

JOURNAL OF MEDIA ECONOMICS, 18(2), 109–129
Copyright © 2005, Lawrence Erlbaum Associates, Inc.

Multimedia, Entertainment, and Business Software Copyright Piracy: A Cross-National Study

Hans van Kranenburg
*Department of Organization and Strategy
University of Maastricht*

Annelies Hogenbirk
*Economic Research Department
Rabobank Nederland*

This article examines cross-national variations in piracy of U.S. copyright-related products in the multimedia, entertainment, and software industry. To determine which economic, legal, and social factors cause the considerable differences in piracy of U.S. copyright industries' products in individual countries, we tested 4 industry models. We found that for most industries piracy can be explained by the risk profile of the country involved (signaling economic and political stability and growth potential) and the existence of a strong intellectual property rights system. Furthermore, for the 4 analyzed copyright-based industries, considerable variation in piracy exists between geographic regions. This study shows that disaggregation of the copyright piracy data by industry is helpful in analyzing and understanding piracy.

U.S. companies with strong copyright interests and their partners are shaping the intellectual property related trade diplomacy of the United States in the World Trade Organization. These companies have vigorously argued that inadequate copyright protection would threaten the basic incentive of copyrights and would jeopardize investments in the creation and innovation of products in business, literature, music, arts, and science (Stolpe, 2000). The companies in the copyright-based industries share the characteristic that their products can be imitated

Requests for reprints should be sent to Hans van Kranenburg, Department of Organization and Strategy, Faculty of Economics and Business Administration, University of Maastricht, P.O. Box 616, 6200 MD Maastricht, The Netherlands. E-mail: h.vankranenburg@OS.unimaas.nl

and copied at a relatively low cost (Gallegos, 1999; Stolpe, 2000). These developments stimulate the desire for improved copyright legislation and cross-border harmonization of intellectual property rights regimes.

Economists, politicians, legal scholars, and other professionals in the creative industries are still debating the effects of unauthorized copying on society and companies and the need to prevent illegal activities. A large group of studies is concerned with the influence that strengthening the protection of intellectual property rights will have on society. In this context, researchers have considered the social and economic developments of an economy under various enforcement and protection systems. For instance, Gould and Gruben (1996) found that intellectual property rights foster the economic growth of a society. Dunning (1993) and Seyoum (1996) showed that the protection of intellectual property rights is positively related to rates of foreign direct investments and innovations in a country. However, Tang and Von Tunzelmann (2000) emphasized that the diffusion of knowledge and adoption of a new technology can also be sped up within a weak intellectual property protection regime. The evidence regarding the effect of intellectual property rights protection on society is inconclusive.

Another group of studies examines the strategic behavior of companies and the impact of unauthorized copying of their products on their performance. Again the findings are ambiguous. Gallegos (1999) emphasized that piracy is harmful to companies in copyright-based industries. As a result of piracy, companies lose sales and receive lower revenues. Furthermore, by not knowing the users of pirated products, companies lose opportunities to cross-sell their other products and capitalize on any ideas from illegal users for improving the product or developing new products (Givon, Mahajan, & Muller, 1995). However, other studies did not confirm these findings. A company's most profitable strategy may indeed be to encourage imitation when the size of the user base influences the perceived quality of the product (e.g., Connor, 1995; Liebowitz, 1985). The company then experiences positive network externalities due to piracy because it results in an increase in the number of individuals using the product (Katz & Shapiro, 1986; Takeyama, 1997).

For decisions on strategic positioning, exports, and foreign direct investment behavior, copyright-based firms need to know what types of countries provide strong copyright protection. Surprisingly little is known about how intellectual property rights protection is actually determined and which economic, legal, and social factors contribute to this protection. Studying the determinants of piracy rates and the estimated companies' revenue losses suffered abroad due to piracy would be useful for understanding the strategy and policy initiatives to be undertaken by companies, industries, and governments. This study extends existing studies (e.g., Husted, 2000; Marron & Steel, 2000) by examining the cross-national variation in piracy in four U.S. copyright-based industries: business software applications, record and musical compositions, motion pictures, and entertainment software. It focuses on the United States because of its size in copyright-related products and the availability of data.

The data provided by the International Intellectual Property Alliance (IIPA), a coalition consisting of seven U.S. copyright industry representative trade associations, are the only piracy data available for these industries. These data are probably biased in favor of the industries. Despite the limitations, the data are the most commonly accepted piracy indicators.

PIRACY OF U.S. COPYRIGHT-RELATED PRODUCTS

The U.S. core copyright-based industries are categorized broadly into eight industries: motion pictures (television, theatrical, and home video); recording (records, tapes, and CDs); music publishing; computer software applications (both for business and entertainment); books, journals, and newspaper publishing; radio, television, and cable broadcasting; legitimate theater; and advertising (IIPA, 2001). These industries create copyrighted works as their primary product. The economic contribution of these industries to the U.S. economy is substantial. The copyright-based industries' foreign sales and exports continue to be larger than the exports of almost all other U.S. leading industries, such as chemicals and allied products, automobiles, aircraft, and agriculture (IIPA, 2001). However, the most important weakness of these creative industries relates to the ease with which their products can be (illegally) copied and sold. Recently, the increase in copying-related innovations has further facilitated piracy and as a consequence may have a negative effect on the financial results of the creative companies. These developments have prompted a desire for international copyright legislation. As part of the IIPA efforts to protect the U.S. copyright-based industries, it annually reports the deficiencies of the copyright regimes of countries where the U.S. copyright-based industries suffered the most. These countries are ranked on the Special 301 lists according to the importance of monitoring their intellectual property practices by the United States (IIPA, 1999, 2000, 2001). In this study, we focus on piracy rates for four creative industries in different countries for the year 1999: motion pictures, sound recording and musical compositions, business software applications, and entertainment software.¹ The piracy rates for a particular creative industry vary substantially among countries. According to the IIPA, in some countries, virtually all motion pictures have been pirated. Vietnam, Costa Rica, Bolivia, and Latvia, for example, had piracy rates of 95% or more in 1999. Other countries, for instance, Greece, Korea, and Italy, had piracy rates in these materials below 25%. However, in terms of the business software applications piracy rate, the Czech Republic (42%), Israel (44%), and Italy (44%) had the lowest piracy rates, whereas China (91%), the Russian Federation (89%), and Vietnam (98%) had the highest. The average entertainment software piracy rate was

