

# Determinants of Cross-Border Intellectual Property Rights Enforcement: The Role of Trade Sanctions

Eric P. Chiang\*

With growing trade in a global economy, the desire for trade protection becomes increasingly important. One aspect of trade protection that has risen to the forefront is the protection of intellectual property rights (IPR) across national borders. This article analyzes the determinants of U.S.-filed investigations for alleged IPR cross-border violations using the complete set of Section 337 investigations conducted by the U.S. International Trade Commission (USITC). By analyzing political, institutional, and economic variables in an industry-level model, we find evidence that investigations are more frequent in industries that face intense import competition among IPR-protected goods. In addition, greater technology access to U.S. patents by respondent firms is found to increase filings, especially in countries where corruption levels are higher.

**JEL Classification:** O34, K42, F14

## 1. Introduction

The enforcement of intellectual property rights (IPR) across national borders has become increasingly important. Frequently, IPR are used to disseminate and protect the development of new technologies, academic knowledge, and artistic works. In the international setting, it has been found that IPR promote technology transfer between countries, thus leading to productivity growth. In addition, IPR protect innovations embodied in trade.

Much can be learned about the effectiveness of IPR protection by studying the circumstances that lead firms to take actions to protect their intellectual property. Court litigation is a traditional venue used to enforce IPR violations against parties from the same country. However, using court litigation to enforce IPR across national borders is difficult for several reasons: IPR laws differ from one country to another, similar laws between countries can be interpreted differently such that a violation in one country may not be found in another, and attitudes toward IPR protection differ in that innovating firms believe stronger protection increases incentives for further research, whereas others argue that stronger protection restricts access to new goods and reduces welfare.

In addition, court litigation requires that all parties be subject to the jurisdiction of the presiding court. In many cases, factories that illegally reproduce U.S.-patented goods have little or no physical

---

\* Department of Economics, Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431, USA; E-mail: [chiang@fau.edu](mailto:chiang@fau.edu)

This article has benefited from excellent comments from two anonymous referees, Lawrence Kenny, Bin Xu, Douglas Waldo, James Adams, Sharmila Vishwasrao, and seminar participants at the University of Florida, University of Nevada Las Vegas, Weber State University, Colorado College, New Mexico State University, California Polytechnic University at Pomona, the 2001 Midwest International Meetings, the 2001 Southeast International Economics Meetings, and the 2002 Western Economic Association Meetings.

Received May 2003; accepted March 2004.

presence in the United States. Therefore, patent owners are unable to use effectively U.S. courts or the courts in the defendant's country, perhaps due to weak IPR laws, corruption, or simply a preference by the courts of the defendant country to protect its country's interests. Although greater efforts via international cooperation have facilitated court litigation across national borders, cases are still sporadic. For these reasons, accurate empirical studies of cross-country IPR enforcement are difficult to construct.

As an alternative remedy, U.S.-based firms can seek IPR protection from the U.S. International Trade Commission (USITC) by filing a Section 337 investigation that can result in the imposition of trade sanctions on guilty parties.<sup>1</sup> In the past three decades, many firms have successfully used this mechanism. Between 1974 and 2001, 344 out of a total of 459 cases filed (75%) resulted favorably to the complainant. The richness of information contained in Section 337 investigations is an important source that ties the connection between IPR and trade; yet, only few studies have used it, and in limited forms. Mutti and Yeung (1996) offer a detailed look into Section 337 cases (from 1980 to 1991) involving publicly traded complainant firms and find that firms filing Section 337 cases tend to be larger, have greater product range, and have higher R&D expenditures. In addition, they find that successful cases led to higher profits and sales for the complainant firm, whereas unsuccessful cases resulted in lower profits and sales. Harper (1994) shows that successful cases resulted in higher stock returns for publicly traded firms in relation to the market index. Though these studies focus on characteristics of complainant firms, the current study takes a closer look at respondent characteristics to uncover the motivations for filing Section 337 cases. The decision by which firms choose to file cases depends crucially on the conditions facing the firm and the industry. This study evaluates the effects of these conditions on the likelihood and extent of cases. The complete set of Section 337 cases from 1974 to 2001 (459 cases) is studied.

Determining the factors that influence Section 337 cases is congruent with factors that influence court litigation analyzed in recent studies. Lanjouw and Lerner (1998) present a stylized model on the propensity to file litigation and find that the decision to litigate hinges on the comparison between the expected benefits and costs of taking a case to trial. A subsequent paper by Lanjouw and Schankerman (2001) finds that the value of a patent, the extent to which patents are used within an industry, and market competitiveness within industries all increase the likelihood of patent litigation. These studies provide insights into factors that are likely to influence international IPR enforcement, where country-specific factors become important determinants in the decision to take enforcement actions.

In the current study, more complaints are filed against countries where there are more U.S. patents to protect, which suggests a trade-off between greater technology access and more patent violations. In addition, the volume of trade also influences the decision to file, with higher levels increasing the incentive to file cases. This brings into question whether the motivation to file Section 337 cases is influenced by the demand for trade protection in addition to the demand for IPR protection. Finally, country-specific variables, including the level of corruption, patent protection, the rate of economic growth, and the implementation of the Trade-related Aspects of Intellectual Property Rights (TRIPS) agreement by the World Trade Organization (WTO) each influences the number of filings.

The remainder of the article begins with a brief description of the Section 337 mechanism and provides a first look at the data. The framework is then discussed, which ties into the empirical model estimating Section 337 cases. The empirical results show how different industry and country-specific

---

<sup>1</sup> Section 337 investigations include the alleged infringement of patents, copyrights, trademarks, and industry designs. Industry trade secrets also fall into Section 337, though these cases are not very prevalent.

factors within respondent countries affect the likelihood and extent of Section 337 cases. The article concludes by discussing how this study can be applied to general cross-border IPR enforcement issues.

## **2. U.S. International Trade Commission Section 337 Investigations**

The primary task of the USITC is to ensure fair trade for the United States. In addition to hearing cases involving alleged IPR violations, it also hears cases involving antidumping, which has received much attention in the trade literature. The literature on antidumping parallels that of international IPR enforcement in that both address unfair trade across national borders (see Blonigen and Prusa 2003 for a literature survey). However, differences arise between antidumping filings and Section 337 filings. A key difference is that the legal factor in antidumping cases is the trade practice itself (of which the determination of violation may be subjective), whereas Section 337 cases involve trade practices that violate an external law, that of a patent, copyright, or trademark. Mutti and Yeung (1996) state that antidumping cases filed by inefficient firms to gain market share are not uncommon, while Section 337 cases are less likely to be filed in this manner.

