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# GLOBAL SOFTWARE PIRACY: CAN ECONOMIC FACTORS ALONE EXPLAIN *THE* TREND?

*Searching for explanations to increasing global software piracy rates.*

Software piracy is a worldwide phenomenon. In 2001, the Business Software Alliance (BSA) [1] found there are no nations with less than a 20% piracy rate, and two that exceeded 90% (see Figure 1). It is estimated that in 2001 software manufacturers lost \$10.97 billion globally as a result of software piracy [1]. Furthermore, in most regions of the world, piracy increased by 37% in 2000 and by 40% in 2001 (see Figure 2). After showing a decrease for several years, software piracy appears to be on the rise.

The literature offers few explanations for the growth in software piracy. While a Software Publisher's Association (SPA) study [1] found that per-capita income is not an issue in software piracy growth, Shin et al. [9] found evidence that the high price of software is a driving force in piracy in low GNP nations where residents cannot afford high-priced software. They noted that an increase in per-capita GNP is associated with a

decrease in piracy rates. Other factors have also been suggested, including availability of pirated software, less stringent implementation of copyright regulations [8], moral problems with the copyright enforcement, the degree of IT infrastructure, and access to the Internet [3].

In this article, we introduce an approach consistent with previous research [4, 8, 9]. We also suggest some additional factors that may help explain software piracy growth and examine what changes in piracy rate determinants, if any, have taken place over the years.

## WHY DO PIRACY RATES DIFFER?

Commonly assumed factors to explain piracy were grouped into four categories:

*Economic Factors.* Researchers have long recognized the importance of software price in piracy. Shin et al. [9] suggest that Gross Domestic Product (GDP) per capita is inversely related to software piracy level (more affluent nations have less need for piracy). Given the decrease in software prices, it may

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be that a country's GDP has less of an effect on piracy than it did some years ago.

**Technical Factors.** Software piracy is assumed to be more prevalent in nations with low IT infrastructure since the quality (older editions with fewer features) of available software is lower. Thus, people often copy and work with pirated software. The problem is compounded as software revisions occur. While the need to remain competitive through upgrades is important, it is worthwhile only if affordable [8]. Many researchers also believe that software piracy has also flourished with the advent of the Internet [3] since some Web sites provide free software or at prices cheaper than the manufacturer's [9].

**Regulatory Factors.** By imposing high tariffs, hence increasing the cost of software, governments may unwittingly encourage piracy. Developing nations often impose high tariffs on computer products and thus their piracy rates are higher. It is also believed that low censures for buying and high availability of pirated software are also reasons for piracy growth [8].

Copyright rules are considered foreign-induced, not easily understood, and far less rigidly enforced. Meso et al. [7] have identified enforcement of copyright laws as a salient issue in the development of a sound national IT policy. However, governments do not consistently implement such rules, partly because of lax law-enforcement facilities and institutional traditions that tend to ignore corruption. Thus, while enforcement of intellectual property rights and proper education may alleviate the problem, in reality few offenders are caught or prosecuted. Occasional raids from law-enforcement authorities have seldom disturbed the flow of pirated software. In nations that allow pirated software to be sold at lower prices, black markets have flourished. Individuals and firms in these nations may not even be aware that buying pirated

software is illegal since the software has an aura of legitimacy. The overall effect of low censure and easy availability can be captured by the indicator of corruption. Corruption can be defined as "the cost of obtaining privileges that only the State can 'legally' grant, such as favoritism in taxation, tariffs, subsidies, loans, government contracting, and regulation" [5].

**Social/Cultural Factors.**

These factors refer to the prevailing social structure of a country and the attitudes shared by members of that society. One measure of social structure is the distinction between individualism, a loosely coupled social network where people take care of themselves, and collectivism, a tightly coupled social network where the group feeling is strong. Software piracy is popular

in collectivistic societies where people tend to create a psychological distance between members of the in-group and the out-group. Obligations or loyalty to in-groups are considered extremely important, and in exchange people expect that members of in-groups will look after them [6]. Out-groups, on the other hand, are not deemed worthy of respect, since they do not contribute to the general well-being of the in-group. In such societies, software purchased by an individual is expected to be shared among members of the in-group. Since most collectivistic societies tend to be third-world or developing countries, software producers in foreign nations are viewed as out-groups.

