International Software Piracy: Analysis of Key Issues and Impacts

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The pervasiveness of software piracy throughout the world is having a profound effect on the software publishing industry and the development of digital intellectual properties and technologies—especially in developing countries, where the piracy rates are extremely high. An economic model is first presented that incorporates the incentive structures for governments, software publishers, and individual consumers. The analytical model provides the economic rationale for the reluctance of a number of governments to aggressively enact and enforce intellectual property rights. An important proposition derived from the analysis states that *the government's incentive to enact and enforce copyright laws are closely related to the size of the domestic software industry.* The ensuing empirical study provides support for the proposition and further suggests that this relationship holds regardless of the income levels of the countries. Our analysis reveals that alliances between foreign and domestic software publishers through product relationships can be mutually beneficial and will provide an environment of increased copyright enforcement. These results provide a viable strategy to combat global software piracy. With strong policies on copyright enforcement, and a vigorous promotion of alliances between foreign and domestic publishers, a government can increase the net welfare of the country and help establish a strong domestic software industry. Through product relationships with domestic publishers, a foreign publisher can improve profits and operate in an environment of increased intellectual property protection. We then present a general model of ethical behavior related to the impact of behavioral and cultural factors on software piracy. The purpose of this model is to examine whether these determinants of piracy behavior are supranational and transcend cultural and ethical barriers. An empirical study involving U.S. and Indian graduate students suggests that the general model of ethics as related to software piracy is valid in the United States. However, the model results from the Indian sample suggest that additional cross-cultural research with revised models and improved scales is necessary.
(*Economics; Ethics; Software Piracy; Intellectual Property; Culture*)

1. Introduction

Information Technology is a key driver in the increasing globalization of the U.S. economy. In particular, the U.S. software industry is at the cutting edge of the information age and is a major player in the global market. The worldwide market for the software industry in 1997 was $122 billion, and the U.S. software industry

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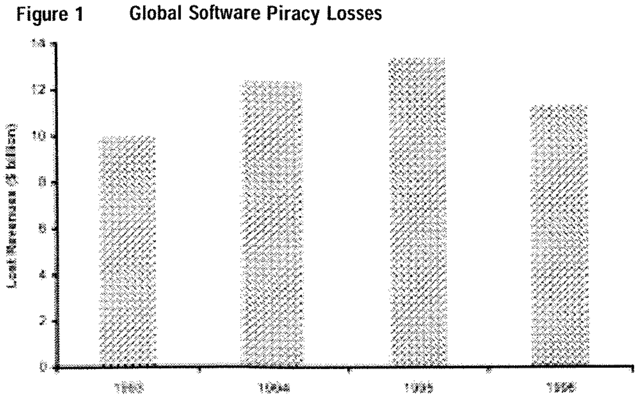
owns 70% of this market. Software piracy creates a significant drain on the revenues and retards the continued growth of the software publishing industry (Software Piracy Report 1997).

Software piracy is the illegal act of copying software for any reason, other than backup, without explicit permission from and compensation to the copyright holder. Software falls under the purview of intellectual property, and illegal duplication is prohibited by the U.S. and international copyright laws and treaties. Despite this legal protection, software piracy is practiced in most countries around the globe. Figure 1 illustrates the global software piracy losses of the business application software for the years 1993–1996. These losses reflect the fact that over 40% of the business application software in use is pirated (Software Piracy Report 1997).

The literature on criminology identifies *preventives* and *deterrents* as two measures to combat crime (Blumstein et al. 1978). The objective of preventives is to increase the costs of engaging in the criminal activity by forcing the perpetrator to expend and deplete resources in the pursuit of a goal. Deterrents impose the threat of legal sanctions to hinder individuals from committing crimes. The purpose of deterrents is to prevent the intent from becoming a reality. Similar preventive and deterrent controls have been used for combating computer hardware abuse (Straub 1990) and software piracy.

Preventive controls for software piracy employ technology-based solutions to make copying software more difficult. These include, for example, hardware-based controls such as nonstandard disks, coder, cards, and hardware locks; and software-based controls such as special password codes and encryption (Malhotra 1994). These techniques have not been widely used because they tend to hurt legitimate buyers, the controls can be overcome by determined pirates, and the techniques to defeat the preventive controls can be easily transferred through vehicles such as the Internet (Antonoff 1987). Deterrent controls for software piracy attempt to dissuade users from copying software through legal, investigative, and educational campaigns (Jerry 1987, Mason 1990). When these deterrents are effective, an individual refrains from piracy out of a perceived threat or fear of sanctions. Besides the legal dimension, these controls endeavor to highlight the moral force behind the laws to achieve compliance. The Software Publishers Association (SPA) and the Business Software Alliance (BSA), representing over 1200 software companies, actively pursue investigative campaigns by setting up piracy hotlines, filing lawsuits, and engaging in educational campaigns by disseminating information on the legal aspects of software piracy.

Figure 1 Global Software Piracy Losses



While piracy causes significant losses in the United States (estimated at $2.3 billion for business application software in 1996), the problem is especially severe internationally. The piracy rates are heavily skewed toward African, Asian, East European, and Latin American countries, with over 90% of the software pirated in a number of these countries. This—combined with the rapidly increasing demand for software in fast growing economies like China, Taiwan, and India—presents a grim picture to software publishers in the United States, who hold 75% of the global market for prepackaged software and approximately 60% of the world market for software and related services (Software Piracy Report 1997). Despite the growing importance of piracy in the international arena, few research studies have attempted a systematic analysis of the problem and proposed solution strategies.

1.1. SPA's Antipiracy Efforts

Since 1985, the Software Publishers Association has taken a leading role in combating global software piracy. Two key strategic elements of the association's antipiracy campaign are: (1) government-to-government negotiations to enforce and protect intellectual property rights, and (2) education and enforcement programs to achieve compliance and fight software piracy by individuals and organizations around the globe.

SPA supports the United States Trade Representative's (USTR) efforts to combat piracy by preparing an annual list of nations that deny adequate and effective protection of intellectual property rights. Under the Special 301 provision of the Omnibus Trade and Competitiveness Act of 1988, these nations become targets for possible trade sanctions. SPA believes that a continued, vigorous action by the U.S. government through trade negotiation is necessary to protect the intellectual property that is the lifeblood of the American and international software industries.

The deterrence efforts undertaken by the SPA have two broad charters:

• Educate users about copyright laws to achieve compliance.

• Execute an active enforcement campaign to fight software piracy.

The deterrence strategy has proven effective in the United States, where piracy rates have declined from 48% in 1989 to 27% in 1996. However, the effectiveness of the deterrence strategy has not proved to be global in scope, and piracy activities by individuals and organizations remain rampant in a number of countries.

1.2. Research Issues

The focus of this paper is on the international dimension of software piracy and the development of the software publishing industry. We address two key issues, along the lines of SPA's antipiracy efforts, that arise in this context.

First, we develop an economic model that incorporates the incentive structures for the government, publishers (both foreign and domestic), and individual consumers and derive their implications for copyright enforcement and publisher profits. We then identify various market scenarios that impact the incentive structures and study the economic outcomes. An important proposition derived from the analysis states that *the government's incentive to enact and enforce copyright laws are closely related to the size of the domestic software industry.* The ensuing empirical study provides support for the proposition and further suggests that this relationship holds regardless of the income levels of the countries.