This study analyzes individual cases of IPR violations filed under Section 337 of the Tariff Act of 1930 and conducted at the USITC. The USITC serves as the primary ombudsman for U.S. and non-U.S. firms to initiate investigations (against entities outside the United States) for alleged violations of U.S. IPR without having to pursue full court litigation. The first modern investigation occurred in 1972 under the rules in force today, with the exception of the 1988 amendment that eliminated the requirement that complainant firms demonstrate injury to the domestic industry. This amendment made it easier for non-U.S. firms to file investigations. Although the presence of foreign-affiliated complainant firms rose since 1988, they still constitute a small portion of cases. The enforcement mechanism used by the USITC comes in the form of exclusionary orders imposed to prevent further importation of products in violation, which are enforced by U.S. Customs.

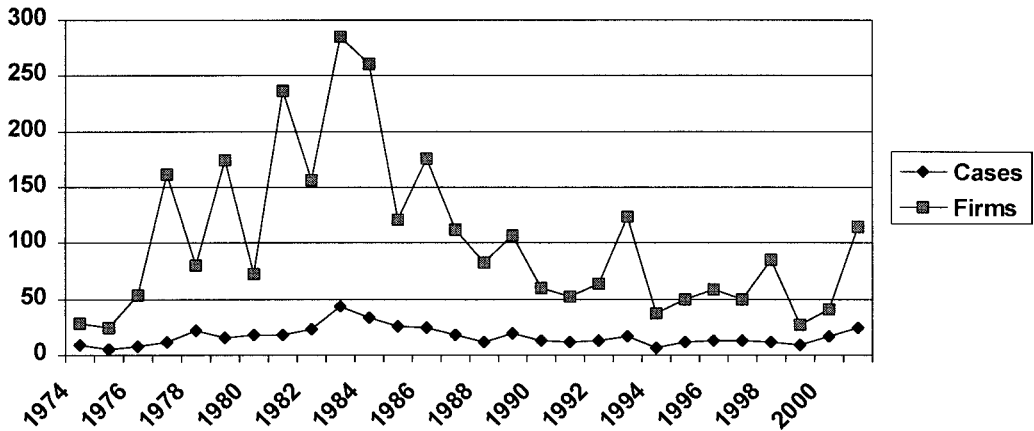
The procedure for a Section 337 case differs from both traditional court litigation and USITC antidumping cases. Section 337 cases are generally much shorter than traditional court cases. Each Section 337 application, once reviewed for correct filing, is assigned to an Administrative Law Judge (ALJ) who then sets a target date for the completion of the investigation, normally less than 12 months. Following evidentiary hearings in which parties present their cases, the ALJ issues a decision called an "Initial Determination," of which the Commission either accepts the decision as final or recommends further review. Unlike antidumping cases where domestic injury must be proved, the U.S. Department of Commerce does not play a role in Section 337 cases. Upon determination of a violation, the Commission issues sanctions in the form of exclusion orders (preventing products from entering the United States) and cease and desist orders (preventing the sale of goods already in the United States). Unlike traditional court litigation, no monetary awards are issued.

Since the inception of modern Section 337 cases in 1972, 505 individual cases of alleged IPR violations have been filed against non-U.S. firms in 40 countries. In this article, we use data from 1974 to 2001 (459 cases).<sup>2</sup> Most case filings involve more than one respondent firm, often located in more than one country. On average, each case involves 6.3 respondent firms located in 1.4 countries.

Figure 1 illustrates the annual count of case filings and respondent firms, and Table 1 shows the

---

<sup>2</sup> Because investigations began in 1972, it does not contain a full year of data and we therefore omit this year. We also omit 1973, as common use of this mechanism was still not prevalent. Finally, we omit 2002 and 2003 data because many of these cases are still pending.



**Figure 1.** Annual number of cases and respondent firms. (Data from 2003, 2002, 1973, and 1972 are not shown because they are not used in the analysis.)

total number of filings by case and total number of respondent firms for each country or region in the sample. A case filing is defined as a complaint filed against a set of accused respondents. A respondent country case (in Table 1) is defined as a set of firms within a single country named in an investigation, without regard to the actual number of firms named. A respondent firm is defined as a single firm named in a case. Therefore, if a case is filed against 16 respondents, 4 of which are located in country A, 4 in country B, and 8 in country C, then we would count this as 1 case filing, 3 respondent country cases, and 16 respondent firms. It is clear that most cases are filed against major U.S. trading partners.

The data reveal that a substantial portion (68%) of Section 337 cases target the major export countries: Canada, Germany, Hong Kong (China), Japan, South Korea, Taiwan, and the United Kingdom, 4 of which are G7 countries. In 1998, these 7 countries were the source of 51% of all manufactured imports to the United States and the target of 62% of Section 337 cases in that year. The data, therefore, suggest that given an ability to impose trade sanctions on firms that violate IPR, firms in these countries would more likely be targeted.

In Table 2, cases are categorized according to the industry classification of the good in question, as well as the aggregate success rate of cases. A substantial number of cases fall in the metals, machinery, and electrical industries, whereas fewer cases are found in the chemical, pharmaceutical, and medical/lab industries. The computer industry, including both hardware and software, saw a large rise in cases in the 1990s, as expected with the growth of the industry.

### 3. Framework

The development of a model estimating cases of IPR violations begins with the assumption that individuals and firms in Country (i) have access to protected information (such as that contained in U.S. patents). Of this available information (which may be embodied in trade or obtained in disembodied form), only a portion of such information is of relevance to an imitating individual or firm, and of which some may potentially be used improperly. If we assume that the portion of information used is relatively constant, the number of violations is influenced by both country and industry-specific factors including the level of corruption, business cycles, and the existence and enforcement of IPR laws in a country.

An important point of this article is that firms do not file complaints against every possible

**Table 1.** Respondent Cases and Firms by Country/Region

Country	Cases	Firms
Australia/New Zealand	4	10
Benelux <sup>a</sup>	24	60
Canada	45	207
France	18	46
Hong Kong <sup>b</sup>	45	227
Ireland	1	4
Italy	12	35
South Korea	42	310
Singapore	12	24
Spain/Portugal	8	42
Taiwan	128	817
Central America/Caribbean <sup>c</sup>	1	5
Africa (except South Africa) <sup>d</sup>	1	5
Eastern Europe/Mediterranean <sup>e</sup>	3	4
Austria	4	12
Brazil	5	16
China	19	67
Germany	50	168
India	0	0
Israel	13	33
Japan	110	526
Mexico	8	31
South Africa	2	13
Switzerland	12	27
United Kingdom	12	85
South America (except Brazil) <sup>f</sup>	3	12
Southeast Asia <sup>g</sup>	13	30
Northern Europe <sup>h</sup>	24	75
<b>TOTAL</b>	<b>636</b>	<b>2896</b>

<sup>a</sup> Includes Belgium, Netherlands, Luxembourg.

<sup>b</sup> Hong Kong is separated from China for the reason that the majority of data is prior to 1997.

<sup>c</sup> Includes Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama.