¹A description of the construction of the piracy data for these four U.S. copyright-based industries and their limitations are available from the authors by request.

more than 78% for the monitored countries. The lowest ranked country was El Salvador, with a piracy rate of 50% for entertainment software materials. Malaysia (99%) and the former Soviet Union members (95% or more) were top-rank countries when it comes to piracy in this industry. The average sound recording and musical compositions piracy rate of the countries listed in the 301 Report is approximately 50%, but the standard deviation is high, with rates ranging from 8% for Czech Republic to 95% for Brazil and Ukraine.

Although the piracy rates differ significantly within and between countries for these four industries, they give insufficient information to draw conclusions on the economic effects of unauthorized production and distribution of materials for personal and business purposes. IIPA (1999, 2000, 2001) reported estimates of the revenue losses suffered by the four U.S. creative industries; however, these data have to be carefully interpreted, because they overestimate the incurred loss. First, loss revenue is usually estimated by multiplying the legitimate price of the product by the estimated number of pirated copies. However, many of these copies would not have been purchased at the legitimate price (Marron & Steel, 2000). Second, companies may experience positive network externalities due to piracy resulting from an increase in the critical mass. Given that no other data are available, these estimates currently provide the best insights into the financial consequences of piracy for the creative industries.

We found a very weak relation between the estimated dollar revenue losses suffered by the U.S. copyright-based industries in foreign countries and piracy rates. The average correlation between piracy rates and associated revenue losses was only 0.15 and statistically not significant different from zero. It is therefore possible that considerable revenue losses suffered by U.S. creative companies due to piracy occur in countries that have low piracy rates.

The entertainment software industry has both the highest mean and the highest standard deviation, signaling considerable revenue losses for U.S. firms. According to IIPA (2001), the estimated worldwide total revenue loss for this U.S. industry amounts to at least 2.9 billion U.S. dollars (USD). China created the highest revenue loss for the entertainment software companies, amounting to almost 1.4 billion USD, whereas countries such as El Salvador and Guatemala showed the lowest revenue losses (0.1 million USD). The estimated revenue losses suffered by U.S. creative companies caused by unauthorized production and distribution of business software applications was also the highest in China (437.20 million USD), although now closely followed by Italy (338.40 million USD) and Brazil (319.30 million USD). The lowest ranked country is Lebanon, with a counterfeiting revenue loss of only 1.6 million USD. However, in terms of sound recordings and musical compositions, revenue losses were highest in Brazil, with an unauthorized copyright production of 300 million USD. In contrast, other countries, such as Oman, Qatar, and Jordan, created revenue losses for U.S. companies in these materials below 1 million USD. The estimated average U.S. motion pictures coun-

terfeiting revenue loss in the countries listed in the 301 Report was approximately 29 million USD, with the levels ranging from 0.5 million for Qatar to 250 million for the Russian Federation.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

Only recently, economists and policy analysts have begun to explore the determinants of intellectual property rights protection and violation. Most studies have investigated the patent-related industries and the business software applications industry. Few studies have explored the differences in other creative industries' piracy rates or estimated revenue losses at the country level. This article attempts to bridge this gap. As a starting point for this study, we use the findings of various works that investigate the cross-national differences of piracy in the copyright-based industries, contributing these differences to a country's specific social, legal, and economic factors. Broadly speaking, four groups of variables influence the levels of piracy and the intellectual property rights protection in a country. First of all, many studies have investigated the relation between a country's economic situation and the intellectual property rights (in particular, patent) protection. These studies include, among others, Ginarte and Park (1997) and Marron and Steel (2000). The literature indicates a relation between market size and intellectual property rights protection. Large markets, in general, are attractive locations for inward foreign direct investments (Buckley & Casson, 1981). However, foreign direct investments are not attracted to places with weak intellectual property rights protection (Dunning, 1993; Lee & Mansfield, 1996; Seyoum, 1996). Furthermore, large markets contain more opportunities for piracy, given that the identification of the unauthorized producers and users of the illegal products is more difficult than in smaller markets (Tang & Von Tunzelmann, 2000). In a large market, even piracy on a small scale can create a considerable loss for the creative firms. To protect their businesses, these companies put pressure on host country governments to strengthen the protection of intellectual property rights (Samuelson, 1999). They may retaliate with actions, such as trade impediments, to ensure protection from piracy. This threat of retaliation increases with the size of the host market (Stegemann, 2000). Many larger countries therefore try to reduce the unauthorized production and use of intellectual property rights related products. To examine the relation between market size and piracy rates and revenue losses suffered by foreign copyright-based industries in a country, we suggest the following two hypotheses:

H1a: The larger the market size of a host country, the lower the piracy rates of copyright-based products.

H1b: The larger the market size of a host country, the higher the revenue losses suffered by foreign copyright-based industries.

The overall level of economic development also influences intellectual property rights protection. Burke (1996) and Marron and Steel (2000), for instance, indicated that the higher the level of economic development, the less likely that piracy occurs. This was confirmed by Silva and Ramello (2000) who found strong evidence of the presence of a buoyant market of unauthorized reproduction of sound recording products in emerging and less developed regions. Similar results have been found in studies focusing on the influence of social and economic conditions and the strength of economic institutions on software piracy. Marron and Steel (2000) found that countries with strong institutions protecting contracts and property also tend to have lower piracy rates. In general, countries that make inefficient public investments and economic policy decisions do not have protection systems or have weak ones (Knack & Keefer, 1995). Ginarte and Park (1997) emphasized that indicators of political credibility and economic development, such as market freedom and openness, are important determinants of the provision of property rights.

