The Measurement of Intellectual Property Rights Protection

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This research improves upon empirical studies that examine the measurement of intellectual property rights (IPR) protection. Prior measures examine only one type of law or lack a component that addresses the actual enforcement of these laws. The measure presented here uses three types of IPR laws and enforcement components for them.

INTRODUCTION

With the increased global attention to intellectual property rights (IPR) issues, scholars have begun to pay more attention to IPR protection and its economic impact. One problem in conducting this research has been the measurement of IPR protection. Prior attempts seem to be limited in their ability to capture IPR protection, focusing more on the laws with limited attention paid to how nations enforce those laws. The importance of the enforcement component, however, becomes even more critical given the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement under the World Trade Organization. The TRIPS agreement requires that most nations should be in compliance with the minimum standards for IPR protection by the year 2006.[1] In practical terms the distinguishing factor among nations in the protection of intellectual property rights will be in how they enforce those laws. The enforcement of intellectual property laws has been a critical issue, particularly in trade relations between developed and developing countries. Thus, the measurement of such practices will be critical in the assessment of national performance in protecting intellectual property. This paper presents an alternative method for measuring IPR protection that incorporates the strength

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of national intellectual property laws and nations' enforcement practices of those laws. The measure is a better gauge of IPR protection than just using the strength of laws, which may lead to greater estimation error of nations' IPR protection.

The measurement of cross-national intellectual property rights protection is a critical issue for international business scholars and practitioners. For scholars, the measures can offer insightful perspectives into micro-level questions about the nature of corporate inventive activity, investment trends, research and development and corporate strategic investments. At the macro-level these data can also help address questions about the relationship between IPR and trade, foreign investment flows, and economic growth and activity. Practitioners in international business may find these data and the approach taken here valuable tools in assessing intellectual property investment risk in countries, particularly in industries that are sensitive to the protection of IPR (e.g. pharmaceuticals and chemical industries, the entertainment and software industry, and marketing and licensing enterprises). This article presents the methodology used to create these data. Due to space limitations, the data have not been reprinted in this article but they are available from the author upon request.[2]

EMPIRICAL RESEARCH

Intellectual property (IP) has long been a concern for many industries, particularly for those with a heavy reliance on the protection afforded by national IPR laws. In many ways, as technology has advanced, industries have been victimized by their own success, because with greater advances in technology have come easier methods for duplicating that same technology and associated products. For instance, the introduction of video recorders to consumer markets also brought with it the capacity to duplicate videotapes, bringing about potential massive violations of entertainment industry copyright protection. As such, advances in technology have made some industries more reliant than other industries on intellectual property protection. The pharmaceutical and chemical industries are highly dependent on patent protection (Nogues 1990; Noonan 1990; Sherwood 1990; Comanor 1986; Besen and Raskind 1991) as a consequence of technology that has reduced the difficulties in duplicating chemical compounds. Other industries such as the entertainment industry and computer software industry have reliance on copyrights and patents for the same reasons (Band and Katoh 1995; Ebanks 1989; United States Congress 1986; Besen and Raskind 1991). Much of this research, however, has been qualitative, with few quantitative studies. One obstacle to doing quantitative IPR research has been in constructing measures of IPR protection. A number of studies have attempted to measure IPR protection cross-nationally; among them are Rapp & Rozek (1990), Seyoum (1996) and Sherwood (1997).

Rapp and Rozek's was one of the first attempts to quantify IPR protection in some form. Scholars have used this measure in their studies (Gould and Gruben 1995), and the United States government cites this study as providing additional evidence to support its position on global IPR (Wichterman 1991). Hence, Rapp and Rozek's measure warrants closer scrutiny. They use patent laws as a proxy for IPR protection. They measured the strength of 159 countries' patent laws on a zero to five scale, where zero represents a country with no patent

TABLE 1
RAPP AND ROZEK'S SCALE FOR INTELLECTUAL PROPERTY RIGHTS/PATENT PROTECTION

Scale Score	Description
0	No intellectual property protection laws
1	Inadequate protection laws; no law prohibiting piracy
2	Seriously flawed laws
3	Flaws in laws, some enforcement laws
4	Generally good laws
5	Protection and enforcement laws fully consistent with minimum standards proposed by the U.S. Chamber of Commerce

Source: Rapp & Rozek, 1990 Appendix 4.

laws and five represents a country that has laws consistent with the minimum standards established by the US Chamber of Commerce Intellectual Property Task Force (Rapp and Rozek 1990a 7; 1990b 79; Gadbaw & Gwynn, 1988 11, 51-55). These guidelines present minimal protection criteria for most areas of intellectual property law (patents, trademarks, copyrights, trade secrets and semi-conductor chip design). The Rapp and Rozek 0-5 measure is presented in Table 1.