<sup>d</sup> Includes Angola, Botswana, Cameroon, Egypt, Ghana, Ivory Coast, Kenya, Malawi, Morocco, Nigeria, Senegal, Tanzania, Tunisia, Uganda, Zambia, Zimbabwe.

<sup>e</sup> Includes Bulgaria, Czech Republic (including former Czechoslovakia), Hungary, Poland, Romania, Russia (including former Soviet Union), Greece, Turkey.

<sup>f</sup> Includes Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela.

<sup>g</sup> Includes Bangladesh, Indonesia, Malaysia, Pakistan, Philippines, Thailand.

<sup>h</sup> Includes Denmark, Finland, Iceland, Norway, Sweden.

violation. Instead, firms are hypothesized to file complaints when the present value of expected current and future benefits resulting from filing a complaint exceeds the expected costs. Given this, we estimate that only a fraction of potential violations are ever pursued by the property-right owner depending on the outcome of the cost–benefit analysis. Another consideration is the possibility that some complaints are filed against innocent parties; thus, the propensity to file is not conditional on the actual likelihood of a violation. This is particularly relevant if cases are driven by greater demand for trade protection than for IPR protection.

Thus, given this model, it is possible to construct a simple specification that estimates the level of Section 337 cases based on the following: (i) the amount of information available and subject to

**Table 2.** Industrial Classification of Cases

Category <sup>a</sup>	Description (SIC Codes)	Total Cases	Success Rate <sup>b</sup>
1	Miscellaneous Manufactures (see notes) <sup>c</sup>	68	56/68 = 82%
2	Chemicals/Pharmaceuticals (2800 to 2899)	43	25/43 = 58%
3	Non-Metal Manufactures (3000 to 3399)	57	42/57 = 74%
4	Metals/Machinery (3400 to 3599) <sup>d</sup>	115	85/115 = 74%
5	Computer Goods (3571 to 73, 3661, 3674)	54	47/54 = 87%
6	Electrical Goods (3600 to 3699) <sup>e</sup>	83	63/83 = 76%
7	Laboratory/Medical Supplies (3800 to 3899)	39	26/39 = 67%
Total	All Goods	459	344/459 = 75%

<sup>a</sup> For industrial categories, only “manufactured” goods are included: SIC Codes 2000 to 3999. Agriculture goods, food products, and services are not included because their trade accounts for less than 1% of aggregate world trade.

<sup>b</sup> Success rate includes cases that concluded with parties entering into a settlement or consent agreement or concluded with a court verdict of an IPR violation.

<sup>c</sup> Category 1 includes SIC codes 2000 to 2799, 3700 to 3799, and 3900 to 3999.

<sup>d</sup> SIC codes 3571 to 3573 are dropped from category 4 and placed separately in category 5. These codes correspond to computer-related hardware equipment.

<sup>e</sup> SIC codes 3661 and 3674 are dropped from category 6 and placed separately in category 5. These codes correspond to semiconductor and other computer-related electrical goods.

potential violation, (ii) factors that affect the likelihood of IPR violations, and (iii) factors that directly influence the likelihood of filing an investigation. The number of cases filed against respondent firms is estimated in the following specification:

$$\text{CASE} = \beta_0 + \beta_1(\text{PATENT}) + \beta_2(\text{VIOLATION}) + \beta_3(\text{FILING}) + \varepsilon, \quad (1)$$

where  $\varepsilon$  captures either variables not controlled in the model or noise in the relationship. The empirical section of this article estimates Equation 1 using variables representing PATENT, VIOLATION, and FILING. The coefficients represent the strength of various political, institutional, and economic factors that contribute to the propensity to violate IPR or to file a claim for IPR violation.

We begin by addressing the legal basis for filing a complaint. Specifically, if a patent for a product does not exist in a country, then its violation is difficult to justify. Thus, the existence of a large patent base gives complainants stronger support for filing cases. Second, in addition to trade, IPR are a source of disembodied technology transfer. Thus, a higher stock of patents in a country gives firms more access to technology, possibly resulting in more violations. However, this must be argued with caution. For countries with weaker IPR laws and/or higher levels of corruption, greater technology access may influence violations more than countries with strong IPR laws and/or low corruption levels. This article includes a measure of the U.S. patent stock to account for the pool from which potential IPR infringements can occur.<sup>3</sup> Although the analysis includes cases of trademark and copyright violations, 83% of all cases filed involved an alleged patent violation. Therefore, we use the patent stock exclusively for data consistency. The inclusion of the patent stock measure predicts a positive influence on the number of cases due to greater potential of violation along with greater legal support.

We next address the factors that lead to the violation of a U.S. patent in a country, a key issue in this article. The propensity of violating patents depends on the characteristics of firms involved, along with the conditions of the industry and country influencing the firm. Industry conditions are important, especially for products containing complex or multiple patents. Such products may lead to a more

<sup>3</sup> A depreciated patent stock, rather than patent flows or a nondepreciated stock, is used to allow for the value of patents granted from previous years that are still used in production, while allowing for the fact that recent innovations tend to make older patents less valuable.

difficult determination on whether a patent is violated or not, either because the respondent firm was not aware of their violation or because a violation is simply harder to detect. Conditions in the country also influence violations as firms operate within the realm of their environment. Such country-level factors include adherence to international IPR agreements, domestic IPR laws, corruption levels, and economic conditions.

Recent policy debates question whether the adoption of uniform standards of IPR protection decreases the number of violations. In the past few decades, many countries have intensified their efforts to create tough universal standards of IPR protection, primarily due to the dynamic growth of “intellectual goods,” which are costly to create but easily reproduced. The only recent comprehensive agreement was the TRIPS agreement of 1994 (United Nations Conference on Trade and Development 1996), which calls for the phase-in of stronger protection and enforcement of IPR, particularly in developing countries. It also encourages countries to recognize IPR of member countries and to enforce them in a uniform manner. And finally, as a mechanism to ensure the compliance of TRIPS, the WTO established a dispute settlement procedure to hear complaints between member countries.

The TRIPS agreement is expected to reduce IPR violations and to offer another avenue for IPR enforcement, both of which should reduce the number of Section 337 cases. However, there are a few limitations of TRIPS. First, some countries such as China, Taiwan, and others only recently became or are in the process of becoming members of the WTO. In addition, there are clauses, for example, that allow developing and least-developed nations a phase-in period to implement protection of pharmaceutical patents. In this article, we test the effectiveness of TRIPS using a binary variable indicating the years in which TRIPS has been in existence for countries who were members of the WTO at that time, while excluding the pharmaceutical industry for countries that are granted the phase-in period.

