

# International patent protection: 1960–2005

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## Abstract

This note provides an update to the index of patent protection published in this journal in 1997. The original paper presented the index for 1960–1990 for 110 countries. The index has now been updated to 2005 and extended to 122 countries. The adoption of stronger patent laws and the composition of patent rights vary across countries by level of economic development.

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## 1. Introduction

The global trade-related aspects of intellectual property rights (TRIPS) agreement of 1995 has intensified interest in, and research on, the economics of intellectual property protection. Researchers and policymakers, for example, have been interested in the extent to which stronger intellectual property rights (IPR) influence R&D and innovation, international trade and technology transfer, productivity growth, and national and global welfare.<sup>1</sup>

Empirical work often relies on a quantifiable measure of the shifts in intellectual property regimes. In [Ginarte and Park \(1997\)](#), an index of patent rights was developed for 110 countries for 1960–1990 (broken down into 5 years intervals). The index is the unweighted sum of five separate scores for: coverage (inventions that are patentable); membership in international treaties; duration of protection; enforcement mechanisms; and restrictions (for example, compulsory licensing in the event that a patented invention is not sufficiently exploited). This index was designed to provide an indicator of the strength of patent protection, not the quality of patent systems.

However, the index is now over 15 years out of date. To better serve ongoing research, I have updated the index of patent rights to the year 2005 and included more countries (such as China and the East European countries, which were originally excluded because laws protecting industrial property were either non-existent or based on a different system, such as inventor certificates). In this note, I present the updated data, highlight the key developments underlying the changes in patent rights across countries, and discuss the possible applications of the data.

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<sup>1</sup> The following list of studies is not exhaustive. For theoretical analyses on the international aspects of intellectual property rights, see [Helpman \(1993\)](#), [Grossman and Lai \(2004\)](#), and [Dinopoulos et al. \(2007\)](#). For empirical work on IPR and innovation, see [Varsakelis \(2001\)](#) and [Chen and Puttitanun \(2005\)](#); for international trade and IPR, see [Smith \(1999\)](#) and [Co \(2004\)](#); for international technology transfer and IPR, see [Javorcik \(2002\)](#), [Park and Lippoldt \(2005\)](#), and [Branstetter et al. \(2006\)](#); and for the effects of IPR on productivity growth, see [Falvey et al. \(2006\)](#). For a global welfare analysis of the effects of TRIPS, see [McCalman \(2005\)](#). A comprehensive review of the literature and analyses of IPR policy can be found in [Maskus \(2000\)](#), [Landes and Posner \(2003\)](#), and [Scotchmer \(2004\)](#).

## 2. Updated patent rights index and key developments

Table 1 presents a summary of the scores by country. The Appendix A summarizes the scoring methodology. The present index incorporates the effects of recent national and global developments, most notably the TRIPS agreement, legislations dealing with emerging technologies such as software and biotechnology, and the revisions in national patent laws required to conform to international and regional agreements (such as the North American free trade agreement (NAFTA), European patent convention (EPC), African Regional industrial property organization (ARIPO), Cartagena agreement, among others).<sup>2</sup>

As the bottom of Table 1 shows, the mean value of the index of patent protection has increased over time, while the coefficient of variation (i.e., standard deviation to mean) has fallen. This reflects a narrowing of the gap in the strength of patent systems worldwide. Moreover, the distribution of patent strength around the world has switched from being positively skewed before the late 1990s to being negatively skewed thereafter.<sup>3</sup> This indicates that most of the countries have a patent index score that is above the mean. These trends reflect the adoption of stronger patent laws across countries particularly after TRIPS came into force, as well as the introduction of patent laws in countries which did not previously have patent systems, such as Indonesia in 1991, Angola in 1992, Ethiopia in 1996, Mozambique in 1999, and Papua New Guinea in 2000.<sup>4</sup>

However, the extent to which national patent systems have increased in strength varies by level of economic development. To illustrate this, I have divided the countries into five income groups (quintiles), based on their real GDP per capita in 1990 (i.e., in constant 2000 US dollars). I then calculated the mean change in the patent rights index between 1990 and 2005 in each group. As Table 2, column 1 shows, the average increase in the patent rights index is smallest for the top quintile, next smallest for the bottom quintile, and highest for

