



# Measuring Intellectual Property Rights:

Existing Indices, Addressing Gaps and Suggestions for Policymakers

## Abstract

When individuals, firms, or countries infringe intellectual property (IP), they increase their resources and decrease their costs at the expense of holders of intellectual property, provoking conflict and reducing the overall market for innovation, creative works, brand development and other IP-supported commercial activities. In order to minimize such outcomes, measurements of global intellectual property rights laws, enforcement, and discrimination are a critical first step. This paper discusses existing measurements of intellectual property rights and develops assessment criteria, demonstrating a trade-off between the methodological depth and geographical breadth of such measurements. The findings emphasize the need for scaling up data initiatives to fill significant gaps between the conceptual definitions of intellectual property rights enforcement and the operational definition embodied in existing measures and practices. The paper argues that better measurements of intellectual property rights are achievable, critical to innovation, essential for trade policy, and could help de-escalate or avoid conflicts between trading partners.

**The Sunwater Institute** is a nonprofit, nonpartisan interdisciplinary think tank with a mission to strengthen the foundations of democracy through interdisciplinary science, technology, and open dialogue. The Sunwater Institute Policy Reports disseminate the findings of its research to encourage the exchange of ideas and contribute to policy discussions. The papers should be cited accordingly.

### Bibliographical reference

Harutyunyan A., Chervenak M., and M. Cohen (2022). *Measuring Intellectual Property Rights: Existing Indices, Addressing Gaps and Suggestions for Policymakers*. North Bethesda, MD: Sunwater Institute.

## Contents

What are Intellectual Property rights?	4
What is IP rights infringement?	4
What is IP rights discrimination?	5
The need to develop measures of IP rights discrimination and enforcement	6
The development of in-depth measures of IP rights discrimination and enforcement is possible: the case of pharmaceuticals	8
Comparing the existing measurements of IP rights	9
Overview of several existing measurements	10
Assessment criteria	11
Correlations of the measurements	13
Conclusion	15
References	16
Authors	17

## What are Intellectual Property rights?

Intellectual Property (IP) rights are legal rights granted and/or protected by governments to ensure innovators benefit from their intellectual creations. IP rights include patents, trademarks, copyrights, trade secrets, and other forms.

Intellectual property rights are territorial; that is, they are defined and protected according to national laws. National governments grant a legal right to holders of such rights to limit or control the use of their IP rights by others, often for a period of time and with certain limited exceptions. IP rights holders may also pursue commercialization of their rights and/or allow others to leverage their innovations in return for fees or collaboration.

Rights holders can control the use of their innovations and benefit from them only if the IP rights are capable of being prosecuted and granted by national authorities and their protection is enforceable, both nationally and internationally. The extent and nature of IP prosecution and litigation vary across countries, and as IP becomes a more critical part of international trade and economic development, those differences can become a source of tension in international economic relations. Absent countervailing interests, including adherence to international agreements for mutual protection of rights, each country may seek advance its own strategic interests, such as by advocating for “the strongest possible protections in foreign countries, and the weakest possible protections for foreigners in its own domestic market” (Scotchmer 2004). Alternatively, countries may also recognize that protecting the IP rights of others helps secure higher value investment and other commercial activity in their economies, thereby helping it advance in the manner of other major developed countries (Maskus 2012).

The World Trade Organization’s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) was an early attempt to create enforceable international obligations regarding how IP rights are granted and enforced across countries by bringing them under a common international set of rules, including those established by TRIPS and by international agreements incorporated into TRIPS. The Agreement establishes minimum standards of IP rights protection and enforcement that each WTO member must give to the IP held by another fellow WTO member. It is based on two basic principles which enjoy very limited exceptions: ‘national treatment’ (treating foreign nationals no less favorably than one’s own nationals), and ‘most-favored-nation treatment’ (no discrimination among trading partners). WTO offers a possibility to its members to challenge the legal enforcement practices of other members through the WTO dispute settlement process, as an “as such” (legislative challenge) or an “as applied” (actual enforcement challenge). Subsequent IP agreements and free trade agreements have built upon the TRIPS agreement to establish more extensive bilateral and multilateral obligations regarding intellectual property rights protection in international trade, including by addressing emerging technology or business challenges.

## What is IP rights infringement?

IP rights infringement is the misappropriation or violation of valid intellectual property rights.

In the case of patents, infringement of a patent owner’s exclusive rights involves a third party’s unauthorized manufacture, use, sale, or importation of the patented innovation. In general, copyright infringement occurs when a third party engages in reproducing, performing, or distributing a copyrighted work without the owner’s consent.

Trademark infringement is the manufacture, marketing, and distribution of goods under another's name with the appearance of being the genuine good, harming both the trademark owner and consumers. Trade secret misappropriation involves injury to the trade secret owner of non-public, commercially valuable information, which the owners of the information have utilized reasonable measures to protect. Each right may have its own definition of what constitutes an infringing act, as well as limitations and exceptions to infringement.