As the discussion of international IPR protection and its economic effects intensified over the past decade, several indices that measure IPR strength across countries have been created. Rapp and Rozek (1990) developed an index, based on surveys of business and government officials, that accounts for a country’s conformity to minimum U.S. standards of IPR protection. Maskus and Penubarti (1995) updated this index by using predicted values to deal with measurement error due to the subjective components of the previous index. Finally, Ginarte and Park (1997) developed an objective index that was the first to incorporate the existence of “enforcement mechanisms” in a country; for example, the availability of preliminary injunctions.<sup>4</sup> This article uses the Ginarte–Park index because it is the most recent and complete.

Another approach to estimating IPR enforcement is to take into account a country’s general legal environment. If a government tends to be corrupt, or does not prosecute ordinary crimes within its own country effectively, it is likely that the prosecution of IPR violations within its borders is also lax. The use of corruption indicators would indirectly account for a country’s enforcement of its IPR laws, and therefore serve as a proxy for the effectiveness of their enforcement. As a result, as corruption levels increase, alleged IPR violations should rise.

The state of the economy in the respondent country is another stimulus for filing IPR investigations. Economic downturns may lead firms to skirt IPR laws in order to maintain economic

---

<sup>4</sup> The use of these indices has been common in several prominent studies. Eaton and Kortum (1996) find that the propensity to file for IPR protection in a country is highly correlated with IPR strength as measured by the Maskus–Penubarti index. In a survey of multinational corporations, Lee and Mansfield (1996) find that firms are less likely to transfer their newest technologies via FDI to countries they perceive as having weak IPR protection. Maskus and Penubarti (1995) find that firms are reluctant to export knowledge-intensive goods to countries where there exists a significant risk of IPR violation.

vitality. Black markets grow as people find cheaper alternatives to licensed goods. If so, gross domestic product (GDP) growth is predicted to be negatively correlated with IPR violations.

Finally, we look at factors that influence the likelihood of a firm to file a complaint. Two key factors play a role in the filing of cases: (i) the availability of sanctions that firms can pursue against suspected firms that under USITC rules is limited to the restriction of imports, and (ii) the state of the U.S. economy.

The value of industry-specific import flows from the respondent country to the complainant country is an important factor in explaining Section 337 cases. As imports rise, the effectiveness of filing a Section 337 case increases as more foreign firms within corresponding industries have imports that can be blocked from entry. Another argument, stemming from the demand for trade protection in the antidumping literature, is that market competitiveness drives firms to take actions in order to secure domestic market share when imports increase within an industry (Blonigen 2002; Sabry 2000). Last, we test whether firms respond to the level of imports itself or to changes in the level of imports. By estimating the effect of import growth, one can determine whether increases in industry imports stimulate firms to take greater actions.

A lingering question of whether firms file Section 337 cases due to a desire for trade protection can be addressed by testing whether U.S. GDP growth affects filings. In the antidumping literature, Knetter and Prusa (2003) find that more filings occur during bad economic times, suggesting greater attempts toward trade protection. In the current study, a negative correlation would support the hypothesis that firms are perhaps motivated more by trade protection than IPR protection.

#### 4. Empirical Model

This article estimates the model described in the previous section using industry and country-panel regressions. Data used in the empirical model are classified into corresponding regional, industrial, and annual groupings. First, 28 countries and regional groupings are selected, encompassing a total of 77 countries based on availability of the country-specific variables used. All 40 countries that have at least one case filed against them are included in the sample. Second, cases and their corresponding respondent firms are classified according to the SIC code of the product involved, then grouped into seven standard industrial categories (similar to those for previous industry studies). All data are collected annually based on the year in which the initial Section 337 application was submitted. In total, there are 5488 observations (28 countries/regions  $\times$  7 industries  $\times$  28 periods) for empirical work.

This study uses two estimation techniques to explain the likelihood and extent of alleged IPR violations under Section 337. Table 3 shows the frequency of investigations filed. A characteristic of the dependent variable is that most observations have a value of zero. Of the 5488 observations, 5159 (94%) have a value of zero. The Probit model is appropriate in this circumstance to estimate whether an observation contains any cases.<sup>5</sup> To explain the actual number of cases filed, we use negative binomial regression, a type of random effects Poisson.

The use of Poisson regression is effective when handling count data where the mean value is

---

<sup>5</sup> A difference between this approach and that of Lanjouw and Schankerman (2001) is that this model estimates the existence of at least one case in a specified grouping, whereas the latter estimated the existence of litigated patents against a control set of nonlitigated patents. Given the differences in data, the approach used in this article facilitates the estimation of cross-country data.

**Table 3.** Frequency of Observations with Number of Case Filings

No. Country Cases	Frequency	Percentage of Observations	No. Respondent Firms	Frequency	Percentage of Observations
0	5042	91.9	0	5042	91.9
1	364	6.6	1	36	0.7
2	53	1.0	2	122	2.2
3	19	0.3	3	72	1.3
4	8	0.1	4	52	0.9
5	1	0.0	5	43	0.8
6–10	1	0.0	6–10	64	1.2
11–20	0	0.0	11–20	35	0.6
21–50	0	0.0	21–50	15	0.3
>50	0	0.0	>50	7	0.1
Total	5488	100.0	Total	5488	100.0

near zero while allowing for the estimation of values greater than one, unlike Probit regressions. A drawback to using Poisson regression is the failure to handle overdispersion in counts. Using a negative binomial regression corrects for this problem of extra variation in the Poisson process. We therefore use negative binomial regression to explain the total number of respondent firms named in Section 337 cases within each observation.

The time period involved is 1974 to 2001 according to the sample groupings specified earlier. The full specification equation follows that of Equation 1 where each vector of variables is estimated individually and assumes a log-linear functional form. The dependent variable is CASE and includes subscripts for Country (i), Industry (j), and Time (t):

$$\begin{aligned}
 (\text{CASE} - N_{ijt}) = & \alpha_0 + \alpha_j + \alpha_1 \ln(\text{PATENT}_{it}) + \alpha_2 \ln(\Delta \text{GDP}_{it}) + \alpha_3 \ln(\text{CORRUPT}_{it}) \\
 & + \alpha_4 \ln(\text{TRIPS}_{ijt}) + \alpha_5 \ln(\text{IND} - \text{IMP}_{ijt}) + \alpha_6 \ln(\text{IMP} - \text{GR}_{ijt}) \\
 & + \alpha_7 \ln(\Delta \text{USGDP}_t) + \varepsilon_{ijt},
 \end{aligned} \tag{2}$$

where  $N = (1, 2)$ .  $\text{CASE} - 1_{ijt}$  measures the existence of a case (1 = yes and 0 = no) regardless of the number of accused firms.  $\text{CASE} - 2_{ijt}$  measures the number of respondent firms from Country (i) in Industry (j) in Year (t). Independent variables include  $\text{PATENT}_{it}$ , the total depreciated number of U.S. patents in Country (i) in Year (t);  $\Delta \text{GDP}_{it}$ , the real GDP growth rate for Country (i) in Year (t);  $\text{CORRUPT}_{it}$ , the indexed state of corruption in Country (i) in Year (t);  $\text{TRIPS}_{ijt}$ , a binary variable to indicate the existence of the TRIPS agreement in WTO member countries in Year (t) in Industry (j);  $\text{IND} - \text{IMP}_{ijt}$ , the value of imports from Industry (j) in Country (i) in Year (t);  $\text{IMP} - \text{GR}_{ijt}$ , the percentage change in imports from Industry (j) in Country (i) in Year (t);  $\Delta \text{USGDP}_t$ , the U.S. real GDP growth rate in Year (t); and  $\varepsilon_{ijt}$  is a random error term. In a separate test,  $\text{GINARTE} - \text{PARK}_{it}$ , another measure of IPR protection, is tested with  $\text{CORRUPT}_{it}$  to capture differences between corruption and patent-protection measures. Finally, industry dummies ( $\alpha_j$ ) are included in all regressions.