Second, we explore a behavioral model of software piracy and the level to which the model explains pirating behavior in the United States and India. The objective is *to determine whether the determinants of piracy behavior transcend ethical and cultural barriers.* Researchers have proposed a variety of variables to explain an individual's propensity and rationale for pirating software. Age, gender, attitudes, an individual's ethical propensity, and various organizational variables have been examined. The problem is that the resulting models of software piracy might indeed be country or culture specific. There will of course be areas where moral values and ethics will transcend national boundaries, but there will always be cross-cultural idiosyncrasies (Buller et al. 1997). Further confounding the problem is that it is possible for individuals from different cultures to have the same moral values but behave differently in a given ethical context—say, for example, in pirating behavior. Correspondingly, it is possible for individuals from different countries with different ethical mores to act in a similar manner. A general model of ethical behavior related to software piracy will be examined using samples from the United States and India.

The remainder of the paper is organized as follows. Section 2 discusses the literature on software piracy. Section 3 develops an analytical model of the economic factors and a structural equation model of behavioral and ethical factors. Section 4 presents the data analysis. Regression analysis on archival data is used to study the economic factors and structural equation modeling on the data from the United States and the Indian graduate students is used to study the behavioral and ethical factors. Finally, § 5 presents a discussion of the key results and the concluding remarks.

2. Literature Review

In this section, we first discuss studies that analyze the economic impacts of software piracy. Behavioral studies that analyze demographic and cultural factors, and their effect on piracy behavior, are presented after the discussion of the economic factors.

2.1. Economic Factors

Economic models of piracy in general study the impact of piracy on profits, and in particular the effect of enforcing copyright. Conventional wisdom suggests that piracy represents a drain on publisher profits and reducing piracy forces consumers to legitimately acquire software. Gopal and Sanders (1997) argue that the effect on profits is positive only when the antipiracy measures appropriate a higher price from the software pirates. The net effect on profits is based on a combination of the market price for the software and the type of antipiracy controls enforced. Their analytical results show that only deterrent controls improve publisher profits. In the face of increasing preventive controls, individuals do not legitimately acquire software but instead simply do without the software, and this behavior represents a drain on publisher profits. Their results also show that the welfare of the country increases with deterrent controls, and for evidence they point to the increasingly active role of the U.S. Congress in enacting legislation against software piracy. Conner and Rumelt (1991) argue that software piracy might not be harmful for certain types of software products that exhibit network externalities. The consumption utility for these software depends on the total user base. The utility of the software consumption increases with software piracy as it increases the total number of individuals using it.

Most existing economic models of software piracy focus on the domestic U.S. market, where strict copyright laws exist and mechanisms for active enforcement are in place. The environment changes dramatically when the focus shifts to international markets. Publishers can no longer rely on the government to provide copyright protection. In a number of countries the illegal duplication of software is widespread, and the governments undertake little effort to enact copyright laws and vigorously enforce compliance. In the next section, we develop a model that incorporates the economic incentive structures for the government and the foreign publisher and analyze the ensuing implications for copyright enforcement efforts undertaken by the government. We then identify various scenarios, including the existence of a domestic software industry, and study their effect on the government's incentive for increased copyright enforcement and publisher profits.

2.2. Behavioral and Ethical Factors

Behavioral studies focusing on the demographics and personality characteristics of software pirates and the social and organizational context of software piracy are also gaining momentum. Recently, Gopal and Sanders (1997) found that gender (females pirate less), age (older individuals pirate less), and ethical propensity (ethical individuals pirate less) were related to software piracy behavior. These findings support earlier work by Solomon and O'Brien (1991), who found that females engage in less piracy, and younger students pirate more software. Sims et al. (1996) also found that males pirate more than females and that heavy users of personal computers pirate more software.

Harrington (1996) examined the roles that ethical codes and the tendency to deny responsibility have on computer abuse. She found little statistical support for the assertion that codes of ethics have an effect on computer abuse judgments and intentions. *Computer abuse* was defined as cracking and copying software, computer sabotage, writing and spreading viruses, and fraudulent use of computers. She did, however, find that the relatively stable psychological trait, the tendency to deny responsibility (RD), was related to software abuse. An individual who is low in RD tends to accept responsibility, looks out for the welfare of others, and live up to moral commitments. She also found that IS personnel with low RD exhibited a greater tendency to judge computer abuse as wrong.

Glass and Wood (1996) studied software piracy from an equity theory perspective using undergraduate business students. They found that an individual would provide another person with an illegal software copy if (1) the individual owed a debt to the person, or (2) perceived that the other person would provide a favor in return. Eining and Christensen (1991) found that negative attitudes toward computers, individual perceptions concerning the net benefits of piracy, and personal norms were related to the amount of pirated software possessed by business students.

Recently, Banerjee et al. (1998) developed a research framework to model the ethical behavior of information systems personnel. They reported that the most important variable explaining ethical behavioral intentions for IS employees was the ethical context. They also found that an individual's personal normative beliefs and the organizational ethical climate were related to ethical behavioral intentions. In related work, Loch and Conger (1996) found that attitudes and social norms play an important role in ethical decision making situations related to intentions to perform computing acts involving privacy and ownership. More recently, Thong and Yap (1998) found that IS professionals use both deontological and teleological evaluation strategies in making moral judgements related to softlifting.

The importance of ethics in modeling software piracy is a recurring theme that is just beginning to be tapped. The decision to copy or not copy intellectual property is influenced by ethical mores. The following discussion will delve more deeply into the role of ethics in constructing a model of software piracy.

Ethics is the study of moral systems. It is important to note that the moral philosopher does not make moral judgments about right or wrong, but rather attempts to "discover truth about the meanings of moral concepts and the justification of moral judgments" (Sprague and Taylor 1967). Most normative ethical philosophies can be categorized as belonging to either the consequential or teleological family of ethical theories or the deontological family of ethical theories (Murphy and Lacznick 1981, Hunt and Vitell 1986, Brady and Wheeler 1996).

Consequentialism-based theories examine ethical behavior in terms of the consequences or outcomes of actions. Consequentialism holds that people should identify the consequences of behaviors and evaluate the goodness or badness of all consequences (c.f. Hunt and Vitell 1986). There are several subcategories of consequential ethics; however, consequential ethics is often equated to utilitarianism, where a utilitarian strives for the greatest good to the greatest number of people. The principle of utility states that an action is right if it tends to produce the greatest level of happiness for the greatest number of people. The essence of the utilitarianism philosophy is that an act or behavior is right if it provides an excess of benefits over harmful effects. It is thus the consequences rather than the motive that determine whether an act is right or wrong. The implication of this ethical philosophy is that the rightness or wrongness of an act has no bearing on the goodness or badness of the individual who carries out the act. Ethical egoism is a consequences-based philosophy that stresses an individual-centric view of ethics. Egoists, from an ethicists perspective, weigh and judge an action according to its effect on individual interests. The objective of the egoists is to maximize individual outcomes.

In contrast, deontological ethical theories focus on the central role of duty and moral obligations in behavior. The treatise by Immanuel Kant (1949) forms the basis of the deontological viewpoint. Kant developed a principle for determining moral duties and responsibilities: "Act as if the maxim of thy action were to become by thy will a universal law of nature." To the deontologist, motives play no role in judging an act as either right or wrong; it is the act or behavior that is either right or wrong. Deontological theories are often described as formalistic because individuals ascribing to this philosophy act according to rules and laws. A special case of the deontological perspective, which is of interest here, is the belief in the philosophy of justice. This is in the spirit of Rawl's (1971) first principle of justice: ". . . each person is to have an equal right to the most extensive liberty compatible with a similar liberty for others (p. 60)." This philosophic viewpoint looks towards institutional systems to derive fair laws. The laws are derived through a process of representation, deliberation, and compromise among societal members.