Table 1  
Index of patent rights 1960–2005<sup>a</sup>

	Average 1960–1990 <sup>b</sup>	1995	2000	2005
Algeria	2.74	2.74	3.07	3.07
Angola	0.00	0.88	1.08	1.20
Argentina	1.60	2.73	3.98	3.98
Australia	2.35	4.17	4.17	4.17
Austria	2.96	4.21	4.33	4.33
Bangladesh	1.34	1.87	1.87	1.87
Belgium	3.39	4.54	4.67	4.67
Benin	1.64	1.78	2.10	2.93
Bolivia	1.38	2.37	3.43	3.43
Botswana	1.59	2.08	3.32	3.52
Brazil	1.22	1.48	3.59	3.59
Bulgaria	1.83	3.23	4.42	4.54
Burkina Faso	1.62	1.98	2.10	2.93
Burma (Myanmar)	0.00	0.20	0.20	0.20
Burundi	1.98	2.15	2.15	2.15
Cameroon	1.74	2.10	2.23	3.06
Canada	3.00	4.34	4.67	4.67
Central African Republic	1.74	1.98	2.10	2.93
Chad	1.61	1.78	2.10	2.93
Chile	2.04	3.91	4.28	4.28
China	1.33	2.12	3.09	4.08
Colombia	1.05	2.74	3.59	3.72
Congo	1.74	1.90	2.23	3.06
Costa Rica	1.07	1.56	2.89	2.89
Cyprus	2.52	2.78	3.48	3.48
Czech Republic		2.96	3.21	4.33
Denmark	2.88	4.54	4.67	4.67
Dominican Republic	2.12	2.32	2.45	2.82
Ecuador	1.16	2.04	3.73	3.73
Egypt	1.41	1.73	1.86	2.77
El Salvador	1.71	3.23	3.36	3.48
Ethiopia	0.00	0.00	2.00	2.13
Fiji	2.20	2.20	2.40	2.40
Finland	2.64	4.42	4.54	4.67
France	3.29	4.54	4.67	4.67
Gabon	1.74	2.10	2.23	3.06
Germany	3.24	4.17	4.50	4.50
Ghana	1.47	2.83	3.15	3.35
Greece	2.40	3.47	3.97	4.30
Grenada	1.67	1.76	2.48	3.02
Guatemala	0.77	1.08	1.28	3.15
Guyana	0.82	1.13	1.33	1.78
Haiti	2.58	2.58	2.90	2.90
Honduras	1.25	1.90	2.86	2.98
Hong Kong	2.44	2.90	3.81	3.81
Hungary	2.20	4.04	4.04	4.50
Iceland	1.67	2.68	3.38	3.51
India	1.03	1.23	2.27	3.76
Indonesia	0.00	1.56	2.47	2.77
Iran	1.91	1.91	1.91	1.91
Iraq	1.95	2.12	2.12	1.78
Ireland	2.15	4.14	4.67	4.67
Israel	2.76	3.14	4.13	4.13
Italy	3.16	4.33	4.67	4.67
Ivory coast	1.64	1.90	2.36	3.06
Jamaica	2.66	2.86	3.06	3.36
Japan	2.93	4.42	4.67	4.67

<sup>2</sup> The sources of information are Westlaw (2006), World Intellectual Property Office (2007), and the statutory and case laws summarized in Baxter et al. (2006).

<sup>3</sup> Skew = (Mean – Median)/Standard deviation.

<sup>4</sup> Some countries were signatories to an international intellectual property agreement before introducing national patent laws; for example, Indonesia became a party to the Paris Convention in 1950. Burma (Myanmar) is currently in this situation, where it is a signatory to TRIPS but has not enacted patent laws.