GDP growth data are obtained from Datastream (2001) and the *World Development Indicators Database* (World Bank Group 2002). The corruption variable is an index created from two well-known sources: *The International Country Risk Guide* (ICRG) (PRS Group 2002) and the Corruption Perceptions Index (Transparency International and Göttingen University 1999), both of which are based on surveys of industry experts. The index gives each source equal weight and ranges from 0 to

10, with higher numbers representing higher levels of corruption.<sup>6</sup> Import data are obtained from Feenstra (1996) (available from 1972 to 1994) and Feenstra, Romalis, and Schott (2002) (for years 1995 to 2001). All trade data are corrected to reflect real U.S. dollars by the use of a deflator (1985 = 1). Because investigations are filed solely for infringement of U.S. patents, the patent stock measure is the U.S. patent stock in a foreign country, constructed using annual bilateral data on patent applications available from the World Intellectual Property Organization (WIPO)'s Industrial Property Statistics, 1963–2000.<sup>7</sup>

## 5. Empirical Results

Summary statistics and estimation results for each modeling technique are reported in Tables 4, 5, and 6. Probit estimation results are shown in Table 5. These results show the likelihood that an industry category within a country will contain at least one investigation during a period of a year. Regression 5.1 is the baseline regression taken from Equation 2. In Regression 5.2, the level of industry import growth is added. The Ginarte–Park measure of IPR protection is included in Regression 5.3. Regressions 5.4 and 5.5 include interaction variables Patent  $\times$  Corruption and TRIPS  $\times$  Corruption to test whether patent stocks and the TRIPS agreement play a larger influence when countries are more corrupt.

Table 6 estimates the number of respondent firms named in Section 337 cases within the country, industry, and time specification. Single equation negative binomial results are shown in Regressions 6.1 to 6.5 and are identical to Regressions 5.1 to 5.5. Using a likelihood ratio test for overdispersion, all regressions show very high chi-square values, thereby warranting the use of the negative binomial regression instead of Poisson regression.

Overall, key variables among the filing, violation, and patent determinants conform to expectations in both Probit and negative binomial regressions. Filing determinants, particularly industry imports, appear strong while results for U.S. GDP provide support that Section 337 cases are not used primarily as an avenue for trade protection. Significant results for variables reflecting IPR violations, including corruption and TRIPS, give further credence to the argument that Section 337 cases are not filed frivolously. Individual effects are discussed as follows.

Consistent positive and significant coefficients for IND-IMP (the value of industry, country, and time-specific imports) in the Probit and negative binomial regressions provide strong evidence that firms tend to take greater action for IPR infringement when there is a higher potential for punishment. In other words, unless a firm can justify filing an investigation, it generally does not pursue it. Industries within countries that compete most directly with their U.S. counterparts tend to generate a higher number of cases, as each successful case may result in fewer competitive imports. This result is consistent with findings in the antidumping literature (Blonigen 2002) that finds a significantly

<sup>6</sup> The corruption data come from two well-known sources: *The International Country Risk Guide* (ICRG; PRS Group 2002) and Corruption Perceptions Index (CPI; Transparency International and Göttingen University 1999), both of which are based on surveys of industry experts. The ratings range from 0 to 6 and 0 to 10, respectively, with higher numbers indicating lower levels of corruption. The ICRG is an annual index available from 1983 to 2001, and CPI is an annual index from 1996 to 1999 with multiyear rankings from 1980 to 1995. Because both sources are respected and independent of each other, we create a new index, giving each source equal weight. This is done by multiplying the ICRG score by 5/6 and the CPI score by 1/2, then summing to give a maximum of 10. Finally, to simplify interpretation, the new score is subtracted from 10, which allows higher numbers to indicate higher levels of corruption.

<sup>7</sup> Using these data, a depreciated U.S. patent stock is formed using the 15% discount rate commonly used in these cases (see Griliches 1979 and Coe and Helpman 1995 for methodology on building stocks from annual flow data).

**Table 4.** Variable Definitions and Summary Statistics: Country Panel (28 countries/regions, 7 industries, 28 annual time periods)

Variable	Description	Mean	SD	Min	Max
CASE-1	Binomial variable representing the existence of a case (1 = yes) within Country (i), Industry (j), in Time (t)	0.08	0.27	0	1
CASE-2	No. firms listed as respondents of cases in Country (i), Industry (j), in Time (t)	0.50	2.93	0	68
W-CASE-2	Case-2 weighted by size of complainant, using a 1 to 10 size scale	1.74	11.84	0	285
PATENT	Depreciated U.S. patent stock in Country (i) in Time (t) based on actual depreciated patent flows (in thousands)	109.04	118.12	0.76	460.62
$\Delta$ GDP	Real GDP % growth rate in Country (i) in Time (t)	3.87	3.43	-7.28	17.20
CORRUPT	Composite TI and ICRG corruption index in Country (i) in Time (t) (0 = least to 10 = most corrupt)	3.42	2.13	0.33	7.47
GINARTE-PARK	Index of Patent Protection by Ginarte and Park (0 = least protection to 5 = most protection)	2.99	0.79	1.4	4.24
TRIPS	Existence of TRIPS agreement (1 = yes) in Time (t), in WTO member (i), in Industry (j)	0.22	0.42	0	1
IND-IMP	Value of imports from Country (i), Industry (j), to the U.S. in Time (t) (in constant 1985 \$ billions)	1.27	2.93	0	39.13
IND-IMP GROWTH	Average percentage growth in imports (1 = 100%) from Country (i), Industry (j), to the U.S. in Time (t)	0.12	0.58	-0.87	38.94
$\Delta$ USGDP	Real U.S. GDP % growth rate in Time (t)	3.04	1.83	-2.07	5.64

positive relationship between imports and antidumping investigations. Using the coefficients from Regressions 5.1 and 6.1, a one standard deviation increase in U.S. industry imports (\$2.93 billion) from a country increases the likelihood of a case occurring by 77.9% and results in 0.46 additional respondent firms for that specific industry and country, an increase of 92% from the mean.<sup>8</sup> These

<sup>8</sup> The magnitudes of the negative binomial coefficients are calculated using the same formula as an ordinary least squares (OLS) coefficient:  $\log(\mu_1 + x) - \log(\mu_1) = \alpha[\log(\mu_2 + \sigma) - \log(\mu_2)]$ , where  $\mu_1$  and  $x$  are the mean and change from mean of the dependent variable, respectively, and  $\mu_2$  and  $\sigma$  are the mean and standard deviation of the independent variable, respectively. Though the negative binomial is not explicitly written in log form, the inherent specification of the negative binomial is  $\log \lambda_{ijt} = x'_{ijt} \alpha$ , where  $\lambda_{ijt}$  is the Poisson parameter written in log form to ensure non-negativity.