Piracy may also be more acceptable in low uncertainty-avoiding nations (that is, high risk-taking nations). Low uncertainty traits include less resistance to changes and breaking of rules, if needed. In high-uncertainty avoiding nations, there will be concern and anxiety in illegal use of software. People in high-uncertainty avoiding nations may feel more secure and

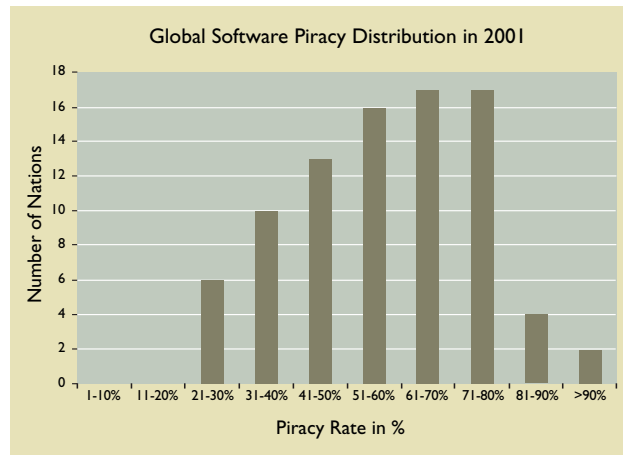


Figure 1. The piracy rate distribution in 2001.

THE IMPLICATION IS THAT IN ORDER FOR PIRACY RATES TO DECREASE THERE MUST NOT ONLY BE A CHANGE IN ECONOMIC CONDITIONS, BUT ALSO IN SOCIETAL STRUCTURE AND ATTITUDES.

comfortable with software obtained via legal means.

In a study of 53 countries (later extended to 69 nations), Hofstede [6] developed an index for rating Individualism/Collectivism (IC) and Uncertainty Avoidance (UA). This index remains the most highly regarded index for measuring social dimensions. For example, Japan has an uncertainty avoidance value of 92 (out of a maximum 100), The U.S. (91), the U.K. (89), and the Netherlands (80) and are considered very individualistic nations. Nations such as Ecuador (8) and Pakistan (14) and Sweden (29) are collectivistic societies.

Attitudes about copying also play a major role in piracy. Unlike countries such as the U.S., where copying is generally equated with cheating, copying is often viewed a cultural exercise, not an immoral practice, in many Asian nations. Asian art students are required to diligently copy the work of masters as an exercise in learning. Success is measured by the similarity of the copy to the original. Copyright laws are not well understood or even recognized in many of these nations [10].

Even in developed Western nations, some people believe that pirating software is not wrong. The example of piracy in the music industry is worth noting in this context; many U.S. citizens who could otherwise buy a copy of a popular music CD regularly downloaded pirated music from sites such as Napster and Kaaza [3]. Since the price of a CD is frequently considered exorbitant relative to the cost of producing one, individuals in many uncertainty-embracing nations may feel that the injustices inflicted by the manufacturers justify piracy.

#### METHODOLOGY AND ASSUMPTIONS

The dependent variable, software piracy rate, was obtained from the BSA/SPA piracy study [1] which compared the difference between the demand for new software applications, and the legal supply of new software applications. PC shipments to major countries were estimated from proprietary and con-

fidential data supplied by BSA/SPA member companies. The number of software packages installed per PC shipment was viewed as product demand. The number of software applications legally shipped formed the supply side. The difference between the demand and supply formed an estimate of software pirated. The piracy rate was defined as the amount of software pirated/total amount of software installed. The data was compared and combined to form a consensus estimate.<sup>1</sup>

To examine the impact of each of the explanatory variables on piracy, a partial least squares regression [2] on 37 nations was conducted for three periods of time: 1996, 2001, and 2003 (The results are similar with ordinary least square regression). This data constitutes the complete set of data available (see Table 1 for sources and expected relationships). The usual regression conditions were met using this scheme.

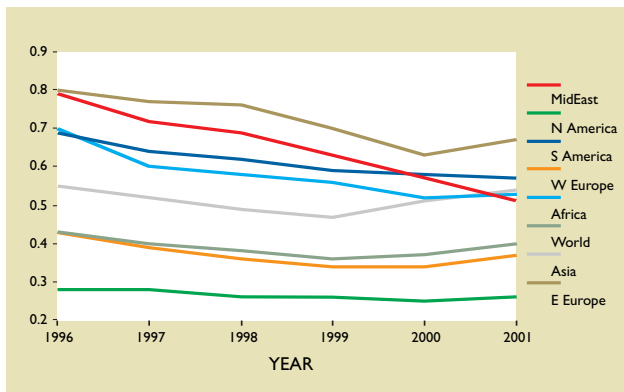


Figure 2. Piracy growth in different regions of the world.

Factors/Dependent Variable	Definition	Data Source	Expected Relationship to Piracy
<b>Economic</b>	GDP per Capita	World Bank	Inverse (-)
<b>Technical</b>	IT Infrastructure Internet Access	World Bank	Inverse (-) Positive (+)
<b>Regulatory</b>	Trade Regulations Enforcement (Corruption) IT Law	Heritage Foundation TI/GU Index World Economic Forum	Positive (+) Inverse (-) Inverse (-)
<b>Social/Cultural</b>	Individualism/Collectivism Social Structure Social Conservatism	Hofstede's Index	Inverse (-) Inverse (-)

Table 1. Factors, data sources, and expected relationships.