As noted by Hunt and Vitell (1986), any theory of ethics must take into account the deontological and consequential aspects of ethical evaluation and ethical behavior. In this paper we will investigate whether an ethical predisposition toward deontology, in particular toward the justice system, is associated with less software piracy. As noted earlier, a primary focus of this paper is to understand software piracy in the international context. The consequential perspective will not be included directly in the analysis but will be examined indirectly by comparing how well the software piracy model fits a western country (United States) and an eastern country (India). Figure 2 presents a general model of ethical relationships that will be used as the basis for examining software piracy behavior.

3. Methodological Approaches

This section presents an analytical model of the economic factors, followed by a structural equation model of the behavioral and ethical factors. An overview of the key factors analyzed is provided in Table 1, and the detailed analysis is presented in the following discussion.

Figure 2 General Model of Ethical Behavior

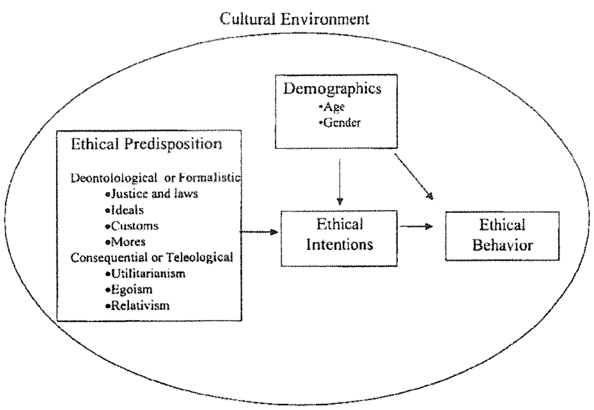


Table 1 Methodological Approaches

Factor Type	Analysis Approach	Key Factors
Economic	Analytical Modeling	Software Piracy
		Copyright Laws
		Antipiracy Controls
		Copyright Enforcement
		Market Price of Software
		Demand for Software
		Software Industry
		Domestic
		Foreign
		Producer Profits
		Welfare
	Regression Analysis	Piracy Rate
		Size of the Domestic Software Industry
		Per capita GDP
Behavioral and Ethical	Structural Equation Modeling	Ethics
		Ethical Predisposition to Deontology
		Software Piracy Level
		Nationality
		Demographics
		Age
		Gender

3.1. Analytical Modeling of Economic Factors

The purpose of the model is to analyze the economic behavior of the software publishers, consumers, and the government. Each participating entity is assumed to exhibit a value maximizing behavior. In particular, the software publishers attempt to maximize profits, consumers endeavor to maximize the net value of acquiring the software, and the government's policy setting and enforcement incentive is driven to maximize the net welfare of its constituents.

A software consumption model needs to consider that software exhibits the classic characteristics of a public good. Similar to a public good, the consumption utility to a consumer does not decrease when the software is shared with other individuals. This characteristic leads to the concept of a *software piracy club* (Gopal and Sanders 1997), where individuals in the club purchase one legitimate unit of the software and make copies for all the club members. The disincentives for this behavior stem from the fact that the software clubs are illegal and that the government along with the software publishers take measures to deter software piracy. Let P_{market} denote the market price of the software product and δ index the deterrent controls that are employed. The effective price paid by an individual in a club of size n is[1]

$$P_{\text{paid}} = \frac{P_{\text{market}}}{n} + C_{\delta}(n - 1), \tag{1}$$

where $C_{\delta}(n - 1)$ depicts the threat to an individual due to legal sanctions, and it increases monotonically with the size of the club. This captures the fact that larger clubs are easier to detect. C_{δ} represents the impact of deterrent controls and it follows that $\partial C_{\delta}/\partial \delta > 0$. Given the market price and deterrent controls, the software clubs control their membership to balance the

[1]Gopal and Sanders (1997) also consider costs to overcome technological barriers imposed to make copying software more difficult. However, they show that these copy prevention controls are negatively associated with profits. Additionally, since a number of software companies have begun to remove these controls (Antonoff 1987), we do not consider these in our model.

benefits of lowered price along with the threat of detection and ensuing legal sanctions. Thus minimizing Equation (1) with respect to n yields

$$\eta = \sqrt{\frac{P_{\text{market}}}{C_\delta}}, \tag{2}$$

where η is the optimal club size for a given P_{market} and C_δ. Note that η represents the number of copies of the software *in use* for each copy of the software that is legitimately purchased from the software publisher. Thus, η measures the "extent of piracy." Since $\partial\eta/\partial C_\delta < 0$ and $\partial\eta/\partial P_{\text{market}} > 0$, it follows that the software publisher can reduce piracy through increased deterrent controls or by reducing the market price of the software.

The aggregate demand for software is dependent on the price paid by individual consumers. For reasons of analytical tractability, the market demand is depicted in the following linear form:

$$Q_{\text{uses}} = z - \alpha P_{\text{paid}}, \tag{3}$$

where z is the total size of the market for the software product, α measures the demand impact of price paid, and Q_{uses} denotes the total number of software units, purchased or copied. Of the total number of software units in use, Q_{sold}, which equals Q_{uses}/η, are the legitimate purchases made from the publisher.

The production of software is characterized by significant fixed costs in developing and marketing the software and negligible marginal production costs (Conner and Rummelt 1991). Consequently, the software publisher's profits Π can be represented by

$$\Pi = Q_{\text{sold}}\, P_{\text{market}} - F, \tag{4}$$

where F is the fixed cost associated with developing and marketing the product. The publisher's revenue R is given by $\Pi + F$.

The government represents the entity that enacts the legislation on the protection of intellectual property. It is also largely responsible for undertaking measures to enforce compliance with the copyright laws.[2] While the software publishers can also take steps to deter software piracy, they possess limited legal authority, especially when they operate in foreign countries. The publisher's role is restricted to engaging in educational campaigns and providing assistance to the government in copyright enforcement. The government's incentive to enact and enforce the copyright laws results from their effect on the welfare of its citizens. The welfare is the net effect of the consumer surplus, domestic publisher's profits, foreign publisher's revenues, and the costs associated with enacting and enforcing the copyright laws. The welfare function W is

$$W = S_{\text{DP}} + S_{\text{FP}} + \Pi_{\text{DP}} - R_{\text{FP}} - F_{\text{gov}}. \tag{5}$$

In the above expression, the subscripts DP and FP refer to the domestic and foreign publishers; S denotes the consumer surplus from software consumption. Note that the foreign publishers' revenues represent a drain on the country's resources and negatively affect the welfare of the country. F_{gov} is the cost to dissuade piracy through legislative action and impose sanctions on those who pirate. We assume this cost to increase with C_δ and provide decreasing marginal returns, and represent it as

$$F_{\text{gov}} = KC_\delta^2, \tag{6}$$

where K measures the impact of government's antipiracy measures on deterrence cost to individuals.

The focus of our model is on identifying various contextual situations and analyzing their impact on the government's incentive to increase copyright protection. In particular, we study the nature of the domestic software market and the relationships a foreign publisher can develop with the domestic software suppliers and the government to foster a climate of increased copyright enactment and enforcement. We consider two broad scenarios—without and with a viable domestic software industry—and develop the welfare implications and their impact on publisher profits.