The level of economic and social development, political credibility, and the security of legal rights are reflected in measurements of country risk (Oetzal, Bettis, & Zenner, 2001). The country risk measure determines the effect of possible political or economic events on the business climate in a country. Companies may experience less protection of the intellectual property rights in countries that are characterized by high risk and are therefore likely to suffer considerable revenue losses. Moreover, the security of property and contractual rights and efficiency is negatively related to the country risk. We therefore hypothesize:

H2: Countries that are characterized by more political and economic risk exhibit higher piracy rates and revenue losses for foreign copyright-based companies than countries with low risk characteristics.

The second group of factors relates to the size of the user base of copyright-related products (e.g., Givon et al., 1995). The size of the user base becomes important when there is a positive consumption or network externality that exists if the utility for the product increases with piracy, because it increases the number of other individuals using it (Shy & Thisse, 1999; Takeyama, 1997). The risk of piracy increases with the number of owners of complementary products—such as televisions, personal computers (PCs), and CD players—because they are potential users of copyright-related products. For instance, Gallegos (1999) and Moorehouse (2001) indicated that software piracy has increased considerably due to the explosive growth in the number of people that have access to the Internet and the advances in technology that have increased the ease and speed of access to the Internet. Unlike the physical distribution of pirated software, the Internet allows

pirated products to be transferred from a host computer to a personal computer without anyone's knowledge. Similarly, Ostergard (2000) stressed that the great advances in technology have resulted in easier methods of duplicating that same technology and associated products. For instance, the introduction of video recorders in the consumer market has brought with it a capacity to duplicate videotapes, bringing about potentially massive violations of entertainment industry copyright protection. Likewise, Silva and Ramello (2000) indicated that the introduction of recording equipment by Philips and other producers in the late 1960s resulted in private music copying by individual consumers using their home equipment. This leads to the following hypotheses:

H3: Countries that are characterized by a high density of computers exhibit higher piracy rates and revenue losses for foreign copyright-based companies than countries that have a low computer density.

H4: In the motion picture video and entertainment industries, countries that are characterized by a high density of television sets exhibit higher piracy rates and revenue losses for foreign copyright-based companies than countries that have a low television density.

The third group of determinants is related to the importance of trade in a country and its effect on the protection of copyright-based materials and fair market access. Open countries with high export shares have many domestic firms that require safeguarding of their own unique assets to remain competitive in the international arena (Gould & Gruben, 1996). These countries are more careful in their international relations because they are more dependent on them for economic growth. Therefore, they are more inclined to respect intellectual property rights of foreign firms due to the fear of repercussions (such as trade boycotts) in case they would violate international agreements (Stegemann, 2000; Stolpe, 2000). Thus, we expect that the piracy measures to be negatively related with a country's level of export.

Another interesting measure is the share of high technology exports in total exports, which is a good indicator of the technology level of that particular country. The higher the level of technology, the more likely it is that unauthorized production and distribution of copyright-based materials will take place, because the skills and related technologies are available (see, e.g., Ostergard, 2000). An important example is computer software from Hong Kong (Gallegos, 1999). When countries lack a minimum technology base, they are not able to copy high-technology products. We would therefore expect a positive relation between the piracy measures and the share of high-technology exports. We suggest the following hypotheses:

H5: Countries that strongly depend on exports exhibit lower piracy rates and revenue losses for foreign copyright-based companies than countries that are less dependent on exports.

H6: Countries that have a relatively large share of high-technology products in exports exhibit higher piracy rates and revenue losses for foreign copyright-based companies than countries that have a relatively small share of high-technology products in exports.

The last essential group is composed of legal factors. Intellectual property rights protection has two components: a statute component and an enforcement component. We must consider both the strength of the laws and the enforcement of those laws to assess the extension of intellectual property rights protection in a country (Ostergard, 2000; Samuelson, 1999). The enforcement of intellectual property rights embodies two tasks: preventing their infringement by free-riders and disciplining attempts by the rights holders to extend them beyond the terms of the grant (Maskus, 1998). For the enforcement of these laws, countries must have institutional structures and financial resources (Ostergard, 2000). In empirical studies, intellectual property rights protection is frequently measured by the country's membership in international conventions on the subject (Ginarte & Park, 1997). Burke (1996), for instance, tested the importance of convention membership on piracy levels in the audio software industry. Several international conventions (such as Berne 1887, Rome 1961, Geneva Phonogram 1971) have tried to enforce copyright protection for artists and producers in the music industry. Burke (1996) found that countries that are members of those convention agreements have lower piracy rates than countries that are not. We therefore hypothesize:

H7: The existence of an extensive copyright protection system in a country reduces the piracy rates and the revenue losses suffered by foreign copyright-based companies.

THE DATA

The data set for this study was composed of data from various sources. The primary sources we employed were the IIPA (1999, 2000, 2001) and the World Bank (2000, 2001). The former provides data on the estimated copyright piracy rate levels and the associated estimated aggregate revenue losses suffered by U.S. copyright-based industries in the countries that are listed on the Special 301 reports. The world development indicators database of the World Bank provides an extensive collection of data about social, financial, economic, and political indicators. For this study, we used only those countries for which sufficient data were available from both sources. These countries are listed in Table 1.