**Table 5.** Probit Estimation of a Case in a Country Panel (28 Annual Time Intervals in 7 Industries for 28 Countries/Regions)

Dependent Variable: CASE-1: Existence of a Case filed in Time (t), Industry (j), Country (i)					
Regression No.	5.1	5.2	5.3	5.4	5.5
Industry dummies	Yes	Yes	Yes	Yes	Yes
Log(patent stock)	0.147 (4.68)***	0.155 (4.85)***	0.127 (3.73)***	0.051 (0.97)	0.059 (1.11)
Log( $\Delta$ gdp)	0.174 (1.85)*	0.161 (1.71)*	0.183 (1.90)*	0.142 (1.49)	0.130 (1.35)
Log(corrupt)	0.015 (0.36)	0.017 (0.40)	0.052 (1.17)	-0.984 (-2.19)**	-0.996 (-2.21)**
Log(Ginarte-Park)	—	—	0.286 (2.31)**	—	—
TRIPS (1 if yes, 0 if no)	-0.653 (-8.49)***	-0.640 (-8.28)***	-0.682 (-8.59)***	-0.644 (-5.16)***	-0.633 (-5.07)***
Log(industry imports)	0.267 (12.42)***	0.267 (12.39)***	0.277 (12.49)***	0.274 (12.44)***	0.275 (12.42)***
Log(industry import growth)	—	0.321 (1.59)*	0.354 (1.75)*	—	0.327 (1.63)*
Log( $\Delta$ usgdp)	0.159 (1.01)	0.136 (0.86)	0.134 (0.85)	0.163 (1.05)	0.139 (0.89)
Log(patent stock) $\times$ Log(corrupt)	—	—	—	0.087 (2.22)**	0.088 (2.25)**
TRIPS $\times$ Log(corrupt)	—	—	—	-0.016 (-0.14)	-0.014 (-0.12)
No. of observations	5488	5488	5488	5488	5488
Pseudo $R^2$	0.2971	0.2997	0.3005	0.3031	0.3034
Log-likelihood	-626.72	-625.93	-623.74	-624.28	-623.81

Z-Statistics in parentheses. \*, \*\*, \*\*\* represent significance levels at the 10%, 5%, and 1% levels, respectively.

results are robust when total imports from all industries are added (not shown), implying that they are not spuriously reflecting general trading patterns. Finally, the weaker but still significantly positive coefficients for import growth implies that firms are more sensitive to the actual level of industry imports rather than changes in the level of imports.

These results, however, do not explain whether U.S. firms are motivated by trade protection over IPR protection, as greater imports increase the incentive to protect IPR. An alternative indicator is how U.S. firms respond during varying economic times. U.S. GDP growth is found to be positively correlated to Section 337 cases in all regressions, giving support to the notion that firms are not using Section 337 to seek pure trade protection. This is clearly different from the antidumping literature where cases are not tied to a violation of an IPR.

Evidence shows that corruption indicators do not explain the existence of a case but do influence the number of cases filed. Although U.S. firms file cases in countries with varying levels of corruption, the extent of cases tend to target countries with relatively higher corruption. But because most of the target countries are developed countries with relatively low corruption, the results are sensitive to smaller variations in corruption compared to models that involve lesser developed countries. In this model, the four Asian countries with the most number of cases (Taiwan, Japan, Hong Kong, and S. Korea) had an average corruption level of 3.58, whereas the four European countries with the most number of cases (Germany, United Kingdom, France, and Italy) had an average corruption level of

**Table 6.** Negative Binomial Estimation of Respondent Firms in a Country Panel (28 Annual Time Intervals in 7 Industries for 28 Countries/Regions)

Dependent Variable: CASE-2: Respondent firms in Time (t), Ind. (j), Country (i)					
Regression No.	6.1	6.2	6.3	6.4	6.5
Estimation Method	Negative Binomial Regression				
Industry dummies	Yes	Yes	Yes	Yes	Yes
Log(patent stock)	0.209 (3.43)***	0.233 (3.79)***	0.219 (3.52)***	0.087 (0.85)	0.102 (0.99)
Log( $\Delta$ gdp)	-0.048 (-0.31)	-0.107 (-0.68)	-0.083 (-0.52)	-0.054 (-0.34)	-0.115 (-0.71)
Log(corrupt)	0.326 (3.59)***	0.324 (3.59)***	0.361 (3.83)***	-0.874 (-1.08)	-0.966 (-1.18)
Log(Ginarte-Park)	—	—	0.324 (1.35)	—	—
TRIPS (1 if yes, 0 if no)	-1.949 (-12.15)***	-1.870 (-11.50)***	-1.918 (-11.49)***	-1.956 (-7.04)***	-1.886 (-6.80)***
Log(industry imports)	0.593 (15.05)***	0.584 (14.73)***	0.585 (14.75)***	0.596 (14.96)***	0.588 (14.64)***
Log(industry import growth)	—	1.122 (2.43)**	1.121 (2.43)**	—	1.157 (2.50)**
Log( $\Delta$ usgdp)	0.576 (2.14)**	0.559 (2.06)**	0.551 (2.03)**	0.556 (2.06)**	0.537 (1.98)**
Log(patent stock) $\times$ Log(corrupt)	—	—	—	0.106 (1.48)	0.114 (1.57)*
TRIPS $\times$ Log(corrupt)	—	—	—	-0.001 (-0.01)	0.010 (0.04)
No. of observations	5488	5488	5488	5488	5488
Adjusted/pseudo $R^2$	0.2335	0.2359	0.2385	0.2326	0.2305
Log-likelihood	-1519.63	-1515.15	-1514.32	-1518.01	-1513.97

Z-Statistics in parentheses. \*, \*\*, \*\*\* represent significance levels at the 10%, 5%, and 1% levels, respectively.

2.43. Correspondingly, more cases were filed against Asian firms than European firms. A drawback of the corruption variables is that they are not industry-specific. Nonetheless, the results suggest that corruption levels do influence USITC filings. In Regressions 5.3 and 6.3, the Ginarte-Park IPR index is added in addition to the corruption indicator and appears to be a better predictor of the existence of cases but not the extent of cases.