**Economic Factors.** GDP data is readily available from the World Bank ([www.devdata.worldbank.org](http://www.devdata.worldbank.org)) and is generally assumed to be inversely related to piracy rates [4, 9], although other studies [1] found no relationships. We believe that GDP is an important factor, although its impact may be lessening.

**Technical Factors.** Determination of IT infrastructure was based on the availability of two main information technologies: PCs and the telephone.<sup>2</sup> Internet access was determined by the number of Internet Ser-

<sup>1</sup>This procedure was verified and validated by several experts.

<sup>2</sup>A Principal Component Analysis for data reduction method was used for this purpose. The component extraction score was significant (98%).

vice Providers (ISPs). While software availability over the Internet might reduce the need for piracy, it could simply facilitate the ability to acquire legitimate software at reduced prices, and consequently, no assumptions can be made.<sup>3</sup>

**Regulatory Factors.** Tariff rates can be captured by the trade policy index developed by the Heritage Foundation [5]. The Trade Policy Index (TPI) is based on a country's average tariff rate. Since tariff rates and TPI are correlated and the TPI is a more general indicator, we decided to drop tariff rate in favor of the TPI to keep the regression parsimonious. We assume that piracy will be directly related to the TPI: the higher the TPI, the lower is the software piracy.

Transparency International/Gottingen University have generated a Corruption Index [11], or Corruption Perceptions Index (CPI), which reports perceptions of corruption (as seen by business people, risk analysts, and the general public) within a range between 10 (highly uncorrupt) and 0 (highly corrupt). The Black Market Index [5], based on the CPI, measures the prevalence of black market activities. Because of the correlation between the Black Market Index and the CPI, we decided to drop the Black Market Index from our analysis. Nonetheless, we assume the CPI will be directly related to piracy. We did, however, include ITLAW [12], (subject to the availability of data) as it might measure slightly different aspects of regulatory law.

**Social/Cultural Factors.** Using Hofstede's [6] cultural dimensions, we postulated that piracy rates will be negatively related to a nation's IC rating and its UA rating (a high IC rating indicates high Individualism; a high value of UA index denotes high uncertainty avoidance).

## FINDINGS AND DISCUSSION

Table 2 provides a summary; prior to any discussion, it should be noted that while all available data was

used, the sample size is limited. Consequently, those relationships that were not found to be significant at generally applied levels, may become significant should more data become available.

**Economic Factors.** GDP was found to be a significant indicator of piracy in 1996 but not in 2001 or in 2003. Further, GDP alone could explain only 62%–63% of the variance in piracy. These findings

Explanatory Variables <sup>a</sup>	Expected relationship	Observed relationship 1996	Observed relationship 2001	Observed relationship 2003	Relationship significance <sup>b</sup> 1996	Relationship significance <sup>b</sup> 2001	Relationship significance <sup>b</sup> 2003	Overall <sup>b</sup>
GDP	-	-	+	-	Significant	NS	NS	Partly significant
IT Infrastructure	-	-	-	-	Significant	NS	NS	Partly significant
Internet use	-	+	-	-	NS	NS	Significant	NS
Trade Regulations	-	-	-	-	Significant	NS	--	Partly significant
ITLAW	-	N/A	N/A	-	N/A	N/A	Significant	Partly significant
Corruption	-	-	-	-	Significant	Significant	Significant	Significant
Cultural Collectivism (IC)	-	-	-	-	Significant	Significant	Significant	Significant
Cultural Uncertainty avoidance (UA)	-	-	-	-	NS	Significant	Significant	Partly significant

<sup>a</sup> Number of nations available =37 ; NS-not significant; --Not included  
<sup>b</sup> If significant, significance level is 0.10 or better

**Table 2. Regression results between piracy rate and explanatory variables.**

may help explain why different studies have arrived at different conclusions about the role of GDP. It appears that the decrease in relative cost of software (and in some cases the absolute price of software), has lessened the need for piracy. Given the increase in piracy over this period, however, it follows that other factors are involved, and further that these factors are increasing in impact.

**Technical Factors.** Corresponding to the impact of GDP on piracy, IT infrastructure was inversely related to piracy (the greater the IT structure, the less the piracy rate) in 1996, but not in 2001 nor 2003. Regardless of period, Internet growth rate was not found to be a significant predictor of piracy. Internet use, however, emerged as significant in 2003.

In order to examine whether the relationship between Internet use and piracy rates differs in nations with high piracy rates, a separate analysis was performed using only those nations with high piracy rates (piracy rate  $\geq 50\%$ ). The findings were insignificant, which intuitively follows, since Web site content is the same regardless of point of access.

These findings offer a few possible explanations. It may be that the increased availability of legal software over the Internet, especially given the decrease in software prices, lessens the need for piracy. This corresponds to the relationship between GDP and piracy.