3.1.1. No Domestic Software Industry. In this environment, the foreign publisher attempts to maximize the profits given C_δ, i.e., given the level of copyright enforcement set by the government. The foreign publisher's problem is to determine the market price that

[2]Typically, enactment of laws and enforcement of the laws enacted fall under the purview of separate governmental entities. However, we assume that these distinct entities share the common goal of maximizing the welfare of their citizens and, hence, model them as a single entity.

optimizes the profits. Profit maximization through the market price yields the optimal profits shown in Table 2. The resulting club size is

$$\eta^*_{FP} = \frac{[z_{FP} + \alpha_{FP} C_\delta]}{4\alpha_{FP} C_\delta}. \qquad (7)$$

Clearly, the profits increase and software piracy (inversely related to the club size) decreases as the deterrence costs to consumers rise through antipiracy measures. The government, on the other hand, attempts to maximize the welfare of its citizens. The consumer surplus from software consumption is

$$S_{FP} = \int_{P^*FP}^{zFP/\alpha FP} \alpha_{FP} (P - P^*_{FP})\, dP, \qquad (8)$$

and the welfare function is $S_{FP} - R_{FP} + KC^2_\delta$. Simplifying, we obtain

$$W = F_{FP} - KC^2_\delta. \qquad (9)$$

Note that the government has no incentive to undertake antipiracy measures as

$$\frac{\partial W}{\partial \delta} = -2KC_\delta \frac{\partial C_\delta}{\partial \delta} < 0.$$

This explains the economic rationale behind the reluctance of a number of governments to implement antipiracy programs. U.S.-based software companies who maintain a significant presence in international markets have traditionally faced lax enforcement efforts by foreign governments. This is especially the case in countries with no viable domestic software industry. The problem has become so severe that SPA has classified a number of countries as *one-copy* countries, where virtually one legal copy of the software can satisfy the demand of an entire country (Software Publishers Association 1996). A typical response of the U.S. government has been to impose trade sanctions on these countries (Pontin and Mills 1995). This strategy attempts to utilize as bargaining chips the trade segments between the two countries that are beneficial to the foreign country to force them to strengthen copyright laws and increase enforcement. While this represents a viable strategy, our focus is on software industry-specific situations that mutually benefit the foreign publisher and the government and its constituents.

An obvious option for the foreign publisher is to help pay for the government's enforcement efforts. Indeed, SPA, on behalf of the mostly U.S. personal computer software industry, actively works with governments in more than 60 countries and conducts enforcement, education, and public policy activities to eradicate software piracy (Greenless and Clark 1995). The existence of a domestic software industry alters the government's welfare function and provides increased incentives for antipiracy controls. The following discussion analyzes the various scenarios that arise in this context.

3.1.2. Domestic Software Industry. The software

Table 2 Profit and Welfare Maximization Results

	Π^*_{FP}	Π^*_{DP}	C^*_δ	W^*
No Domestic Software Industry	$\frac{[z_{FP} + \alpha_{FP} C_\delta]^2}{8\alpha_{FP}} - F_{FP}$	—	0	F_{FP}
Distinct Product	$\frac{[z_{FP} + \alpha_{FP} C_\delta]^2}{8\alpha_{FP}} - F_{FP}$	$\frac{[z_{DP} + \alpha_{DP} C_\delta]^2}{8\alpha_{DP}} - F_{DP}$	$\frac{z_{DP}}{(4K - \alpha_{DP})}$	$\frac{z_{DP} K C^*_\delta}{\alpha_{DP}} + F_{FP}$
Substitute Product	$\frac{2(\alpha_{DP} + \alpha_{FP})(z_{FP} + \alpha_{FP} C_\delta)^2}{(4\alpha_{FP} + 3\alpha_{DP})^2} - F_{FP}$	$\frac{\alpha_{DP}(z_{FP} + \alpha_{FP} C_\delta)^2}{2(4\alpha_{FP} + 3\alpha_{DP})^2} - F_{DP}$	$\frac{z_{FP}}{\left(\frac{(4\alpha_{FP} + 3\alpha_{DP})^2 K}{\alpha_{DP}\alpha_{FP}} - \alpha_{FP}\right)}$	$\frac{z_{FP} K (4\alpha_{FP} + 3\alpha_{DP}) C^*_\delta}{\alpha_{FP}} + F_{FP}$
Complementary Product	$\frac{[z_{FP} + \alpha_{FP} C_\delta]^2}{8\alpha_{FP}} - F_{FP}$	$\frac{[z_{FP} + \alpha_{FP} C_\delta + 2\alpha_{DP} C_\delta]^2}{32\alpha_{DP}} - F_{DP}$	$\frac{z_{FP}}{\left(\frac{16\alpha_{FP} K}{(\alpha_{FP} + 2\alpha_{DP})} - (\alpha_{FP} + 2\alpha_{DP})\right)}$	$\frac{z_{FP} K C^*_\delta}{(\alpha_{FP} + 2\alpha_{DP})} + F_{FP}$

industry is one of the fastest growing industries in the recent years. The growth of this industry has been global in scope and is evident in a number of countries around the world. This trend is beginning to alter the incentive structures for governing bodies and is helping to bring about an increased awareness on the potential benefits of intellectual property rights. We model this scenario by considering a domestic software publisher. Three distinct relationships between the domestic and foreign publisher are considered: that the domestic publisher markets a product that is either distinct from, or substitutes for, or is complementary to the foreign publisher's product. The economic outcomes of these product relationships are developed below.

Distinct Product. In this case the domestic and foreign publisher maintain a monopoly in their respective markets. Given C_δ that is set by the government, the two publishers optimize their profits by controlling the market price of their products. The two optimization problems are independent, and each can be solved as in the preceding case (with no domestic publisher). The results are shown in Table 2. The consumer surplus from the foreign publisher's product is given in Equation (8), and that from the consumption of the domestic publisher's product is

$$S_{DP} = \int_{P^*DP,\text{uses}}^{z_{DP}/a_{DB}} \alpha_{DP} (P - P^*_{DP,\text{uses}})\, dP. \quad (10)$$

The government's general welfare function depicted in Equation (5) simplifies to

$$W = F_{FP} + \frac{(z_{DP} + \alpha_{DP} C_\delta)^2}{4\alpha_{DP}} - KC_\delta^2. \quad (11)$$

The first-order condition for welfare maximization is $\partial W/\partial C_\delta = 0$. The optimal values for the resulting deterrent costs imposed by the government and the net welfare are shown in Table 2. The net welfare of the country and the government's piracy control measures are greater than in the case when the domestic software industry is nonexistent. Note that the degree to which the antipiracy controls are enforced depends on the size of the domestic industry and is unrelated to the foreign publisher. Typically, the domestic publisher's market size (z_{DP}) is significantly smaller than the foreign publisher's market size (z_{FP}), especially when the foreign publisher is a major U.S. software house. Therefore, the foreign publisher reaps significant benefits only when the domestic industry is strong and vibrant.