Seyoum (1996) also used the US Chamber of Commerce's minimum standards for his criteria. However, his 0-3 scales of IPR protection components were constructed from surveys sent to IPR practitioners. After validating the responses against each other and existing literature, Seyoum constructed four variables (patents, copyrights, trademarks and trade secrets) for use in his analysis.

Sherwood (1997) proposed a third measure of IPR protection that combined personal knowledge and experience with professional interviews. The protection scores theoretically range from 0-103 and were developed for eighteen countries. Eight major components comprised Sherwood's measure summarized in Table 2 (Sherwood, 1997, 265). The conditions for rating countries were derived from the US Chamber of Commerce Guidelines, but the relative weights were derived mostly from the author's experience (Sherwood 265, 267). Similarly, the points assigned under any category to a

TABLE 2
SHERWOOD'S EIGHT INTELLECTUAL PROPERTY RIGHTS COMPONENTS

Description	Assigned Points
Enforceability	25
Administration	10
Substantive Law	
Copyright	12
Patents	17
Trademarks	9
Trade Secrets	15
Life Forms	6
Treaties	6
Total	100
Public Commitment	3
Total Possible Points Added	3

Source: Sherwood, 1997, 265.

country were also based on the author's experience (Sherwood, 267). Interviews with local attorneys augmented the author's experience, particularly with the enforceability component.

Each major component contained subcategories for which each country could lose points from the total allocated for that major component based on observed deficiencies. For instance, the enforceability component (worth 25 points in the coding scheme) contains eight separate areas of interest to the author: judicial independence (up to 12 points), quality of judges (up to 10 points), lack of legal tools for enforcement (up to 10 points), judicial knowledge of intellectual property concepts (up to 7 points), reliability of prosecutors, police, and customs officials (up to 6 points), civil and criminal sanctions (up to 6 points), delays in enforcement proceedings (up to 4 points), and the lack of transparency for final decisions (up to 2 points). Deficiencies in these components resulted in the subtraction of points ranging from a high of 12 for judicial independence to a low of up to 2 points for the final transparency issue. The amount to be subtracted was again based on interviews and the author's experience.

The sub-category point deductions were then subtracted from each component total score. All component scores were then added to obtain the aggregate IPR measure for each country. Finally, an impressionistic assessment of the public's commitment to intellectual property accounted for up to three additional points, which were then added to the eight major components. This final step made the theoretical total points for each country 103. In practice the final scores ranged from a high of 83 for the Bahamas to a low of 13 for Guatemala.

Research Assessment

While each study makes important contributions in assessing the strength of IPR protection in countries, several conceptual and measurement issues are raised. The first conceptual issue is which IPR laws must be examined to gauge protection. Rapp and Rozek's measure assumes patent laws are *ipso facto* IPR laws. However, services increasingly are accounting for larger portions of economic growth. The value of a name or identification therefore has significant economic impact. Particularly in western countries, the economic contributions of copyrighted software production, entertainment products, and publishing are significant. To discount these two forms of IP protection would be to underestimate their economic impact. Similarly, it has been argued elsewhere (Ostergard 1999; Hettinger 1989) that nations do not treat all IP equally. Some forms of IP are more important to nations' economies than others. Using patents as a proxy for all IPR may overlook this issue. While Seyoum measures the strength of these laws individually, Sherwood's measure blends five different forms of IPR laws into the measure. As I noted earlier, the combining of various laws into one conceptual measure of IPR protection may present some theoretical and methodological difficulty.

A second conceptual issue relates to the enforcement of the laws. Rapp and Rozek and Seyoum do not include a component for enforcement in their study, though Rapp and Rozek recognize the issue (1990a, 7). The logic behind this proposition is intuitively simple. Nations may have in place the institutional structures and financial resources to enforce these laws, but others that do not have these structures and resources

may not be able to enforce the laws adequately. Sherwood too recognizes this issue by including an enforceability component in his measure, but it does not significantly address the behavior of the governing regime in enforcing the intellectual property laws. The enforcement component Sherwood uses reflects an assessment of the *potential* to enforce IPR laws and not an assessment of the regime's *actual* performance.

From a measurement perspective, all three researchers assign scores based on the laws in force at the time they coded their data. Changes and amendments to the laws that may have occurred during any specific time period are not taken into account. The temporal element becomes critical particularly when using such measures to gauge the effect of IPR on foreign direct investment, technology levels and industry and economic growth. The missing temporal element means that their measure will not capture the impact of changes to these laws.