The dependent variables were piracy rate and estimated revenue loss suffered by the four U.S. creative industries due to piracy in each country in the analyses. In all regressions for the estimated suffered revenue losses in U.S. dollars, we used the log

TABLE 1
 Overview of Countries Monitored by the International Intellectual Property Alliance,
 Their Membership of Intellectual Property Right Treaties, and the Protection of
 Intellectual Property Rights Under National Laws

Country	Intellectual Property Right Treaties					Existence of National Protection Law	
	<i>Berne</i>	<i>Universal</i>	<i>Paris</i>	<i>European</i>	<i>Patent</i>	<i>Copyright</i>	<i>Patent</i>
	<i>Convention</i>	<i>Convention</i>	<i>Convention</i>	<i>Convention</i>	<i>Cooperation</i>	<i>Protection</i>	<i>Protection</i>
					<i>Treaty</i>	<i>Law</i>	<i>Law</i>
Argentina	Yes	Yes	Yes	No	No	No	No
Bolivia	Yes	Yes	Yes	No	No	No	No
Brazil	Yes	Yes	Yes	No	Yes	Yes	No
Chile	Yes	Yes	Yes	No	No	No	No
China	Yes	Yes	Yes	No	Yes	Yes	No
Colombia	Yes	Yes	Yes	No	No	Yes	No
Costa Rica	Yes	Yes	Yes	No	Yes	Yes	No
Czech Republic	Yes	Yes	Yes	No	Yes	Yes	No
Dominican Republic	Yes	Yes	Yes	No	Yes	Yes	Yes
Egypt	Yes	No	Yes	No	No	Yes	No
El Salvador	Yes	Yes	Yes	No	No	Yes	No
Estonia	Yes	No	Yes	No	Yes	Yes	No
Greece	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Guatemala	Yes	Yes	Yes	No	No	No	No
Hungary	Yes	Yes	Yes	No	Yes	Yes	No
India	Yes	Yes	Yes	No	Yes	Yes	No
Indonesia	Yes	No	Yes	No	Yes	Yes	No
Israel	Yes	Yes	Yes	No	Yes	Yes	Yes
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Jordan	Yes	No	Yes	No	No	Yes	No
Korea Republic	Yes	Yes	Yes	No	Yes	Yes	Yes
Kuwait	No	No	No	No	No	No	No
Latvia	Yes	No	Yes	No	Yes	Yes	No
Lebanon	Yes	Yes	Yes	No	No	Yes	No
Lithuania (OCR)	Yes	No	Yes	No	Yes	Yes	No
Malaysia	Yes	No	Yes	No	No	Yes	No
Oman	Yes	No	Yes	No	No	Yes	No
Pakistan	Yes	Yes	No	No	No	Yes	No
Paraguay	Yes	No	Yes	No	No	Yes	No
Peru	Yes	Yes	Yes	No	No	Yes	No
Philippines	Yes	No	Yes	No	No	Yes	No
Poland	Yes	Yes	Yes	No	Yes	Yes	No
Qatar	Yes	No	Yes	No	No	Yes	No
Romania	Yes	No	Yes	No	Yes	Yes	No
Russian Federation	Yes	Yes	Yes	No	Yes	Yes	No
Saudi Arabia	No	Yes	No	No	No	Yes	No
Slovakia	Yes	Yes	Yes	No	Yes	Yes	No

(continued)

TABLE 1 (Continued)

Country	Intellectual Property Right Treaties					Existence of National Protection Law	
	Berne Convention	Universal	Paris Convention	European	Patent Cooperation Treaty	Copyright	Patent
		Copyright Convention		Patent Convention		Protection Law	Protection Law
Taiwan	No	No	No	No	Yes	Yes	Yes
Thailand	Yes	No	No	No	No	Yes	No
Turkey	Yes	No	Yes	No	Yes	Yes	No
Ukraine	Yes	Yes	Yes	No	Yes	Yes	No
Uruguay	Yes	Yes	Yes	No	No	Yes	No
Venezuela Republic	Yes	Yes	Yes	No	No	Yes	No
Vietnam	No	No	Yes	No	Yes	Yes	No

Note. Source: Fenwick and West (2000), International Intellectual Property Alliance (2001), and World Intellectual Property Organization (2001).

value of the dependent variable revenue loss. Because revenue losses were defined as ≥ 0 , the use of the log value of specific revenue losses was an attractive feature.

We included a country's domestic market size to test H1a and H1b. Following, for instance, Buckley and Casson (1981) and Lee and Mansfield (1996), we proxied market size by the host country's gross domestic product (GDP). Domestic market size was also logged in all equations, because we expected percentage differences in market size, rather than absolute dollar differences in GDP, to be linearly related to piracy rates and log value of the revenue losses due to piracy, respectively.

The level of exports was measured by the share of exports of goods and services in GDP. High-technology exports were measured as the percentage of total manufactured exports made up by high-technology products. The values of the number of PCs and the number of TVs per 1,000 persons were converted into natural logarithm values. This procedure renders the relations between rates and revenue losses and each of the explanatory variables in percentage terms, either by definition of the variable itself as a percentage or by transformation of the relation to log values.

The risk of a country was measured by the Euromoney's country risk rating (see World Bank, 2000). Countries are rated on a scale of 1 (*very high risk*) to 100 (*no risk*). These risk ratings are based on nine weighted categories that assess country risk, covering economic performance, political risk, debt, and access to financial and capital markets. These include economic data (25%), political risk (25%), debt indicators (10%), debt in default or rescheduled (10%), credit rating (10%), access to bank finance (5%), access to short-term finance (5%), and access to capital markets (5%). They are composed of polls of economists and political analysts supplemented by quantitative data (Oetzel et al., 2001).

A variety of data sources on international legal protection for copyright-based materials were consulted to determine if protection is available in a particular country for either a U.S. or a foreign company. An index was constructed that indicated how strongly a country would provide intellectual property rights protection. The variable equals 1 if the country in question meets all the following three criteria: (a) Protection is available under the national copyright law of a particular country; (b) patent protection is available in national law; (c) the country belongs to the maximum number (five) of intellectual property rights treaties. The five convention memberships are Berne Convention, Universal Copyright Convention, Paris Convention, European Patent Convention, and Patent Cooperation Treaty.² Table 1 also shows an overview of a country's membership in the intellectual property rights treaties and whether it has a national law for both copyright and patent protection as of 1998. To calculate the copyright protection system index, we recoded a membership into the value 1 and also the existence of protection in the national laws: yes = 1 and no = 0. The protection value for a country is the number of conditions satisfied (number of 1s received) divided by the maximum number of conditions to be satisfied. The law index varies from 1 (*strong protection*) to 0 (*low protection*).