Substitute Product. In this case the two publishers compete head-on. The two products in the market are assumed to differ on the quality of the product.[3] The domestic publisher markets a product of lower quality and competes through price differentiation. This is a reasonable assumption, because the United States maintains a significant technological edge over most countries in the world. The demand structure faced by the two publishers is represented as

$$Q_{FP,\text{uses}} = z_{FP} - \alpha_{DP} (P_{FP,\text{paid}} - P_{DP,\text{paid}}) - \alpha_{FP} P_{FP,\text{paid}}, \quad (12)$$

$$Q_{DP,\text{uses}} = \alpha_{DP} (P_{FP,\text{paid}} - P_{DP,\text{paid}}). \quad (13)$$

The domestic publisher competes on a lower price and sells to consumers who are willing to trade quality for lower price. The foreign publisher loses this customer base to the domestic competition. Given C_δ, the first-order condition for Nash equilibrium is

$$\frac{\partial \Pi_{FP}}{\partial P_{FP,\text{market}}} = 0 \quad \text{and} \quad \frac{\partial \Pi_{DP}}{\partial P_{DP,\text{market}}} = 0.$$

The resulting profits are shown in Table 2. The consumer surplus from the two products is

$$S_{DP} = \int_{P^*DP,\text{uses}}^{P^*FP,\text{uses}} \alpha_{DP} (P^*_{FP,\text{uses}} - P)\, dP, \quad (14)$$

$$S_{FP} = \int_{P^*FP,\text{uses}}^{(z_{FP} + \alpha_{DP} P^*DP,\text{uses})/(\alpha_{DP} + \alpha_{FP})} (\alpha_{DP} + \alpha_{FP})(P^*_{FP,\text{uses}} - P)\, dP. \quad (15)$$

Welfare maximization results can be obtained from the welfare function in Equation (5) and are shown in Table 2. As the results indicate, the government's antipiracy efforts are directly tied to the foreign publisher's market. By sharing this market with the domestic publisher, the foreign publisher can realize greater profits through increased copyright enforcement. At the same time some of the profits are lost due

[3] Quality differences in software products can arise from factors such as functionality, ease of use, and product support.

to competition (see Table 2). The net gains to the foreign publisher are positive when the market size is large and the competition is small (low α_{DP}).

Complementary Product. In this case the two publishers enter a cooperative agreement where the domestic publisher markets a complementary product. This could, for example, be an add-on product or one that runs on the foreign publisher's operating system. The demand structure can be represented as

$$Q_{FP,uses} = z_{FP} - \alpha_{FP}P_{FP,paid}, \tag{16}$$

$$Q_{DP,uses} = Q_{FP,uses} - \alpha_{DP}P_{DP,paid}. \tag{17}$$

The domestic publisher's market base is the total number of individuals who utilize the foreign publisher's product. Through the complementary product the foreign publisher is able to provide access of its markets to the domestic publisher, without foregoing any of it to the competition. Profit maximization can be performed similar to the preceding case, and the results are shown in Table 2. The consumer surplus from the foreign publisher's product is indicated in Equation (8) and that from the domestic publisher is

$$S_{DP} = \int_{P^{*}DP,uses}^{Q^{*}DP,uses/\alpha_{DP}} \alpha_{DP}\,(P - P^{*}_{DP,uses})\;dP. \tag{18}$$

The general welfare function of Equation (5) can now be optimized with respect to C_δ, and the ensuing results are shown in Table 2. As in the case with substitute products the level of deterrent controls employed by the government are closely associated with the size of the foreign publisher's market. Therefore, through a complementary relationship with the local industry, the foreign publisher is able to realize a climate of increased enforcement efforts, even when the local industry is in early stages of growth. Furthermore, the foreign publisher is not placed in a position of losing the market base to domestic competition.

3.1.3. Empirical Methodology. Regardless of the software industry structure that relates the products from the two publishers, the government's incentive to stem piracy results from the size of the domestic software industry. This result is captured in the following proposition.

PROPOSITION 1. *The government's incentive to undertake antipiracy measures is proportional to the size of the domestic software industry.*

Proposition 1 follows from the fact that $C_\delta = 0$ in the case of no domestic software industry and $C_\delta > 0$ in every other case (Table 2). Note that the government's anti-piracy measures are reflected in the *piracy rate* for the country. The piracy rate measures the percentage of software in use in a country that is pirated and is annually estimated by SPA (Software Piracy Report 1997). The following hypothesis follows directly from Proposition 1.

HYPOTHESIS H1. *Countries with larger domestic software industries have smaller piracy rates.*

The size of the domestic software industry was measured by the sales of business application software in the country that are attributed to the domestic software industry. To adjust for the size differences among the nations in the sample, the size of the domestic software industry was normalized with the gross domestic product (GDP) of the nation. Our primary interest is in the role of the domestic software industry on piracy rates. We are, however, cognizant of the fact that income levels can influence the ability of consumers to purchase software. This is clearly evident from the piracy rates reported by the SPA, where significantly higher piracy rates are found predominantly in underdeveloped and low-income nations (Software Piracy Report 1997). A similar income effect has been observed at the individual level, where the household income level is found to be an important reason to pirate software (Cheng et al. 1997). We will examine this notion empirically by asserting that countries with a lower per-capita gross domestic product (per-capita GDP) should have higher piracy rates than countries with a higher per capita GDP.[4]

HYPOTHESIS H2. *Countries with larger per capita GDP have smaller piracy rates.*

The data on the GDP and the per-capita GDP were obtained from the World Bank and the remaining data

[4]The authors thank the referees for the suggestion related to including the income level in the empirical analysis.

from the Software Publishers Association. [5] The data used for the empirical analysis are reported in Table 3. Countries from North America, Europe, and Asia constituted the sample, and the piracy rates among these countries varied from 26% to 96%. Regression analysis of this archival data is presented in the next section.

While the economic model reveals that increased copyright enforcement can be beneficial to all parties concerned, the question of what deterrence strategies to adopt in order to dissuade individual users from copying software remains an open one. In the United States a key element of this strategy is the educational campaigns that attempt to educate users about copyright laws and inspire attitudinal changes about appropriate copying behavior. The question of whether these determinants of piracy behavior are supranational and transcend cultural barriers is investigated in the following discussion.

3.2. Structural Equation Modeling of Ethical and Behavioral Factors

Figure 3 presents the model of ethical relationships related to software piracy that will be examined in this study. It draws on the descriptive model of marketing ethics developed by Hunt and Vitell (1986), the concept of ethical predisposition set forth by Brady and Wheeler (1996), the synthesis and evaluation of scales for measuring the various components of ethical decision making (Vitell and Ho 1997), and the ethical decision-making framework presented by Raghunathan and Saftner (1995). The model is also influenced by the empirical work on software piracy discussed in the literature review.

3.2.1. Empirical Methodology. The primary research question to be answered is whether the software piracy model detailed in Figure 3 is valid in multiple cultures. As noted earlier, there is empirical evidence that the model is valid for the United States, but there is very little research on the behavioral mechanics of software piracy in different cultures. In addition, there are also several subhypotheses that will be examined that are related to previous research on software piracy and ethics.

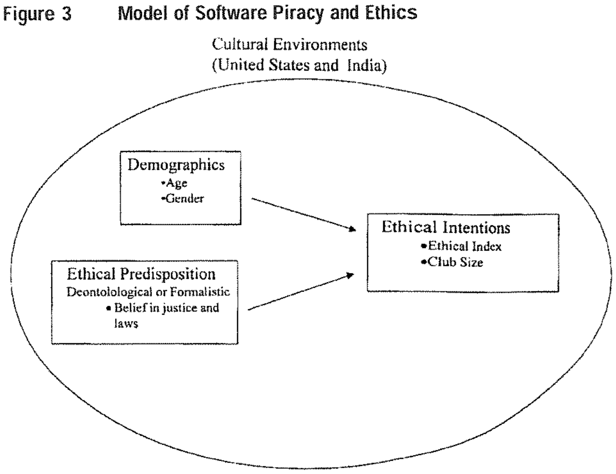
[5]According to the SPA "The piracy loss and rate estimates . . . are the result of a commissioned methodology and study by International Planning Research." Additional details on the description of the methodology used to obtain the piracy rates and software sales estimates can be found in the recent report on software piracy by the SPA (Software Piracy Report 1997).