Another measurement concern is the replicability of these measures. For instance, Rapp and Rozek do not explain what constitutes the difference between a score of two and a score of three. What is the difference between "inadequate" laws and "seriously flawed" laws or the difference between "generally good laws" and laws that are "fully consistent" with the minimum standards? Without clearer criteria, an element of subjectivity is introduced, which casts doubt on the measurement's validity and reproducibility. In Seyoum's study, it is unclear as to how the raw data were reduced to a 0-3 scale. Similarly, because Sherwood's study is based preponderantly on the author's expertise, the ability to replicate the results without that vast experience is limited. Moreover, because the procedures use on-site interviews in the country, the practicality of duplicating these measures across time and across countries is limited as well.

A second concern with Sherwood's procedures is that because they are largely based on his experience, they may be more subjective than is desirable. For instance, when judging how many points to subtract for judicial independence, no set rules exist for what does constitute judicial independence. What criteria are used to subtract 5 points versus 6 points? We cannot be certain about distinctions given that the assessment is grounded in personal perception. Moreover, there seems to be some incongruity between the total points assigned to the major components and the total points that can be subtracted in the sub-categories. For instance, the enforceability component itself is worth 25 points, but the sub-category points that can be subtracted total 55 points. Is it possible that countries could have a negative score for enforceability? In theory, it is a possible scenario.

THE CONCEPT OF INTELLECTUAL PROPERTY RIGHTS PROTECTION

The measurement of IPR must incorporate both a statute component and an enforcement component. Roughly categorized, nations' laws can range from having no laws to having the strongest laws, and enforcement practices can range from having no enforcement of the laws to having strong enforcement of the laws. As Sherwood (1997) also notes, a nation can have strong laws or weak laws, but unless those laws are enforced, they are virtually non-existent in terms of the protection afforded IP owners and investors.

Law Measurement

In order to measure the strength of IPR laws, two issues must be addressed:

what IPR laws and by what standards? I have settled for using just patents, copyrights and trademarks because the bulk of IP is protected under these laws (Benko 1987) and the information on cross-national patent, copyright, and trademark laws are more readily available than other types of IP laws. Following the practice of the other three studies, this study is based on the minimum criteria for IPR laws established by the US Chamber of Commerce. Using these criteria, separate code sheets for patent, copyright and trademark laws were created to conduct a content analysis of countries' IP laws.[3] A number of legal sources were used to complete codesheets for each country in this study. All sources used pertained to IP statutes only, without reference to prior judicial review, trial histories or customs. The laws for seventy-six nations were coded twice with different coders utilizing the same code sheets.[4] A comparison of the two codings showed intercoder agreement to be high; all inter-coder agreement scores were .90 or higher. This score reflects a 90% or higher agreement between coders on all items coded, which also indicates that these code sheets were constructed such that coding replication could be reasonably achieved. The laws for each nation were coded for three time intervals, 1988, 1991 and 1994. Three year intervals were used because the laws were not expected to change much on an annual basis. The time period was chosen because of the temporal limits of the enforcement component.

Enforcement Measurement

The enforcement score of the IPR protection measure was obtained through content analysis as well. Under the 1988 Omnibus Trade and Competitiveness Act, the United States Department of State was legislatively mandated to track the status of the IP laws and enforcement practices of the United States' trading partners. These assessments appear in the US State Department's book, *Country Reports on Economic and Trade Practices*. These reports are produced semiannually and began in 1989. Hence, the data set is temporally limited to the post-1988 period. The early reports do not distinguish among the different types of IPR laws as the later reports do. The enforcement code sheet, which contains only one variable, was constructed to gauge a general assessment of the enforcement of IPR laws in the country.[5] Coding of the enforcement practices was done for 1988, 1991 and 1994 (whereas the reports began in early 1989, it was assumed information gathered was for 1988 and reported in 1989). The laws for each year were coded twice by separate coders using the same code sheet with inter-coder reliability scores all over .90.

Scale scores of the IPR laws were obtained using Guttman scaling procedures (Garson 1976; MacRae 1970; McIver and Carmines 1981). Any polychotomous items were converted to dichotomous variables. A gamma matrix, measuring the strength of association among all variables, revealed that not all the variables clustered together (with a gamma score of .80 or higher) to form one scale of IPR laws. In fact, the clustering that did occur was within each individual type of law. This finding has *theoretical significance* in that it confirms the idea that nations *do* treat these laws differently and that there is no unidimensional concept of IPR law. Each type of law *must* be treated distinctly from others.