The sample included a substantial number of countries from different regions: East Europe (10), Asia (11), the Middle East (8), and Latin America (13). It is clear that countries from Western Europe (2) and Africa (zero) do not have the highest monitoring priority by the U.S. government. In Western Europe, overall the countries adequately and effectively protect U.S. intellectual property rights and provide fair and equitable market access to U.S. companies that produce copyright-based materials (Markusen, 2001). In Africa, only few business activities occur, reducing the overall risk of piracy.

RESULTS

Table 2 shows the results of the model of ordinary least squares (OLS) estimations for piracy rates. We tested our model for four U.S. copyright-based industries in which intellectual property rights protection matters: business software applications, sound recording and musical compositions, motion pictures, and entertainment software.

²Software can be protected against piracy by using copyrights and patents. When a software-related invention is only a mathematical algorithm, such as a computer program designed to convert binary-coded decimal numbers into binary numbers, then the invention is not eligible for patent protection. However, if the invention utilizes the device to manipulate numbers that represent concrete, real-world values, then the invention is a process relating to those real-world concepts and is patentable. However, copyrights are the strongest legal protection instrument to be used in the fight to reduce globally software piracy (Tysver, 2000).

TABLE 2
Results of the Industry Models Explaining the Copyright Piracy Rates of U.S. Creative Industries in
Different Countries in 1999

<i>Variables</i>	<i>Business Software Applications</i>		<i>Recording and Musical Compositions</i>		<i>Motion Pictures</i>		<i>Entertainment Software</i>	
	<i>Coefficient</i>	<i>t</i>	<i>Coefficient</i>	<i>t</i>	<i>Coefficient</i>	<i>t</i>	<i>Coefficient</i>	<i>t</i>
Constant	130.795***	12.681	123.500***	5.323	39.658	1.011	103.558***	3.476
Domestic market	-1.969	1.072	0.125	0.032	-5.111	1.463	1.713	0.739
Country risk rating	-72.601***	3.312	-93.248*	1.858	-89.349*	1.963	-37.011	1.262
Number of PCs per 1,000 persons	-2.321	0.881	-0.979	0.167	-4.845	0.791	0.866	0.215
Number of TVs per 1,000 persons	—	—	—	—	19.328**	2.691	0.415	0.082
Export of goods and services (% of GDP)	-0.067	0.469	-0.314	1.008	0.119	0.398	-0.062	0.309
High-technology exports (% of manufactured exports)	0.065	0.399	0.076	0.207	-0.011	0.032	0.102	0.465
Country copyright protection system	-22.581*	1.881	-22.158	0.814	-8.855	0.338	-44.368**	2.638
Region								
Western Europe	31.991***	2.901	22.584	0.893	-6.823	0.293	14.975	0.982
Eastern Europe	2.139	0.347	5.976	0.458	-15.552	1.233	20.717**	2.536
Asia	9.537	1.386	-6.221	0.405	20.050	1.338	15.617	1.450
Middle East	12.546**	2.096	0.970	0.075	6.422	0.547	-7.110	0.904
Number of countries	35		39		38		34	
R ² adjusted	0.545		0.153		0.341		0.341	

Note. PC = personal computer; GDP = gross domestic product.

* $p < .10$. ** $p < .05$. *** $p < .01$.

H1a implies a negative relation between market size and piracy rate. The results, however, show no clear relation between market size and piracy rates. H2, based on the economic development and stability group literature, argues that the level of piracy rates for the copyright-based products is positively associated with countries with high-risk characteristics, such as political and economic instability. We did find that for all four industries, low country risk resulted in a significantly lower piracy rate, although entertainment software showed a weak relation. Thus, the results support H2 for the business software applications, recording and musical compositions, and motion pictures industries. Regarding the presence of related products, we found that the presence of a high density of television sets in a country positively and significantly influenced the motion pictures piracy rate. H4 was therefore supported for this particular creative industry. On the other hand, we did not find a clear effect of the penetration of PCs on the piracy rates in any of the four creative industries.³ We therefore found no support for H3 in the case of piracy rates.

We also hypothesized that the countries depending on exports are more inclined to respect the intellectual property of foreign firms. However, the results do not support the relation between dependence on exports and copyright protection. We therefore cannot confirm H5. In H6 we argue that the higher the level of technology, the more likely that unauthorized production and distribution of copyright-based materials would take place because the skills and related technologies are available. However, no conclusive evidence was found for the relation between a country's technology level and the piracy rate for the studied creative industries.

H7 argues that countries with strong copyright protection systems have low piracy rates. The estimates of the indicator for the country's copyright protection system was negative and for two industries significantly different from zero. Thus, a sufficient legal system with strong copyright protection generally results in lower piracy rates. This effect was particularly strong and significant in the case of the entertainment software industry and business software applications industry. Hence, these results confirm H7.

It is interesting to note that we found strong differences in piracy rates among different regions in the world. Our benchmark region was Latin America. The estimates show that Western European and Asian countries demonstrate a higher illegal use of business software applications than their Latin American counterparts. Furthermore, the Eastern European countries show a larger inclination to copy entertainment software materials than countries in other regions.

Table 3 presents the results of the model OLS estimations for revenue losses suffered by the four U.S. copyright-based industries abroad. When considering the estimated dollar revenue losses for U.S. firms due to piracy in other countries, we

³As suggested by one of the reviewers, we also tested the relation between piracy and education. Because of a strong correlation between PC penetration and literacy rates, we could not test the hypothesis on education.