<sup>3</sup>Software purchased over the Internet may or may not be legitimate; we assume that it is, although we concede the possibility of pirated software being sold.



**Regulatory Factors.** Once again, trade regulation was found to have a significant negative impact on piracy in 1996, but not in 2001 nor in 2003. There is no easy explanation for this finding. It may be that the regulations themselves have changed. It may be that the increased availability and the decreased costs of software have lessened the need for regulations. Additional investigation is needed.

Consistent with our assumptions, a high degree of corruption (low corruption index value) was positively correlated with a high rate of piracy and was significant in both the initial and in the final two regressions. Not only are rules and regulations less rigorously enforced in highly corrupted societies, but there appears to be a preference for pirated software.

ITLAW was significant in 2003 (the Pearson's correlation coefficient with software piracy was also significant:  $r=-0.68$ ,  $p<.000$ ). This may be due to better law enforcement in recent years in many of the nations studied.

**Social/Cultural Factors.** A high collectivism rating was found to be positively related to piracy. This was anticipated since collectivistic societies tend to regard foreigners as outsiders [6] and most of these programs are exported from the U.S. Interestingly, piracy rates were higher in high-uncertainty avoiding nations in years 2001 and 2003, but not in 1996. In the final regression, the additional variance explained by these indicators amounted to 13%–18%, after controlling for GDP.

## CONCLUSION

This preliminary study provides some empirical results on the causes of global software piracy. Indicators in four categories of factors (economic, technical, regulatory, and social/cultural) were examined and a combination of a few indicators together explained the vast majority of variance in software piracy data. Nations with less corruption and weak collectivism had less piracy. These factors remained significant over time. Factors such as strong economic growth, low trade regulations, high uncertainty avoidance, low Internet use, better ICT laws, and strong IT infrastructure had partial influence on low piracy, within the timeframe of the study.

The study indicators together explained 78% (1996) to 84% (2001) to 83% (2003) of the variance in software piracy data. It is obvious that more than mere economic factors are involved, and it would appear that non-economic factors, or a combination of such factors, are much more relevant in predicting piracy. This might help to explain why piracy is prevalent even in developed nations. The implication is that in order for piracy rates to decrease there must not only be a change in economic conditions, but also

in societal structure and attitudes.

Nonetheless, additional investigation is needed. As noted previously, the data available is limited, although it is expected that additional data should be available in the next few years. There may also be additional social/cultural factors that impact on piracy (such as trust), and variations in growth and product elasticity across nations could be significant. Combinatory interactions between factors also need to be investigated. For example, it may be that Internet usage and collectivism together are better predictors of piracy than either one alone.

This study was also limited to a five- to seven-year observation period: as more data becomes available, additional observations may offer new insights. It also seems reasonable to assume that as a result of changing legislation and shifts in attitudes toward piracy, we can expect the factors affecting piracy to change. Longitudinal studies mapping the changes over time might prove enlightening with respect to constructing policies to discourage piracy. **□**

## REFERENCES

1. BSA/SPA Study Report on Global Software Piracy, 2006; www.bsa.org.
2. Chin, W. Partial least squares for IS researchers: An overview and presentation of recent advances using the PLS approach. In *Proceedings of CIS 2000*, 741–742.
3. Forum section. *Commun. ACM* 43, 12 (Dec. 2000), 11–13.
4. Gopal, R.D. and Sanders, G.L. Preventive and deterrent controls for software piracy. *J. MIS* 13, 4 (1997), 29–47.
5. Heritage Foundation index of economic freedom. *The Heritage Foundation/Wall Street Journal* (2006); www.heritage.org/research/features/index/.
6. Hofstede, G. *Culture's Consequences: International Differences in Work-related Values*. Sage Publishers, Beverly Hills, CA, 2001.
7. Meso, P., Checchi, R.M., Sevcik, G.R., Loch, K.D., and Straub, D.W. Bounded rationality and sectoral differences in diffusion of national IT policies. *Electronic Journal of on Information Systems in Developing Countries*, 2005.
8. Moores, T. and Dhillon, G. Software piracy: A view from Hong Kong. *Commun. ACM* 43, 12 (Dec. 2000), 88–93.
9. Shin, S.K., Gopal, R.D., Sanders, G.L., and Whinston, A.B. Global software piracy revisited. *Commun. ACM* 47, 1 (Jan. 2004), 103–107.
10. Swinyard, W.R., Rinne, H. and Kau, A.K. The morality of software piracy: A cross-cultural analysis. *Journal of Business Ethics* 9 (1990), 655–664.
11. Transparency International, Internet Center for Corruption Research. *The Corruption Index* (2006); www.gwdg.de/~uwww/icr.htm.
12. World Economic Forum. *The Global Information Technology Report*, Oxford University Press, 2003–2004, 238.

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