The variables were then ordered and summated according to Guttman scaling

procedures (Garson 1976; MacRae 1970; McIver and Carmines 1981). This procedure produced three scales: patents (0-5), copyrights (0-10) and trademarks (0-8). In these scales, zero represents no laws while the other ends of the scales represent the strongest laws. Tests of reproducibility and scalability were conducted on the scales. Coefficients of reproducibility were above .90 and all coefficients of scalability were above .60, the minimum acceptable levels for Guttman scaling.

To obtain complete IPR protection scores for each nation and each type of law, the scale score for each nation and law was multiplied by the enforcement score for each nation, which ranged from zero to four. Zero represents no enforcement of IPR laws while four represents the strongest enforcement. The multiplication of these two measures signifies that the law *and* the enforcement component are both *necessary conditions*. Because enforcement information could not be obtained for each type of law for each year, it is assumed that the enforcement practices apply to all the laws. In later years, the State Department reports assessed the enforcement of each of these types of laws, making individual enforcement scores for each type of law feasible in future studies.

The multiplication of the enforcement and law components is not problem-free. First, it creates great variation in the data from country to country. For instance, the multiplication of a country's patent score of 3 with its enforcement score of 3 creates a score of 9. The same procedure for a country with a patent score of 3 and an enforcement score of 1 creates a score of 3. Is the relationship between the enforcement and the law component multiplicative or additive? And by inference what weights should be given to the enforcement component? Two ways of dealing with both questions exist; the first is grounded in the assumptions of the research question, the second is methodological.

In multiplying the two scores together, the underlying assumption is that the laws and the enforcement are *necessary* conditions for intellectual property *protection*. Laws must be enforced in order to provide substantive protection. Researchers, however, may be inclined to believe that the enforcement is not a necessary and separate policy issue from the enactment of the laws, that enforcement is simply another component of protection and is weighted no differently than the laws. The researcher may even find that the laws themselves have a deterrent effect and that the correct approach is to consider the scores additive. However, the issue is one of formulating the research assumptions. The benefit of these data is that both assumptions can be accommodated. Because the laws and the enforcement components are separate entities, the researcher is free to make the assumptions deemed appropriate. Should the researcher assume a multiplicative relationship, then some additional work is needed to address the question of how to weigh the enforcement component in the multiplicative relationship.

By taking the log of each of the variables, the data distances are reduced and the researcher can utilize the data in linear-log or log-log models. Moreover, the weights for each of the components are adjusted automatically by virtue of the log function.[6] Both model types are quite common in business, economics and political science studies where data are often characterized by wide variations cross-sectionally or temporally.

Reliability and stability coefficients for the IPR protection scores were calcu-

lated across the three panel waves (Heise 1970). The coefficients show that the measures are reliable across the three-wave panel design, with all reliability coefficients at .98 and higher. However, the stability of these measures varies. The stability of the copyright variable is high across all time periods (.879, .950, .830). Patents are stable over the first two waves (.993), but the stability decreases over the second and third waves (.769) and from the first to the third waves (.764). Trademarks reflect the greatest decline in stability over the three waves. While highly stable over the first and second waves (.984), the stability coefficients show a large decline over the second and third waves (.595) and from the first to the third waves (.588). This finding would indicate that trademarks have undergone the most change over the six year period.

IPR PROTECTION SCORE ANALYSIS

Correlations between the IPR protection scores and Rapp and Rozek's patent scale scores, Sherwood's IPR scores and Seyoum's three new IPR measures were calculated for the countries in the IPR protection data set; these results are presented in Table 3. The results show that Rapp and Rozek's scale score correlates inconsistently across the three types of IP laws and protection. The highest correlations are with patent laws and protection, which correlate at .56 and higher. The lowest correlations were with trademark laws and copyright pro-

TABLE 3
IPR PROTECTION MEASURES CORRELATIONS, 1988–1994

Variable	Rapp & Rozek (N = 76)	Sherwood (N = 18)	Seyoum (N = 23)
1988			
Copyright Protection	.512**	.281	.419*
Patent Protection	.659**	.194	.653**
Trademark Protection	.502**	.129	.608**
1991			
Copyright Protection	.559**	.411	.472*
Patent Protection	.705**	.237	.467*
Trademark Protection	.600**	.340	.322
1994			
Copyright Protection	.431**	.299	.503*
Patent Protection	.568**	.132	.563*
Trademark Protection	.453**	.164	.512*
Rapp & Rozek	1.00	.307	
Sherwood	.307	1.00	
Seyoum Patents	.883**	.004 (N = 7)	
Seyoum Trademarks	.603**	−.226 (N = 7)	
Seyoum Copyrights	.573**	.098 (N = 7)	

**$p < .05$.

tection. While patents are moderately correlated with Rapp and Rozek, the other two forms of IPR protection do not correlate as highly. The copyright and trademark variables' low correlation with Rapp and Rozek's patent variable is further indication of the theoretical importance of treating intellectual property law components separately. One can not be used as a proxy for the other because nations do not assign equal importance and attention to them.