TABLE 3
 Results of the Industry Models Explaining the U.S. Creative Industries Revenue Losses in a Country Due to
 Copyright Piracy in 1999

Variables	Business Software Applications		Recording and Musical Compositions		Motion Pictures		Entertainment Software	
	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t
Constant	-1.239***	3.347	0.899	0.709	-2.761**	2.552	-1.595	0.529
Domestic market	0.994***	15.094	0.742***	3.539	1.109***	11.510	1.294***	5.517
Country risk rating	2.004**	2.548	-2.813	1.026	-3.368**	2.683	-1.558	0.526
Number of PCs per 1,000 persons	-0.166	1.609	0.264	0.823	-0.061	0.361	0.611	1.502
Number of TVs per 1,000 persons	—	—	—	—	0.417**	2.105	-0.308	0.599
Export of goods and services (% of GDP)	0.010*	1.947	-0.023	1.350	0.006	0.671	-0.003	0.143
High-technology exports (% of manufactured exports)	0.002	0.374	0.031	1.516	0.018*	1.959	-0.001	0.143
Country copyright protection system	0.256	0.595	0.014	0.009	-0.537	0.744	-2.640	1.552
Region								
West Europe	-1.212***	3.063	-0.747	0.541	0.679	1.058	0.561	0.364
East Europe	-0.431*	1.945	0.182	0.255	0.252	0.724	1.497*	1.812
Asia	-0.791***	3.202	-1.770**	2.111	0.025	0.061	1.781	1.635
Middle East	-0.993***	4.625	-0.860	1.225	0.865**	2.672	-0.343	0.431
Number of countries	35		39		38		34	
R ² adjusted	0.926		0.407		0.905		0.650	

Note. PC = personal computer; GDP = gross domestic product.

* $p < .10$. ** $p < .05$. *** $p < .01$.

found related, though slightly different, results as for piracy rates. First of all, contrary to the results for piracy rates, we found strong evidence of a positive influence of the market size of the host country and the estimated revenue losses of U.S. creative companies resulting from illegal copying of business software applications, entertainment software, sound recording and musical compositions, and motion pictures industries. Thus, the estimates of market size strongly support H1b.

The results on country risk are conflicting. In the case of the motion pictures industry, they confirmed our expectation that higher stability results in a decline of revenue losses for U.S. companies. However, we found that in the case of business software applications, it actually results in an increase in revenue losses. Therefore, H2 cannot be generally accepted.

Regarding the density of television sets, we again found evidence that supports H4 in the case of the motion pictures industry. In this particular industry, a high penetration of television sets results in an increase in estimated revenue losses. Again, we found that the density of PCs in a country has no influence on the estimated revenue losses in any of these four copyright-based industries. Thus, H3 about the effect of the penetration of PCs on the suffered revenue losses due to piracy is not supported.

Furthermore, the estimate of the indicator for a country's export dependence was only positive and significant in the case of the business software applications industry. This result is surprising because H5 argues that a country with a high export ratio has an incentive to protect intellectual property right based products of foreign companies. For the motion pictures industry, we found that countries with high-technology exports significantly and positively influenced the estimated revenue losses suffered by U.S. companies. It is relatively easy to copy motion pictures and videos once a country has a certain level of technological development. Thus, H6 is partly supported.

We also hypothesized that a strong system to protect copyrights in a host country would have a positive impact on the revenue losses of foreign copyright-based companies due to illegal copying of their products (H7). The estimates of the indicator of a country's copyright protection system were not significantly different from zero. Thus, H7 is not supported for the estimated revenue losses of U.S. companies due to piracy.

Again, we found considerable differences in the effect of specific regions. For U.S. firms in copyright-based industries, the likelihood of a revenue loss due to business software applications piracy was significantly smaller in Western Europe, Asia, and the Middle East than in Latin American countries. In the entertainment software industry, we found evidence that countries in Eastern Europe show the highest likelihood of revenue losses for U.S. companies due to piracy of entertainment materials. Furthermore, the regions of Asia and the Middle East behave differently from the other regions, in particular in comparison with Latin America, in the sound recording and musical compositions industry and motion pictures indus-

try, respectively. The estimate of Asia was negative, whereas the estimate of the Middle East was positive and significantly different from zero.

DISCUSSION

To determine the cross-national variation in piracy rates and the resulting estimated revenue losses for U.S. copyright-based industries (business software applications, recording and musical compositions, motion pictures, and entertainment software), we have considered four groups of variables as identified by previous studies: economic development and stability, penetration of related products, trade relations, and legal factors. It is important to emphasize that only a sample of countries is listed in the Special 301 report. These countries have the highest monitoring priority by the U.S. government. This decision is based on the weakness of their intellectual property rights protection system, particularly for copyrights.⁴ Furthermore, the piracy data are based on only four U.S. copyright-based industries. This implies that some caution must be used regarding the generalization of the findings.

Regarding the economic variables, the results of our analyses strongly support the hypothesis that, in larger markets, the estimated revenue losses suffered by U.S. copyright-based companies due to unauthorized (re)production and distribution of their copyright-related materials in large host markets are considerable, even when these countries are characterized by relatively low piracy rates. Therefore, even though host countries may have relatively low piracy rates, the overall estimated revenue losses suffered by foreign copyright-based companies due to piracy in these economies are not necessarily negligible. This result is in line with Tang and Von Tunzelmann (2000) who emphasized that large markets offer many opportunities for piracy, given that the identification of the unauthorized producers and users of the illegal products is more difficult than in smaller markets. Even piracy on a small scale can then create a considerable loss for the creative firm.

We found no significant relation between market size and piracy rates. Even though most studies indicate that larger countries have better intellectual property rights protection out of fear for retaliation (Samuelson, 1999; Stegemann, 2000) or to remain an attractive location for foreign direct investment (Dunning, 1993; Lee & Mansfield, 1996; Seyoum, 1996), this expectation was not confirmed in our study. This can be explained by the fact that other factors related to market size capture the economic situation of the country better than market size measured by GDP. For instance, Husted (2000) and Marron and Steel (2000) emphasized that it is not only one

⁴As emphasized by one of the reviewers, the United State's 301 watch lists are quite political. Although primarily shaped by copyright protection and piracy factors, it is also occasionally the case that a country's placement on the 301 list reflects nonpiracy-related foreign and trade policy considerations rather than purely intellectual property issues.

variable that indicates the level of economic development per se that influences the provision of intellectual property rights, but rather a group of determinants of economic development, such as income, stability and political climate, demand for luxury goods, technology level, market size, and market access and openness.