The U.S. patent stock has a positive impact on case filings in all regressions, though with varying degrees of significance depending on whether interaction variables are included. As the pool of patents increases, the use of U.S. knowledge increases, resulting in a greater likelihood of patent violation. Therefore, Section 337 cases increase. Regression 6.1 shows that a one standard deviation increase in the U.S. patent stock in a country (118,120 patents) results in 0.086 additional respondent firms, an increase of 17% from the mean. Another consideration is the extent to which firms withhold innovations to corrupt countries. The correlation between corruption and the patent stock is  $-0.4323$ . When patent stock is interacted with corruption in Regressions 5.4, 5.5, 6.4, and 6.5, the interaction variable is highly significant while the variables themselves lose explanatory power. This suggests that large patent stocks in countries with high corruption levels are more vulnerable to infringement and subsequently result in more cases. In other words, a large patent stock does not predict more cases in countries with low corruption, and high corruption in countries does not influence cases if the patent stock is small.

**Table 7.** Breakdown of Cases by Verdict

Total Cases	459	100%
Closed by settlement	211	46%
In violation	92	20%
Closed by consent	41	9%
No violation	78	17%
Case withdrawn	23	5%
Case suspended	14	3%

Since the implementation of the TRIPS Agreement among WTO members in 1994, case filings have significantly decreased, possibly due to a reduction of IPR violations in industries where TRIPS took precedence. Specifically, the average number of respondent firms sharply decreased from the late 1980s to the late 1990s. Initial conclusions would suggest that TRIPS has encouraged stronger IPR protection resulting in fewer cases filed; however, such optimism needs to be taken with caution. First, the TRIPS agreement created an alternative complaint mechanism, the WTO, which potentially has greater enforcement power compared to unilateral enforcement by the USITC. In addition, during the past decade the use of cross-border court litigation has increased due to greater facilitation in their implementation. Thus, the TRIPS agreement has reduced USITC filings; however, it is unknown whether the extent of IPR violations has decreased or greater alternatives became available.

The economic variable  $\Delta$ GDP (change in real GDP) in respondent countries is shown to be marginally significant and positive in predicting the existence of cases and insignificant and negative when predicting the extent of cases. This result supports the notion that respondent firms are not intentionally violating IPR during economic downturns. Instead, other factors such as corruption levels play a larger role.

Finally, industry fixed effects are included to control for time-invariant industry characteristics that may inherently result in greater or fewer investigations. The dummy coefficients indicate that Industry Category 4 (metals/machinery) and Category 6 (electrical goods) have higher number of investigations not controlled by other variables. Possible explanations include a greater intensity of competition due to the innovation-intense nature of the industries where innovations often build upon each other.

## 6. Considering the Success and Size of Cases

This section tests two alternative specifications of the dependent variable in the previous model. First, we distinguish between cases that are successful and unsuccessful to the complainant and test whether the explanatory variables explain the number of successful cases. Second, we address the question of whether the size of complainants affects the results. The motivation for the latter test is that larger complainants tend to have larger claims and, therefore, file larger and higher profile cases. We account for this by giving greater weight to cases filed by larger complainants.

The breakdown of verdicts of cases filed is shown in Table 7. A “successful” case is defined as one that favors the complainant, which includes cases closed by settlement, cases closed by consent, or cases that find violation against the accused firm. A majority of successful cases (61%) are closed by settlement, generally by way of the accused firm entering into a licensing agreement with the complainant regarding the IPR in dispute. Overall, successful cases account for 75% of all cases.

Each equation in the previous model is reestimated using only “successful” cases, limiting data

to those that result in favor of the complainant. The results from these tests are not displayed because they are qualitatively identical to the estimation of both successful and nonsuccessful cases combined. This suggests that a majority of cases filed are legitimate actions where the complainant has strong evidence of an IPR violation and, therefore, is not simply using the enforcement mechanism as a means to file frivolous cases. Indeed, given the high overall success rate, this premise is supported.

One potential concern with the dependent variable count is the large difference in profile of cases. For example, some cases involve a small firm or individual as the complainant, whereas others involve large multinational corporations. In order to allow for variation in the size of firms involved, one approach is to take a weighted value of the number of respondent cases; this is achieved by multiplying each case by a scalar corresponding to the sales value of the complainant. In this study, annual sales data are obtained from OneSource. Because some firms did not appear in OneSource, direct firm contacts were also used. All sales data are in constant 1990 dollars.

In separate regressions, a weighted count of the CASE dependent variable is estimated, where a larger scalar is applied to larger complainants.<sup>9</sup> This allows one to test the plausible assumption that the actions of larger firms carry greater effects than their smaller counterparts. Thus, a weighted dependent variable is created as follows:

$$\text{W-CASE-2}_{ijt} = \sum_{ijt} [(S_n \times \text{Respondents}_{ct})], \quad (3)$$

where  $n = (1, 2, \dots, 10)$ .  $S_n$  is a scalar ranging from 1 to 10 depending on the annual PPI-corrected sales of the complainant firm in Case (c).  $\text{Respondents}_{ct}$  is the number of respondent countries or firms corresponding to Case (c). Each weighted respondent value in Country (i), Industry (j), and Time (t) are summed to form the modified dependent variable,  $\text{W-CASE-2}_{ijt}$ , that is then reestimated using Equation 2.

Results from the weighted CASE variable, where each respondent firm is given a weight according to the size of the complainant, are qualitatively identical to the nonweighted CASE variables and therefore are not reported. This finding implies that the size of complainants does not matter.

## 7. Conclusions

This article provides unique evidence on IPR enforcement related to trade. We analyze the complete set of USITC Section 337 cases to identify factors that influence U.S.-based firms to file complaints against non-U.S. entities for alleged IPR violations embodied in traded goods. We find that Section 337 cases are clearly a popular mechanism used by U.S.-based firms against foreign firms that compete most directly within its specific industry by way of industry-specific imports. Because enforcement by the USITC is limited to trade sanctions, actions aimed toward firms in lesser developed countries, which have been the focus of IPR in recent decades, are not as prevalent as those against firms in industrialized countries. The ability to impose trade sanctions is a valuable tool to use against firms in countries that manufacture and export large values of potentially infringing goods. Thus, Section 337 serves as a potential mechanism for trade protection. However, we find that the

<sup>9</sup> A scaled value of sales is used to allow larger firms to be weighted more without eliminating the importance of small firms due to vast differences in sales volumes. The scaled indicator chosen ranges from 1 to 10 according to sales volumes (in millions of dollars) as follows: 0 to 1, 2 to 25, 26 to 100, 101 to 250, 251 to 500, 501 to 1000, 1001 to 2500, 2501 to 5000, 5001 to 10,000, over 10,000.

characteristics of the respondent industries and countries highly influence Section 337 cases, suggesting that pure trade protection is not a key reason for using Section 337.