Table 3 Data For Economic Analysis

	Piracy Rate		Per-Capita GDP ($)		Domestic Market Size/GDP ($\times 10^{-6}$)	
Country	1995	1996	1995	1996	1995	1996
Belgium/Netherlands*	51%	47%	$26,065	$26,530	10.89	5.91
China	96%	96%	$581	$634	0.35	0.49
Finland/Norway/Denmark*	53%	43%	$32,992	$33,773	19.79	15.26
France	51%	44%	$26,457	$26,857	20.47	16.89
Germany/Austria*	42%	36%	$29,508	$29,801	9.11	7.62
Greece	86%	78%	$8,651	$8,783	5.98	2.21
Italy	61%	55%	$19,001	$19,079	2.19	1.44
Korea	76%	70%	$10,155	$10,817	10.25	9.74
Spain/Portugal*	74%	65%	$14,251	$14,753	2.32	1.66
Sweden	54%	47%	%25,898	$26,850	16.24	8.57
Switzerland	47%	43%	$42,492	$42,965	15.70	12.05
U.K./Ireland*	38%	34%	$18,892	$19,236	15.48	9.58
U.S.	26%	27%	$26,422	$26,973	64.71	67.38

*Domestic market size data were available only for the group and not for individual countries. Piracy rates and per-capita GDP for the group were derived using a weighted average of the data for individual countries, with the weights reflecting the relative populations of the countries. The population data were obtained from the World Bank.

Figure 3 Model of Software Piracy and Ethics



HYPOTHESIS H3. *A general model of ethical behavior, as applied to software piracy, holds in the United States and India.*

H3a. Older individuals will be more ethical.
H3b. Older individuals will pirate less.
H3c. Females will be more ethical
H3d. Females will pirate less.
H3e. Individuals higher on the philosophy of justice scale (a deontological perspective) will be more ethical.
H3f. Individuals higher on the philosophy of justice scale (a deontological perspective) will pirate less.

This empirical study was completed in two major phases. The objective of the first phase was to focus on measurement issues and refine the research instruments that would be used in structural equation modeling. All but one of the scales, the justice construct, had been used in previous studies. A sample of 254 graduate students was used to factor analyze and perform reliability analysis on the original scale items. The second phase of the research involved a new data set consisting of 242 graduate students from the United States and India. This section will concentrate on the second data set that was used to construct the structural equation model.

The Sample. Two sets of questionnaires were administered to graduate students with concentration in information systems in India and the United States. Subjects were assured of complete anonymity. There were 118 usable responses from India and 124 from the United States. Although there is no clear consensus on the optimal sample size for research involving structural equation models, a sample size of between 100 and 200 for each group appears satisfactory (c.f. Hair et al. 1995 and Fassinger 1987). The average age for the U.S. sample was 26, and for the Indian sample it was also 26. Age was also used in the structural equation model. There were five missing values for age. The average age was used to replace these values. This is a typical and reasonable strategy for dealing with such a small number of missing values for this type of a variable (cf. Roth 1994). There were 22 females in the U.S. sample (15%) and 44 females (37%) in the Indian sample. Gender was also used in the constructing the structural equation model.

Club Size (Piracy Level). Three items were used to operationalize the piracy level and they are shown in Table 4. They describe hypothetical scenarios describing an individual making illegal copies for himself or herself at home, for a friend or family member, and for some colleagues. The sum of these responses is the piracy level. A higher scale value for the club size indicates higher levels of software piracy. Cronbach's coefficient alpha for the three club items is 0.83, indicating that the scale is fairly stable and consistent. For additional details on the club measure see Gopal and Sanders (1997). The club size measures the behavioral intention to pirate software.

Ethical Index. The five items for this scale were adapted from an instrument developed by Wood et al. (1988) to determine the ethical profile of business students and is used here as another way to capture behavioral intentions. The ethical index is computed by summing the responses to five hypothetical situations listed in Table 5. A higher scale value indicates higher ethical values. The Cronbach's coefficient alpha value for the five-item scale is 0.74, indicating that this scale is reasonably stable and reliable.

Justice—An Ethical Predisposition Dimension. Four

Table 4 Club Size Items*

Doug Watson is an architect at Architects Unlimited. He is working on a major consulting project for Architects Unlimited. The timing and the completion of the project is critical, and he is committed to the project. He recently purchased an expensive copyrighted software that is essential to finish the project correctly and on time.

1. A close family member of Doug Watson is also an architect. During a holiday family get together, the family member comes to know about the software and asks to make a copy of the software. Doug Watson lets him make a copy of the software.
2. While Doug Watson is using the software at work at Architects Unlimited, one of his colleagues happens to pass by and notices the new software. This person shows strong interest in making a copy of the software. Doug Watson lets him make a copy of the software.
3. The computer consultant at Architects Unlimited comes to know about the software. The consultant wants to keep a copy of the software at the lab so that any employee at the company can copy and use the software. Doug Watson lets the consultant make a copy of the software.

*Ratings for the items consisted of a five-point scale, with steps varying from "Never Acceptable" to "Always Acceptable." Higher values indicate a greater propensity to form a software club.

Table 5 Ethical Index Items*

1. An executive earning $50,000 a year padded his expense account by about $1500 a year.
2. In order to increase profits, a general manager used a production process that exceeded legal limits for environmental pollution.
3. Because of pressure from his brokerage firm, a stock-broker recommended a type of bond that he did not consider a good investment.
4. A small business received one-fourth of its gross revenue in the form of cash. The owner reported only one-half of the cash receipts for income tax purposes.
5. An engineer discovered what he perceived to be a product design flaw that constituted a safety hazard. His company declined to correct the flaw. The engineer decided to keep quiet, rather than taking his complaint outside the company.

*Ratings for the items consisted of a five-point scale, with steps varying from "Always Acceptable" to "Never Acceptable."

items were used to operationalize the justice construct, a latent variable, as an ethical predisposition toward laws and the justice system. The items were adapted from a variety of sources, including quotes and popular sayings, and subjected, as noted earlier, to psychometric analysis with a sample consisting of 254 graduate students. The items were anchored by a five-point scale (ranging from "strongly disagree" to "strongly agree"). The final items delineating the Justice construct were:

- Just 2: All individuals deserve equal treatment before the law.
- Just 4: Man's capacity for justice makes democracy possible; but man's inclination to injustice makes democracy necessary. Reinhold Niebuhr, *The Children of Light and Darkness*, Foreword, 1944.
- Just 5: To no man will we sell, or deny, or delay right or justice. *Magna Carta*.
- Just 6: All human beings are born free and equal in dignity and rights. *Universal Declaration of Human Rights*, 1948, Article 1.

This scale was assessed in the context of the structural equation model. Additional discussion on the Justice construct will be presented in the following section.

4. Data Analysis

Regression analysis was used to empirically evaluate the archival data and structural equation modeling was used to analyze the data from the U.S. and the Indian samples.

4.1. Regression Analysis

The formal model tested is:

piracy rate = f(size of the domestic software industry/GDP, per capita GDP)

The results of the regression analysis follow.