Table 1 (Continued)

	Average 1960–1990 <sup>b</sup>	1995	2000	2005
Jordan	0.66	1.08	3.03	3.43
Kenya	1.55	2.43	2.88	3.22
Korea (South)	2.55	3.89	4.13	4.33
Liberia	1.78	2.11	2.11	2.11
Lithuania		2.69	3.48	4.00
Luxembourg	2.16	3.89	4.14	4.14
Madagascar	1.05	1.85	2.31	2.31
Malawi	1.35	2.03	2.15	2.15
Malaysia	1.70	2.70	3.03	3.48
Mali	1.78	1.98	2.10	2.93
Malta	1.34	1.60	3.18	3.48
Mauritania	1.70	1.98	2.43	3.27
Mauritius	1.62	1.93	1.93	2.57
Mexico	1.19	3.14	3.68	3.88
Morocco	1.58	1.78	3.06	3.52
Mozambique	0.00	0.00	1.06	2.52
Nepal	1.79	1.79	1.79	2.19
Netherlands	3.43	4.54	4.67	4.67
New Zealand	2.67	4.01	4.01	4.01
Nicaragua	0.92	1.12	2.16	2.97
Niger	1.64	1.78	2.10	2.93
Nigeria	2.50	2.86	2.86	3.18
Norway	2.75	3.88	4.00	4.17
Pakistan	1.09	1.38	2.20	2.40
Panama	1.34	1.46	3.64	3.64
Papua New Guinea	0.00	0.00	1.40	1.60
Paraguay	1.13	1.53	2.39	2.89
Peru	0.59	2.73	3.32	3.32
Philippines	2.19	2.56	3.98	4.18
Poland	1.38	3.46	3.92	4.21
Portugal	1.48	3.35	4.01	4.38
Romania	1.50	3.52	3.72	4.17
Russian Federation		3.48	3.68	3.68
Rwanda	1.94	1.95	2.28	2.28
Saudi Arabia	1.83	1.83	1.83	2.98
Senegal	1.70	1.98	2.10	2.93
Sierra Leone	2.38	2.45	2.98	2.98
Singapore	1.64	3.88	4.01	4.21
Slovak Republic		2.96	2.76	4.21
Somalia	2.00	2.00	2.13	2.13
South Africa	2.94	3.39	4.25	4.25
Spain	2.74	4.21	4.33	4.33
Sri Lanka	2.27	2.98	3.11	3.11
Sudan	2.61	2.61	2.61	2.61
Swaziland	1.36	1.98	2.43	2.43
Sweden	2.86	4.42	4.54	4.54
Switzerland	3.04	4.21	4.33	4.33
Syria	1.68	1.87	1.99	2.19
Taiwan	1.26	3.17	3.29	3.74
Tanzania	1.84	2.32	2.64	2.64
Thailand	0.95	2.41	2.53	2.66
Togo	1.60	1.98	2.10	2.93
Trinidad and Tobago	1.78	2.33	3.63	3.75
Tunisia	1.45	1.65	2.32	3.25
Turkey	1.16	2.65	4.01	4.01
Uganda	1.77	2.85	2.98	2.98
Ukraine		3.68	3.68	3.68
United Kingdom	3.20	4.54	4.54	4.54

Table 1 (Continued)

	Average 1960–1990 <sup>b</sup>	1995	2000	2005
United States	4.14	4.88	4.88	4.88
Uruguay	1.54	2.07	3.27	3.39
Venezuela	0.92	2.82	3.32	3.32
Vietnam	1.38	2.90	2.90	3.03
Zaire (Dem Rep Congo)	1.49	1.58	1.78	2.23
Zambia	1.54	1.62	1.74	1.94
Zimbabwe	1.61	2.28	2.60	2.60
Mean	1.80	2.58	3.05	3.34
Standard deviation	0.80	1.09	1.00	0.89
Coefficient of variation	0.45	0.42	0.33	0.27
Skewness	0.09	0.14	-0.07	-0.43

<sup>a</sup> See the Appendix A for details on the components of the index.

<sup>b</sup> Detailed breakdowns are available from the author.

the second quintile. In what follows, I provide some explanations behind this pattern.