To capture these elements, this study therefore also considered country risk as a potential explanation for piracy rates and losses. Risk was measured as a combination of economic performance, political stability, access to domestic markets, and a country's debt situation. In general, the evidence shows that countries that have a high-risk profile offer little protection of copyrights, resulting in high piracy rates, particularly in the business software application, recording and musical compositions, and motion pictures industries. This result confirms Ginarte and Park (1997). Countries that are very risky are therefore not attractive locations for business activities of U.S. firms in the copyright-based industries. For piracy rates, the risk variable captures the elements mentioned by Marron and Steel (2000).

The results regarding the actual estimated revenue losses are conflicting. Contrary to our expectation, we found that for the business software applications industries, low-risk countries are actually associated with large revenue losses suffered by foreign creative companies due to piracy in this industry. This surprising phenomenon can be attributed to the fact that relatively developed and stable economies have enough resources to invest in (copying) business software materials. In general, state-of-the-art business software applications products are developed and used in countries with high-technology knowledge industries. These countries are characterized by low risk. It seems that revenue losses suffered by creative companies due to piracy of their products are the highest in these countries.

The second group of variables was the penetration of related products. Our results confirm the expectation that the risk of piracy increases with the number of owners of complementary products, which is in line with previous studies by Takeyama (1997) and Shy and Thisse (1999). This is particularly true in case of the motion pictures industry as related to the number of televisions. The fact that many households possess TVs and recording equipments encourages the illegal copying of videos. However, the penetration of computers has no significant effect on the piracy rates or losses occurring in any of the four studied industries. This can be explained by the fact that computers are still a relatively new phenomenon. They are not nearly as widespread as televisions, and not every household currently has access to a computer, the Internet, or the necessary software to engage in illegal activities, in particular for the countries listed on the 301 report.

The third group of factors considered in this study was trade-related measures. The results for the two variables introduced here are disappointing. We find no proof for the hypothesis that exporting countries exhibit lower piracy rates and losses. This result is not in line with Stegemann (2000) and Stolpe (2000).

Intellectual property rights protection is a tremendously fluid concept strongly affected by cultural values. It is very much rooted in the Western cultural values of

liberalism and individual rights. A majority of countries in our sample are middle-income countries that do not value liberalism and individual rights as high as Western countries do. In general, even when they are export-oriented, they still have problems accepting the legitimacy of the monopoly claims over intellectual property as asserted by companies. Maskus (1998) emphasized that middle-income countries indeed may weaken their protection systems because they have the ability to imitate new technology that can help to stimulate their economy. Many countries in our sample, therefore, even though they export heavily and may fear retaliation, prefer to allow piracy. Only when economies move from the middle-income to the high-income group do intellectual property rights protection increase sharply.

The theoretical debate of the effect of the technology level of a country on piracy is still undecided. Our results are in line with Marron and Steel (2000), who found no convincing evidence for the effect of technology on piracy. However, despite these results, many innovative firms do perceive substantial revenue losses in foreign markets from illegal copying (Maskus, 1998). The opportunities for international free riding have increased because technologies for copying software, entertainment products, books, transmissions, and certain technologies have become cheaper and more reliable. This development has therefore increased the pressure for strong international standards on intellectual property rights protection (Maskus, 1998). As a result, each member of the World Trade Organization has agreed to develop an intellectual property rights system according to minimum standard. However, as of the time of this study, the deadline for countries to meet the obligations had not passed. The results therefore may not be visible yet.

Finally, we considered legal factors. Technological advantage is among the U.S. creative companies' most important strengths, as it is for most multinational enterprises. Slack intellectual property rights protection in host countries can lead to a rapid erosion of this key advantage. Locating research and development activities in a host country with lower intellectual property protection levels increases the companies' exposure to the possibility of losing technological secrets and advantages to local competitors. An extensive copyright protection system can help to protect the intellectual property of these companies. Our evidence shows that the existence of a strong protection system in a host country indeed reduces the piracy rates of various foreign copyright-related materials (in particular for business and entertainment software).

This study treated the four different copyright-based industries as almost undifferentiated. However, it is likely that differences exist among the industries that were not considered here. There exists some evidence that the specific utilities of copyright products may be important in piracy issues (Becker & Vlad, 2003). Further research should pay attention to the specificity of each context and should try to extend the number of countries in the sample. Another interesting research focus would be to investigate whether the universal consideration regarding the findings for pat-

ent-related products and industries are also valid for copyright-related products and industries. Given this research agenda, our contribution has certain limitations, but it also provides us with some interesting answers to a number of relevant questions regarding the determinants of piracy, taking country characteristics into account.

We implicitly modeled that individual countries select their copyright protection policy as a result of economic and legal conditions. Observed piracy rates and the estimated revenue losses suffered by copyright-based companies due to piracy are the outcome of these policies, their implementation, and the response of individuals and companies to them. An alternative approach, not adopted here, would be to analyze how individuals decide whether to pirate copyright-related products based on the costs and benefits facing them.

CONCLUSION

This study examined the cross-national variations in piracy of U.S. copyright-related products in four creative industries: business software applications, recording and musical compositions, motion pictures, and entertainment software. The piracy rate and estimated revenue losses data must be interpreted with some caution, because these data are probably biased in favor of the industries. We acknowledge the limitation of the data. However, given that no other data are available, we have decided to use the provided figures for our study. The piracy rates of copyright-related products and the revenue losses suffered by U.S. copyright-related companies due to illegal production and distribution of their products abroad show considerable differences among countries and regions but also among the different kinds of copyright-based industries. We considered four groups of country-specific variables—economic development and stability, legal issues, trade relations, and penetration of related products—to explain the cross-national piracy differences for these creative industries. We show that the disaggregation of the profile of a country is helpful in analyzing the piracy issue around the world.