Seyoum's measures reflected moderate positive correlation with the IPR protection scores, with the highest correlations in the area of patent protection and the lowest correlations in trademark protection. There was no significant correlation between any IPR protection scores and Sherwood's measures, which may be due in part to the low number of observations available in Sherwood's data set.

The correlations among the other variables were also mixed. The strongest correlations were between Seyoum's patent measure and Rapp and Rozek's measure (.883), indicating a close relationship between the two. There was moderate correlation between Seyoum's measures for trademarks and copyrights and Rapp and Rozek's patent measure. Sherwood's measure had a low level of correlation with Rapp and Rozek's measure. However, the low and insignificant correlations of Sherwood's measure with Seyoum's measure cannot be assigned much importance given the low number of cases the two data sets had in common.

Additionally, the low correlations among the IPR protection scores and the other scores may be a product of the differences in the methodology used to create these data. The enforcement component in the IPR protection score has the capacity to enhance or to detract from the strength of the laws. It is possible that nations may have weak laws but strong enforcement of those laws or strong laws but weak enforcement of them. Measures that do not capture this distinction will correlate modestly with measures that do.

CONCLUSIONS

This article has attempted to accomplish two goals. The first was to call attention to the need for additional quantitative research in the area of IPR protection. Given the scarcity of such research, more will be needed before we can begin to address how IPR protection affects processes such as investment and capital movement decisions. The second goal was to contribute to the literature on measuring IPR laws. The importance of an enforcement component in assessing the strength of IPR protection in countries should not be overlooked. Measures that do not take enforcement into account may unintentionally overestimate the protection afforded IPR in a particular country. While the approach taken here is an improvement, additional information on enforcement *practices* from government sources and private foundations will continue to improve these measures.

Two veins of work in the measurement of IP protection are also needed in light of the new TRIPS agreement. Future research in such measures should be directed at measuring how nations are complying with the agreement. Research in this direction becomes important because when nations come into compliance with the agreement, the distinguishing factor, theoretically, should be in how nations are enforcing those laws. Additionally, research into the nature of the enforcement component is needed. Enforcement of IPR laws is a two dimensional concept that involves the institu-

tional capacity together with the institutional will to enforce laws. The first element addresses the actual institutions needed to enforce the laws (i.e. the statutes, the nature of the judiciary, technical expertise, and policing organizations). The second addresses whether those institutions actually carry out the enforcement of the laws. The second dimension is a behavioral component as opposed to an institutional and resources component. The institutional dimension is a necessary condition for enforcement, but it alone is not sufficient to constitute enforcement; the institutional will to do so is needed. Research in this direction will contribute much to the discussion concerning the role of IPR protection in business and national development.

1. This date includes the 10-year exception for implementation of the agreement's provisions by developing countries established in Article 65 of the agreement. The full text of the TRIPS agreement can be found at the World Trade Organization web site at http://www.wto.org/wto/intellec/intellec.htm.

2. Those wishing to obtain the data may contact the author at his email address at rost@binghamton.edu or they may obtain the data from Binghamton University's Department of Political Science web page at http://www.binghamton.edu/polsci/.

3. While not perfect, the use of content analysis provides a *set criteria* for coding elements, making the coding much *less* subjective. Of course, it does not eliminate subjectivity in deciding *what* to code. For a classic statement on content analysis, see Krippendorf 1980.

4. The countries were determined by the countries listed in the initial reports of the State Department's report on *Country Reports on Economic and Trade Practices*, which I discuss later in this paper. The other coders were research assistants independent of the author.

5. In later reports, the State Department presents a breakdown by type of IPR law, copyrights, trademarks and patents which could be useful in determining enforcement differences among the three types of laws in subsequent studies.

6. The proof of this follows from logarithmic transformations. In using the IPR protection variables in a linear regression, the equation is $Y = \alpha + \beta_1(\text{laws} \cdot \text{enforcement})$. By logarithmic transformation, the equation becomes $\text{Log}_e Y = \alpha + \beta_1 \text{Log}_e(\text{Laws}) + \beta_2 \text{Log}_e(\text{Enforcement})$ and when this equation is restated with respect to Y, the retransformed version of the log equation is $Y = e^{\alpha}(\{\text{Laws}^{\beta 1}\}\{\text{Enforcement}^{\beta 2}\})$ The beta coefficients become the weights of each component of the IPR protection score.

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