Dependent Variable: Piracy Rate

Independent Variables	Coefficient	t-value
Constant	0.864777	18.74**
Per Capita Gross Domestic Product	−0.000016	−5.73**
Domestic Software Market Size/GDP	−0.004274	−3.17*

*$p < 0.01$, **$p < 0.0001$.

The adjusted R^2 value of 0.71 and the F-value of 32 (significant at 0.0001 level) indicate a good fit for the regression model. The t-values for the domestic market size and the gross domestic product per capita are both statistically significant. A low value of the variance inflation factor (1.15), and the size of the t-values indicate that multicollinearity did not present a problem in the empirical evaluation (Hair et al. 1995).

The results explain a significant level of variation in the piracy rates across countries and provide statistical evidence for accepting the research hypotheses. Moreover, the results provide validation for the international piracy model and highlights the integral relationship between the domestic software industry and the copyright enforcement efforts.

Hypothesis	Level of Support
Hypothesis 1. Countries with larger domestic software industries have smaller piracy rates.	Supported
Hypothesis 2. Countries with larger per capita GDP have smaller piracy rates.	Supported

4.2. Structural Equation Modeling

The U.S. and the Indian samples were analyzed simultaneously using AMOS version 3.61 (Arbuckle 1997). AMOS is a structural equation modeling program that uses maximum likelihood to estimate model parameters. One objective was to determine if the structural equation model for the U.S. sample (see Figures 4 and 5) was also appropriate for the Indian sample.

The chi-square statistic obtained for the model was 44, with 36 degrees of freedom and a probability value of 0.17. The chi-square value is used to test the null hypothesis that the model is plausible in the population. A significant chi-square indicates that the null hypothesis should be rejected because the model does not fit the data and the model is not possible in the population (c.f. Fassinger 1987, Loehlin 1992). The null hypothesis should not be rejected in this case because of the probability level of the chi-square statistic (p = 0.17). We would therefore accept the hypothesis that the model is correct for both the U.S. sample and the Indian sample.

As noted by Chin and Newsted (1995) there is no one agreed goodness-of-fit measure for structural equation models. Various goodness-of-fit measures are used to compare the estimated population covariance based on the structural equation model with the sample covariance matrix that is calculated from the sample data. The following results indicate several goodness-of-fit indices for this model and how they compare to the recommended values for goodness of fit as reported in Chau (1997).[6]

Goodness-of-Fit Measure	Observed Value	Recommended
Chi-square p-value	0.17	≥0.05
Chi-square/degrees of freedom	1.22	≤3.0
GFI: Goodness of fit index	0.96	≥0.90
AGFI: Adjusted goodness of fit index	0.91	≥0.90
NFI: Normed fit index	0.86	≥0.90
NNFI: Non-normed fit index	0.97	≥0.90
CFI: Comparative Fit Index	0.97	≥0.90
RMSEA: Root mean squared error of approximation	0.03	<0.10

To the extent that the underlying assumptions hold we can say that, overall the structural equation model provides a good fit for the data. The findings are, in general, similar to previous research on software piracy. Figures 4 presents the model results for the U.S. sample, and Figure 5 presents the results for the Indian sample. All the paths are in the hypothesized directions. The results suggest the following outcomes related to the hypotheses.

[6]See also Chin and Todd (1995) and Segars and Grover (1993) for additional discussion of recommended values for model fit.

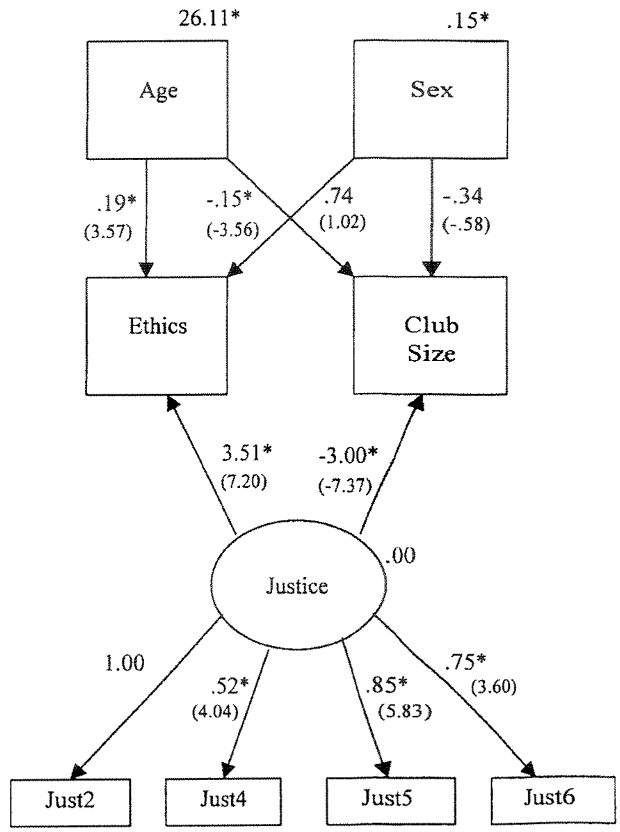
Figure 4 Results for United States

* Path coefficients and variance estimates significant at the .05 level. The critical ratios are located below the path coefficients. Variances are located near the boxes and circles.

Squared Multiple Correlations

Ethics = 0.63

Club Size = 0.67



Hypothesis	Level of Support
H3. A general model of ethical behavior, as applied to software piracy, holds in the United States and India.	Moderate Support
H3a. Older individuals will be more ethical.	Supported for U.S. and India
H3b. Older individuals will pirate less.	Supported for U.S.
H3c. Females will be more ethical.	Not supported

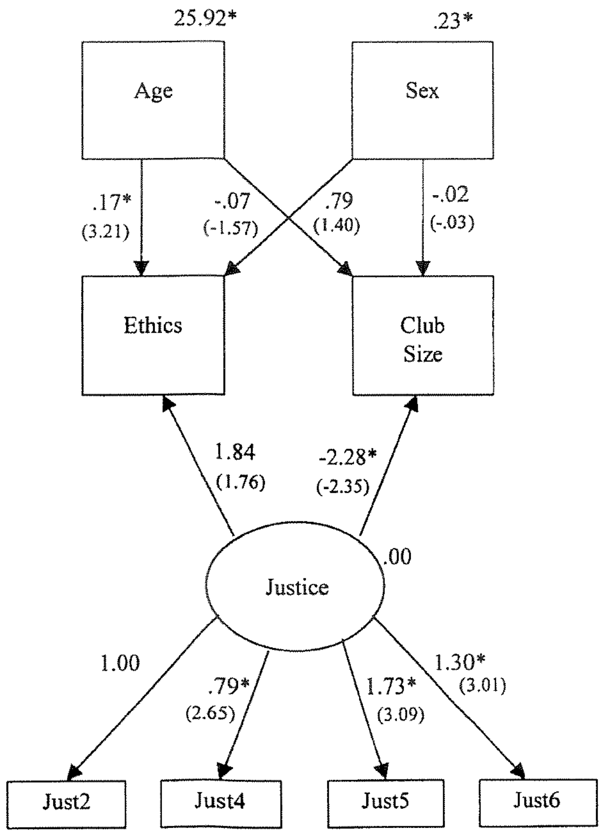
Figure 5 Results for India

* Path coefficients and variance estimates significant at the .05 level. The critical ratios are located below the path coefficients. Variances are located near the boxes and circles.