In addition available to industry trade, we find that firms tend to file more complaints in industries in countries that have greater access to technology by way of a larger foreign patent stock, suggesting a trade-off between greater dissemination of technologies and the higher incidence of IPR violations. This is particularly the case in countries with higher levels of corruption. Also, the number of Section 337 cases fell in the last decade, despite increasing trade volumes. The evidence points to increasing alternatives available to U.S. firms, including cross-border court litigation, and more avenues to enforce IPR since the implementation of the TRIPS agreement, the first comprehensive international agreement addressing IPR and trade.

One of the limitations of the article is analyzing cases that involve U.S.-based complainants, where sanctioning power is limited to trade sanctions rather than monetary compensation. Yet, this article offers insights into how sanctioning mechanisms play a role in implementing effective cross-border IPR enforcement. A valuable extension of this article would be to study cross-border court litigation cases in a multilateral framework. However, because there currently does not exist a central court that possesses the authority to enforce IPR for all countries, and because each country has its own interpretation of what constitutes a violation, empirical studies on cross-border court litigation will need to account for differences in IPR law and its enforcement between countries. This will be a difficult but valuable exercise.

## Appendix

### *Description of Data Sources*

- Alleged Intellectual Property Rights Violations: provided by the U.S. International Trade Commission, Section 337 cases. Data is taken from 1974 to 2001. A total of 459 individual cases were collected, many of which involve more than one respondent firm, often located in more than one country. The total number of alleged respondent firms is 2896.
- U.S. Patent Stock: calculated from the depreciated stock of U.S. patent applications abroad. Detailed bilateral data on the annual patent applications are available from the World Intellectual Property Organization (WIPO) Industrial Property Statistics 1963–2000. To construct patent stocks, annual data on patent application flows are used beginning in year 1963, specified as  $p_0$ . Using  $p_0$ , the initial patent stock  $s_0$  is created using the Griliches (1979) method. Thus,  $s_0 = p_0 / (g + \delta)$ , where  $g$  is the average growth rate of the first 10 years of available data, and  $\delta$  is the depreciation rate, set at 15%, a common rate used for discounting patent flows. For all remaining years, the patent stock is specified as  $s_t = (1 - \delta)s_{t-1} + p_{t-1}$ , where  $p_{t-1}$  equals the patent flow for the previous year.
- GDP Growth Data: obtained from Datastream (2001) and the *World Development Indicators Database* (World Bank Group 2002), which provide annual estimates for the entire sample period.
- Corruption Data: uses two well-known sources: *The International Country Risk Guide* (ICRG; PRS Group 2002) and the Corruption Perceptions Index (CPI; Transparency International and Göttingen University 1999), both of which are based on surveys of industry experts. The ratings range from 0 to 6 and 0 to 10, respectively, with higher numbers indicating lower levels of corruption. The ICRG is an annual index available from 1983 to 1998, and CPI is an annual index from 1996 to 1999 with multiyear rankings from 1980 to 1995.
- Import Data: obtained from Feenstra (1996) and Feenstra, Romalis, and Schott (2002). The Feenstra data set contains four-digit Standard Industrial Classification (SIC) unilateral U.S. imports in current U.S. dollars. Data are available from 1972 to 1994. Trade data from 1995 to 2001 are taken from Feenstra, Romalis, and Schott (2002). All data are corrected to reflect real U.S. dollars using a deflator (1985 = 1).

## References

- Blonigen, Bruce A. 2002. Tariff-jumping antidumping duties. *Journal of International Economics* 57:31–49.
- Blonigen, Bruce A., and Thomas J. Prusa. 2003. Antidumping. In *Handbook of international trade*, edited by E. Kwan Choi and James Harrigan. Oxford, UK, and Cambridge, MA: Blackwell Publishers.

- Coe, David, and Elhanan Helpman. 1995. International R&D spillovers. *European Economic Review* 39:859–87.
- Corruption Perceptions Index (CPI). 1999. Transparency International and Göttingen University, Berlin, Germany.
- Datastream. 2001. *Global financial and economic data*. New York: Datastream International Limited.
- Eaton, Jonathan, and Samuel Kortum. 1996. Trade in ideas: Patenting and productivity in the OECD. *Journal of International Economics* 40:251–78.
- Feenstra, Robert C. 1996. NBER Trade Database, Disk 1: U.S. Imports, 1972–1994: Data and Concordances. NBER Working Paper No. 5515.
- Feenstra, Robert C., John Romalis, and Peter Schott. 2002. NBER Trade Database: U.S. Imports Exports, and Tariff Data, 1989–2001. NBER Working Paper No. 9387.
- Ginarte, Juan C., and Walter Park. 1997. Determinants of patent rights: A cross-national study. *Research Policy* 26:283–301.
- Griliches, Zvi. 1979. Issues in assessing the contribution of research and development to productivity growth. *Bell Journal of Economics* 10:92–116.
- Harper, Richard K. 1994. Intellectual property and unfair trade: Market response to ITC actions. *International Journal of the Economics of Business* 1:343–53.
- Industrial Property Statistics, 1963–2000. Geneva: World Intellectual Property Organization.
- Knetter, Michael, and Thomas J. Prusa. 2003. Macroeconomic factors and anti-dumping filings: Evidence from four countries. *Journal of International Economics* 61:1–17.
- Lanjouw, Jean O., and Josh Lerner. 1998. The enforcement of intellectual property rights: A survey of the empirical literature. *The Annals d'Economie et de Statistique* 49/50:223–46.
- Lanjouw, Jean O., and Mark Schankerman. 2001. Characteristics of patent litigation: A window on competition. *Rand Journal of Economics* 32:129–51.
- Lee, Jeong-Yeon, and Edwin Mansfield. 1996. Intellectual property protection and U.S. foreign direct investment. *Review of Economics and Statistics* 78:181–6.
- Maskus, Keith E., and Mohan Penubarti. 1995. How trade-related are intellectual property rights? *Journal of International Economics* 39:227–48.
- Mutti, John, and Bernard Yeung. 1996. Section 337 and the protection of intellectual property in the United States: The complainants and the impact. *The Review of Economics and Statistics* 78:510–20.
- PRS Group. 2002. *International country risk guide*. East Syracuse, NY: PRS Group, Inc.
- Rapp, Richard, and Richard Rozek. 1990. Benefits and costs of intellectual property protection in developing countries. *Journal of World Trade* 24:74–102.
- Sabry, Faten. 2000. An analysis of the decision to file, the dumping estimates, and the outcome of antidumping petitions. *International Trade Journal* 14:109–45.
- United Nations Conference on Trade and Development. 1996. *The TRIPS Agreement and Developing Countries*. New York and Geneva: United Nations.
- World Bank Group. 2002. *World development indicators database*. Washington, DC: World Bank Group.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.