exports, or bilateral trade flows. Using a sample (*SANC*) that includes the formerly planned economies that were long the target of U.S. economic sanctions in recent history, we have found that U.S. economic sanctions have a significant impact on U.S. exports, imports, and total trade. This negative impact may be explained by a number of possible factors—the inward looking policies adopted by some of these countries, the low level of U.S. investment in these countries (another impact of the sanctions), and difficulties in absorbing external resources even after some economic reforms.

Third, U.S. comprehensive economic sanctions have a significant negative impact on U.S. bilateral trade, exports, and imports, with target countries subject to these sanctions. Not surprisingly, Iran and Cuba are among the countries most severely affected by U.S. economic sanctions.

Fourth, our estimated U.S. export losses due to U.S. economic sanctions are basically consistent with those found in the Hufbauer et al. (1997) study. Adding together the effects of U.S. economic sanctions on U.S. exports to both the formerly planned economies and to those that have been subject to comprehensive economic sanctions, we find that the U.S. export loss averaged more than $15 billion per year between 1989 and 1998, ranging from about $12 billion to over $23 billion.

Fifth, the persistent negative impact of U.S. economic sanctions on the formerly planned economies and on countries subject to comprehensive U.S. economic sanctions shows a strong lingering effect on trade between the United States and the target countries. Even after more than a decade has passed since the Cold War ended, the negative impact on trade between the United States and these countries were still felt toward the end of the 20^{th} century.

Sixth, we have found very different results for the third-country effects for the two groups of countries affected by U.S. economic sanctions. For the group of formerly planned economies, their trade (including bilateral trade, exports alone, and imports alone) with the EU and Japan has been similarly affected by U.S. economic sanctions as their trade with the United States. This is a clear indication that U.S. economic sanctions were part of a multilateral effort in sanctioning those countries. On the other hand, in the case of countries subject to comprehensive economic sanctions imposed by the United States, there is no significant impact on these countries' trade with the EU or Japan. In some cases, we found that these sanctions have actually promoted trade between these countries and the EU or Japan. This is a clear indication of third-country effect.

Our findings for the aggregate study suggest a number of shortcomings and new directions for further research. First, while the impact of comprehensive, or overall, U.S. economic sanctions may be sufficiently captured by aggregate studies such as ours, missing data for some sanctioned countries, like Cuba and North Korea, from publicly available data sources proves to be a challenge. A more complete data set for these countries will shed more light on the impact of U.S. economic sanction.

Second, the selection of sanctioned countries that form the dummy variable for selective sanctions needs to be based on more

refined classifications as the sanction structure is very complex and the results are highly sensitive to sanction classification.

Third, most economic sanctions are industry- or product-specific. The impact of industry- or product-specific sanctions may not be detected in aggregate studies; disaggregated studies are called for. For example, U.S. economic sanctions on China are mainly in the area of export restrictions on products that represents high technology or can be used for dual (military as well as civilian) uses. Disaggregated trade data on industries or products like high performance computers, nuclear power equipment, and communication satellites may allow us to examine the impact of U.S. sanctions on trade between the United States and China in these areas.

Fourth, our empirical study, as well as that by Hufbauer and his colleagues (1997), has focused on the impact of U.S. economic sanctions on U.S. trade and the U.S. economy. It does not provide detailed analysis of the impact on the target countries. Fifth, most of economic sanctions, if not all, have an impact on the target economy beyond just merchandise trade. They explicitly or implicitly affect international capital flows and trade in services between the sender countries and target countries as well. Yet most empirical studies, including ours, have focused on trade alone. We will attempt to include international financing and service trade as much as data availability permits us to in our future studies.

VII. ACKNOWLEDGMENTS

An earlier version of this article appeared in the Occasional Paper Series (24 February 2003), The George Washington Center for the Study of Globalization. We wish to thank seminar participants at the International Business Department, The George Washington University, and at the annual conference of

Academy of International Business (San Juan, 2002) for helpful comments. We greatly appreciate comments of Alain Verbeke of University of Oxford, Lorraine Eden of Texas A&M University, and the three anonymous reviewers. Huiping Dong, Haiyan Yin, and Lili Zhu provided valuable research assistance. We are grateful for financial support from the Center for the Study of Globalization (CSG) and for support and cooperation from the Institute for Global Management and Research (IGMR), both at The George Washington University. We alone are responsible for any errors.

REFERENCES

Askari, H. G., Forrer, J. Teegen, H., and Yang, J. 2003. *Economic Sanctions: Examining Their Philosophy and Efficacy.* Westport, CT: Praeger Publishers.

Aturupane, C. 1999. Corruption and International Trade. *Working paper.* Department of Economics, Palo Alto, CA: Stanford University.

CSIS. 1999. *Altering U.S. Sanctions Policy—Final Report of the CSIS Project on Unilateral Economic Sanctions* (February). Washington, D.C.: The CSIS Press.

Dell'Ariccia, G. 1999. Exchange Rate Fluctuations and Trade Flows: Evidence from the European Union. *IMF Staff Papers* 46(3)(September/December):315–334.

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

Hufbauer, G. C., Elliott, K. A., Cyrus, T., and Winston, E. 1997. U.S. Economic Sanctions: Their Impact on Trade, Jobs and Wages. *Working paper.* Washington, D.C.: Institute for International Economics.

IMF. Various issues. Direction of Trade Statistics.

Maddala, G. S. 1992. *Introduction to Econometrics*, 2nd ed. Englewood Cliffs, N.J.: Prentice-Hall.

Oguledo, V. I., and Macphee, C. R. 1994. Gravity Models: A Reformulation and an Application to Discriminatory Trade Arrangements. *Applied Economics* 26(2):107–120.

Pollard, P. S. 2001. Trade in the Neighborhood. *International Economics Trends*, Annual edition (July): 1. St. Louis, MO: Federal Reserve Bank of St. Louis.

Richardson, J. D. 1993. *Sizing Up U.S. Export Disincentives*. Washington, D.C.: Institute for International Economics.

Wall, H. J. 1999. Using the Gravity Model to Estimate the Costs of Protection. *Review*. 81(1) (January/February):33–40. St. Louis, MO: Federal Reserve Bank of St. Louis.

World Bank. Various issues. World Development Indicators.