Squared Multiple Correlations

Ethics = 0.13

Club Size = 0.12



H3d. Females will pirate less.	Not supported
H3e. Individuals higher on the philosophy of justice scale (a deontological perspective) will be more ethical.	Supported for U.S.
H3f. Individuals higher on the philosophy of justice scale (a deontological perspective) will pirate less.	Supported for U.S. and India

The squared multiple correlation coefficients, which are similar to the coefficient of determination values or R^2 in regression analysis, are quite good for the U.S. group. The squared multiple correlation coefficient for ethics is 0.63 and for club size is 0.67. The path coefficients are nonstandardized partial regression coefficients. In Figure 4, the -0.15 path from age to club means that, other things being equal, a one-year increase in age will reduce the club size value by 0.15 units. Put in another way, older individuals will participate less in software piracy. The parameter estimates for the coefficients are approximations, as are their standard errors; however, estimates with a critical ratio greater than 1.96 are labeled with an asterisk to provide the reader with additional information on the model.[7]

In the case of the United States, the results support earlier studies that older individuals have a higher ethical propensity (Age $\rightarrow$ Ethics path $= 0.19$) and that older individuals pirate less (Age $\rightarrow$ Club path $= -0.15$). For this model, the critical ratio was not significant between sex and ethics, and sex and club size, but the coefficients are in the right direction, suggesting that females would be more ethical and participate in less piracy. (Males were coded as 1 and females were coded as 2.)

The justice construct is promising. The nonstandardized regression weight between justice and ethics is 3.51. The nonstandardized weight between justice and club size is -3.00, thus a 1-unit increase on the justice scale would result in a 3-unit decrease in the club size. In other words, individuals with an ethical predisposition toward the legal and justice system will engage less in software piracy. Confirmatory factor analysis on the Justice items yielded factor loadings of 0.58, 0.52, 0.66, and 0.49 for the four questions with the justice as the latent variable. These are reasonable loadings given the exploratory nature of the construct. The chi-square statistic obtained for the confirmatory model was 0.21, with 2 degrees of freedom and a probability value of 0.90.

The squared multiple correlation coefficients for the Indian group are not as strong as for the U.S. group.

[7] "The critical ratio is the parameter estimate divided by an estimate of its standard error. If the appropriate distributional assumptions are met, this statistic has a standard normal distribution under the null hypothesis that the parameter has a population value of zero. For example, if an estimate has a critical ratio greater than two (in absolute value), the estimate is significantly different from zero at the 0.05 level" (Arbuckle 1997).

The differences between the multiple correlation coefficients for the United States and India, coupled with the differences in the size and critical ratios for the path coefficients for the two groups, are the reasons that the primary research Hypothesis H3 was given moderate support. The squared multiple correlation coefficient for ethics is 0.13 and for club size is 0.12. The path coefficient results for the Indian sample are different from those obtained for the U.S. sample. The path coefficient between age and ethics is significant (Age $\rightarrow$ Ethics path $= 0.17$), thus older students are more ethical than younger graduate students. The path coefficients between age and club size, sex and ethics, and sex and club size are not statistically significant, but they are in the right direction. The nonstandardized regression weight between justice and club size is -2.28. This coefficient is not as large as the U.S. sample, but it is in the right direction and statistically significant. A critical difference test was also performed to determine if the parameter estimates for the regression coefficients for the U.S. and Indian models were statistically different. None of the critical ratios for the U.S. and Indian parameter pairs were statistically significant.

5. Discussion and Conclusions

The focus of this research was on the international dimension of software piracy and its effect on the software publishing industry. An economic model that incorporates the incentive structures for the consumers, the software publishers, and the government, and a behavioral model that studies the cultural impacts on software piracy have been developed and tested.

The economic analysis presents several interesting insights. It provides the economic rationale for the reluctance of a number of governments to aggressively enact and enforce intellectual property rights. An immediate strategy available for foreign publishers who face significant losses as a result of piracy is to help bear the cost of enforcement efforts. Governments of software publishers that maintain a significant international presence can employ trade sanctions in order to induce increased copyright enforcement. The model shows that government's incentive for copyright enforcement is based on the existence of the domestic software industry.

In the case that the domestic and foreign publishers operate in different markets, the enforcement efforts are proportional to the size of the domestic publisher's market. Both publishers realize significant benefits from effective enforcement only when the domestic industry is strong. For the domestic publisher, product tie-ins through substitute or complementary products provide an avenue to tap into the often larger foreign publisher's market. In the case where substitute products are available in the market, the government's enforcement efforts rise in proportion to the total market size. This results in smaller losses to piracy and translates to higher profits for the publishers. However, some of the profits are lost by product competition. Complementary products present an opportunity for the foreign publisher to boost enforcement efforts without a concomitant loss of the market to competitive pressures. Through the complementary product the domestic publisher gains access to the foreign publisher's market and is not placed in a position to compete with the often technologically more advanced foreign competitor. This cooperative agreement also leads to increased antipiracy efforts from the government and is beneficial to all concerned parties.

The empirical evaluation provides strong support to the hypothesis that the piracy rates are related to the size of the domestic software industry, regardless of the income levels of the country. Besides the empirical study, there is anecdotal evidence that provides additional validation of the model. Since entering the Indian market in early 1990s, Microsoft has invested heavily in the domestic software industry by transferring skills and intellectual assets (Sharma 1998). Microsoft also launched the University Advanced Technology Labs that provide the company's software codes to local programmers to develop application software. These initiatives were met with enthusiastic response from the Indian government and the software industry (*News India-Times* 1997). The government of India introduced significant changes to the copyright law in 1994. The amendments to the copyright law, which went into effect in 1995, substantially increased criminal penalties for copyright infringement. Since then the Indian software association, National Association of Software and Service Companies (NASSCOM), in cooperation with the law enforcement authorities and software publishers began conducting antipiracy raids and has stepped up the educational and awareness campaign. In early 1998, Microsoft and NASSCOM, with cooperation from the government conducted the largest antipiracy raid to date in India (Microsoft 1998). Concomitantly, the domestic software industry has become one of the fastest growing sectors of the Indian economy, and since mid 1990s has exceeded 40% average annual growth rate. The segment of the software industry that has experienced the most rapid growth is the development of software products and packages by the domestic software publishers (NASSCOM 1998). Compared to its richer neighbor (based on per-capita GDP) China, India reports lower piracy rates (79% compared to 96% in China for the year 1996) and a more vibrant software industry.

The economic analysis provides a viable strategy to combat global software piracy. By encouraging and promoting alliances between foreign and domestic publishers, and by undertaking increased copyright enforcement, the government can increase the net welfare of the country and help establish a strong domestic software industry. By forging alliances with the domestic software publishers through product relationships, foreign publishers can realize a climate of increased copyright enforcement and higher profits.

A critical issue in software piracy is developing a behavioral model for software piracy activity. If software publishers have insight into the behavioral dynamics of software pirates, then it is possible to initiate more effective educational and legal campaigns to educate users about copyright laws and inspire attitudinal changes about appropriate copying behavior. Based on previous research results and the results of this study, we are confident that the model presented in Figure 3 provides a reasonable explanation for software piracy activity in the United States. However, based on the results derived from the Indian sample, we are convinced that additional research with revised models and improved scales is necessary. The enormous level of monetary resources at stake demands further investigation into the cultural and supranational determinants of piracy behavior.[8]

[8]The authors acknowledge the very helpful comments of the editors and the referees. These have led to significant improvements in the paper.

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