First, the main reason that the average increase in the patent rights index is smallest in the top quintile is that the high income countries, such as the US, Germany, France, and Japan, already had relatively strong patent systems in 1990. Indeed, some commentators have argued that TRIPS and other global agreements reflect the standards of patent protection in the North (i.e., the developed countries).<sup>5</sup> Hence, countries in the top quintile have had fewer patent law provisions to incorporate in order to conform to international agreements. The reason that the average increase in the patent rights index is next smallest in the bottom quintile is that this group consists of least developed countries which had low levels of patent protection in 1990. While they are required to make the most substantive adjustments in their patent systems, they have been granted, under the WTO agreement, an extension until July 2013 to become compliant with TRIPS.<sup>6</sup> Another factor affecting the bottom quintile is cost. As an UNCTAD (1996) report anticipated, the direct and administrative cost of drafting new patent legislations, training skilled personnel, and building the necessary IPR institutions is likely to be especially burdensome to least developed economies. These costs affect the capacity of low income countries to adopt stronger patent laws, and help explain why their patent index scores do not increase at the same pace as that of, say, middle income countries.

The average increase in the patent rights index is highest for the second quintile, followed by the third

<sup>5</sup> See, for example, Gervais (1998) and Ryan (1998).

<sup>6</sup> See the WTO press release of 29 November 2005, [http://www.wto.org/english/news\\_e/pres05\\_e/pr424\\_e.htm](http://www.wto.org/english/news_e/pres05_e/pr424_e.htm).

Table 2

Changes in patent rights index and components between 1990 and 2005, by income group

Quintile	(1) Change in patent index	(2) Change in coverage	(3) Change in membership	(4) Change in duration	(5) Change in enforcement	(6) Change in restriction
Top	0.96	0.24	0.37	0.04	0.21	0.10
Second	1.85	0.45	0.52	0.15	0.50	0.23
Middle	1.71	0.36	0.46	0.22	0.43	0.24
Fourth	1.29	0.20	0.40	0.16	0.35	0.18
Bottom	1.03	0.10	0.33	0.11	0.26	0.23

Income quintiles are based on GDP per capita in 1990 (measured in real 2000 US dollars); that is, countries were sorted by real GDP per capita in 1990 and put into five income groups. The bottom three quintiles consist of 25 countries each, the second quintile of 24, and the top quintile 23. Each entry shows the average changes in the components and in the composite score in each group. See the Annex for a brief description of the components.

and fourth quintiles. Compared to the lower income economies, countries in the second quintile have greater resources with which to implement a stronger patent system. In addition to this greater *capacity* to adjust their patent systems, countries in the second quintile may have a greater *willingness* to adopt stronger patent laws than the lower income economies have. As Grossman and Lai (2004) show, the incentive to provide stronger patent protection varies positively with market size and innovative capacity. The intuition is these factors raise the marginal benefits of stronger patent protection and lower the marginal costs (or deadweight losses) of stronger patent protection. The second quintile indeed consists of developing countries like Korea, Taiwan, Chile, and Mexico whose market size in terms of GDP has expanded since 1990 and whose innovative capacities have strengthened, as measured in terms of R&D and patenting (see OECD, 2007). Eicher and Penalosa (2006) also establish a positive association between economic development and the level of patent protection. As economies develop and acquire valuable knowledge assets, agents have a vested interest in building IPR institutions and protecting patentable innovations. This theoretical insight also helps explain the pattern observed in Table 2, column 1, particularly the changes in patent rights among the middle three quintiles.

Thus far, I have focused on the overall changes in the patent rights index. The rest of Table 2 provides a breakdown of these changes by the components of the index and helps explain the sources of change. For all quintiles, increases in the patent rights index between 1990 and 2005 are largely driven by increases in the membership of countries in international agreements. This reflects the importance of global influences on national patent legislations. Between 1990 and 2005, increases in the duration of patent protection account for the least to increases in patent rights. The reason is

that most countries were providing 15–20 years of patent protection in 1990. Changes in enforcement mechanisms (e.g., provisions for pre-trial injunctions against alleged infringers) are also an important source of change in the patent rights index for all quintiles. The elimination or relaxation of working requirements (i.e., requirement that the patented invention be exploited within a certain period of time) is an important source of change in the patent rights index for all quintiles except the top, since few countries in the latter group have had such requirements.