Our most remarkable finding concerns the differences among the determinants of piracy rates and the resulting revenue losses suffered by U.S. copyright-based industries due to piracy. We find that a large market size of a host country results in higher revenue losses for the creative industries, even if the piracy rates in these industries are relatively low. Furthermore, we find that, in general, low-risk countries show lower piracy rates and that the revenue losses suffered by U.S. companies producing and selling copyright-related products in these countries are positively related with the risk, with one exception: revenue losses due to business software applications piracy. The evidence shows significant differences in piracy among separate regions in the world.

ACKNOWLEDGMENTS

This article was presented at Fifth World Media Economics Conference in Turku, Finland, in 2002 and the 2002 Academy of International Business annual meeting in Puerto Rico.

We are grateful for useful comments by the participants at the aforementioned conferences and the referees.

REFERENCES

- Becker, L. B., & Vlad, T. (2003). *Copyright and consequences: Central European and U.S. perspectives*. Cresskill, NJ: Hampton.
- Buckley, P. J., & Casson, M. C. (1981). The optimal timing of a foreign direct investment. *Economic Journal*, 91, 75–87.
- Burke, A. E. (1996). How effective are international copyright conventions in the music industry? *Journal of Cultural Economics*, 20, 51–66.
- Conner, K. R. (1995). Obtaining strategic advantage from being imitated: When can encouraging “clones” pay? *Management Science*, 41, 209–225.
- Dunning, J. (1993). *Multinational enterprises and the global economy*. London: Addison-Wesley.
- Fenwick & West LLP. (2000). *Chart of international legal protection for software*. Palo Alto, CA: Author.
- Gallegos, F. (1999). Software piracy: Some facts, figures, and issues. *Information Systems Security*, 8, 34–56.
- Ginarte, J. C., & Park, W. G. (1997). Determinants of patent rights: A cross-national study. *Research Policy*, 26, 283–301.
- Givon, M., Mahajan, V., & Muller, E. (1995). Software piracy: Estimation of lost sales and the impact on software distribution. *Journal of Marketing*, 59, 29–37.
- Gould, D. M., & Gruben, W. C. (1996). The role of intellectual property rights in economic growth. *Journal of Development Economics*, 48, 323–350.
- Husted, B. H. (2000). The impact of national culture on software piracy. *Journal of Business Ethics*, 26, 197–211.
- International Intellectual Property Alliance. (1999). *1999 Special 301 Report*. Washington, DC: Author.
- International Intellectual Property Alliance. (2000). *2000 Special 301 Report*. Washington, DC: Author.
- International Intellectual Property Alliance. (2001). *2001 Special 301 Report*. Washington, DC: Author.
- Katz, M., & Shapiro, C. (1986). Technology adoption in the presence of network externalities. *Journal of Political Economy*, 94, 822–841.
- Knack, S., & Keefer, P. (1995). Institutions and economic performance: Cross-country test using alternative institutional measures. *Economics and Politics*, 7, 207–227.
- Lee, J., & Mansfield, E. (1996). Intellectual property protection and U.S. foreign direct investment. *Review of Economics and Statistics*, 77, 181–186.
- Liebowitz, S. J. (1985). Copying and indirect appropriability: Photocopying of journals. *Journal of Political Economy*, 93, 945–957.
- Markusen, J. R. (2001). Contracts, intellectual property rights, and multinational investment in developing countries. *Journal of International Economics*, 53, 189–204.
- Marron, D. B., & Steel, D. G. (2000). Which countries protect intellectual property? The case of software piracy. *Economic Inquiry*, 38, 159–174.
- Maskus, K. E. (1998). The international regulation of intellectual property. *Weltwirtschaftliches Archiv*, 134, 186–208.

- Moorehouse, J. C. (2001). Property rights, technology, and Internet distribution. *Journal of Technology Transfer*, 26, 351–361.
- Oetzel, J. M., Bettis, R. A., & Zenner, M. (2001). Country risk measures: How risky are they? *Journal of World Business*, 36, 128–145.
- Ostergard, R. L. Jr. (2000). The measurement of intellectual property rights protection. *Journal of International Business Studies*, 31, 349–360.
- Samuelson, P. (1999). Implications of the agreement on trade related aspects of intellectual property rights for cultural dimensions of national copyright laws. *Journal of Cultural Economics*, 23, 95–107.
- Seyoum, B. (1996). The impact of intellectual property rights on foreign direct investment. *Columbia Journal of World Business*, 31, 50–59.
- Shy, O., & Thisse, J. (1999). A strategic approach to software protection. *Journal of Economics and Management Strategy*, 8, 163–190.
- Silva, F., & Ramello, G. B. (2000). Sound recording market: The ambiguous case of copyright and piracy. *Industrial and Corporate Change*, 9, 415–442.
- Stegemann, K. (2000). The integration of intellectual property rights into the WTO system. *World Economy*, 23, 1237–1267.
- Stolpe, M. (2000). Protection against software piracy: A study of technology adoption for the enforcement of intellectual property rights. *Economics of Innovation and New Technology*, 9, 25–52.
- Takeyama, L. N. (1997). The intertemporal consequences of unauthorized reproduction of intellectual property. *Journal of Law and Economics*, 40, 511–522.
- Tang, P., & Von Tunzelmann, N. (2000). Management, governance and intellectual property: Electronic publishing in the UK. *Journal of Management and Governance*, 4, 299–318.
- Tysver, D. A. (2000). *Bitlaw: A resource on technology law*. Minneapolis: Beck & Tysver.
- World Bank. (2000). *World development indicators*. Washington, DC: Author.
- World Bank. (2001). *World development indicators*. Washington, DC: Author.
- World Intellectual Property Organization. (2001). *Intellectual handbook: Policy, law and use*. Geneva: Author.