Changes in coverage are a key driver of changes in the patent rights of the top three quintiles. In the top quintile, the increase in coverage reflects the expansion of patentable subject matter to software and biotechnology. In the second and middle quintiles, the increase in coverage is due to the allowing of pharmaceutical, food, and chemical patents. In contrast, the increase in coverage is small in the bottom quintile since a number of countries in this group have not (yet) extended patent protection to pharmaceutical and chemical patents.

In summary, similarities and differences exist in the sources of change in patent rights by level of economic development. For all income groups, increases in membership in international agreements and enforcement mechanisms are key sources of change in patent rights, while increases in duration are a limited source. The main difference among income groups is that an expansion in patentable subject matter is observed primarily among the richest 60% of countries. Why this is so is worth researching further. One possible reason that higher income economies are more apt to expand coverage is that they possess a relatively greater capacity to innovate in more differentiated fields of invention. The legal authorities, from this perspective, accommodate the increased demand for patent protection in growing fields or industries.

### 3. Applications

Further work could be undertaken where the patent rights variable is the independent variable of interest. Previous studies have empirically examined the effects of patent protection on innovation, technology transfer, and productivity growth, controlling for other factors. However, now that a longer time series dimension in the patent rights index exists (i.e., 1960–2005), it would be useful to explore the lag structure behind the effects of patent rights on the above variables of interest. Existing studies tend to examine the contemporaneous effects of stronger patent protection. However, the effects of stronger patent rights may occur with a lag if it takes time for institutions, innovative capacities, and public expectations to adjust. The effects of changes in the components of patent rights could also be illuminating. For example, are tighter restrictions on patent rights (e.g. compulsory licensing requirements) more conducive to productivity growth and technology diffusion?

Further work could also be undertaken where the patent rights index is the dependent variable of interest. It would be useful to explore the incentives or motives behind why certain countries adopted stronger patent protection, particularly the political economy dimensions (see Ryan, 1998; Landes and Posner, 2003). For example, what role did domestic and foreign interest groups play? How important is preferential access to foreign markets, relative to increased market size and innovative capacity, in influencing developing countries to adopt stronger patent systems? Again, it would also be useful to analyze the developments in the components of patent rights. What motivates countries to become signatories to international agreements, expand patentable subject matter, or impose restrictions on patent rights?

#### Appendix A. Components and scoring method of patent rights index<sup>7</sup>

(1) Coverage	Available	Not available
Patentability of pharmaceuticals	1/8	0
Patentability of chemicals	1/8	0
Patentability of food	1/8	0
Patentability of surgical products	1/8	0
Patentability of microorganisms	1/8	0
Patentability of utility models	1/8	0
Patentability of software	1/8	0
Patentability of plant and animal varieties	1/8	0

<sup>7</sup> See Ginarte and Park (1997) for explanations of the categories and features.

(2) Membership in international treaties	Signatory	Not signatory
Paris convention and revisions	1/5	0
Patent cooperation treaty	1/5	0
Protection of new varieties (UPOV)	1/5	0
Budapest treaty (microorganism deposits)	1/5	0
Trade-related intellectual property rights (TRIPS)	1/5	0
(3) Duration of protection	Full	Partial
	1	$0 < f < 1$
(4) Enforcement mechanisms	Available	Not available
Preliminary (pre-trial) injunctions	1/3	0
Contributory infringement	1/3	0
Burden of proof reversal	1/3	0
(5) Restrictions on patent rights	Does not exist	Exists
Working requirements	1/3	0
Compulsory licensing	1/3	0
Revocation of patents	1/3	0

where  $f$  is the duration of protection as a *fraction* of 20 years from the date of application or 17 years from the date of grant (for grant-based patent systems). Overall score for patent rights index: sum of points under (1)–(5).

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