Losses due to IP rights infringement, as broadly defined by such international agreements as the TRIPS Agreement, are often claimed to be extensive. Nonetheless, the quantification of these economic losses has often been a subject of disagreement between countries, as was evident in the recent US-China trade dispute. The area has also been of longstanding interest in the academic, policy, and industry literature. Many experts agree that not much progress has been made in measuring the magnitude of international IP theft with precision. This is due in part to such challenges as the difficulties of measuring IP rights infringement under local law and selecting the appropriate methodologies, which may include varying calculations based on the right, the costs to governments to enforce or protect, the losses to the rights holder, the benefits appropriated by the infringer, the availability of non-monetary relief such as injunctions, the role of criminal enforcement, or other calculations.

## What is IP rights discrimination?

When inventions of one specific group are less likely to be granted IP rights than inventions of another group, IP rights discrimination may be responsible. For example, a country may decline to grant patents to inventions of foreign origin compared to domestic inventions due to bias against foreign applicants. However, lower patent grant rates for foreigners

than locals may also be due to a lack of familiarity by the foreign applicant with local practices, differing approaches towards patent examination in technological areas of interest to foreigners, differing technical complexity of foreign versus domestic patents, problems in translation of patent applications and availability of non-patent literature, or differences in skill of attorneys hired to prosecute patents.

Discrimination may also play role on the likelihood of success in enforcing rights (through litigation, etc.) of domestic IP rights holders compared to foreign IP rights holders, and the degree to which damages, injunctions or other relief awarded discriminate among domestic and foreign IP rights holders in similar circumstances.

Differences in treatment can also be explained by factors similar to those identified in patent examination, including differing quality of patents, lack of familiarity of courts with a given technology, differing skills of attorneys, etc.

Globalization of IP can lead to a false apprehension of bias. An invention deserves IP rights protection in a jurisdiction only if it meets all the IP eligibility criteria specific to that jurisdiction. There might be legitimate reasons for aggregate differences in IP grant rates between foreigners and locals. Methodologies have been proposed and implemented to test for discrimination by controlling for potential confounding factors (Webster, Jensen, and Palangkaraya (2014), de Rassenfosse and Hosseini (2020)). Unless all significant sources of heterogeneity are accounted for between locals and foreigners, it may be misleading to conclude that differences in their grant rates indicate discrimination. Moreover, even when such sources are identified, they may not be easy to incorporate in research due to national differences in the degree of transparency afforded to national procedures to protect and enforce IP. For example, if court cases are not all published and foreign litigants are a small percentage of the total

judicial docket, the failure to publish even a small group of foreign-related court cases may make it exceedingly difficult to determine if foreigners are being treated fairly in a given market.

The ‘national treatment principle’, which imposes equal treatment of foreigners and locals, was established by the 1883 Paris Convention for the Protection of Industrial Property and has been reaffirmed with the TRIPS by all the WTO members. However, adherence to a ‘national treatment’ concept in codified laws alone does not guarantee that foreign applicants are treated as well as domestic applicants (Lehmann-Hasemeyer and Streb, 2020).

## The need to develop measures of IP rights discrimination and enforcement

When one country takes the land of another, it is often considered an act of war. If one country purchases land from another, it is considered trade. It makes little difference whether a country says it is engaging in war or trade. Straightforward methods exist for determining whether one country has taken the land of another. Land appropriation may be reported by individuals on the ground and confirmable via images from aircraft or satellites. The appropriation of intellectual property proves more challenging to identify. While in many cases more commercially and strategically valuable than physical property, IP is routinely appropriated by firms and state actors without reprisal. There are several reasons for this situation.

The first problem involves differing national definitions of IP rights. Although TRIPS provides a framework for IP rights harmonization, it authorizes significant flexibility for WTO members to adopt different standards, leading to disparate legal frameworks among countries that could disadvantage the protection or obtaining of IP rights of other trading partners. This disparity in legal

frameworks often attracts the attention of trading partners and the scholarly community. For example, recent US Supreme Court cases have had the effect of weakening protections for software-enabled and genetic inventions, while other major patent offices have had more consistent or even liberalizing approaches. There continues to be wide debate regarding whether the “weakening” of the US patent system has led to a decline in innovation in affected areas, or whether it has enabled companies to utilize other mechanisms to protect their innovations and thereby achieve greater freedoms to operate and implement inventions (Madigan and Mossoff, 2016).

The second problem arises when, regardless of the content of a nation’s IP rights laws, enforcement may be weak, uneven, or ineffective. Although the TRIPS Agreement provides for flexibility in the distribution of resources to protect IP rights, a state may nonetheless lack the institutional and financial capacity to enforce its laws generally or may believe that other social issues demand greater resources than the protection of IP rights.

The third problem manifests when a state, contrary to the letter of its law, maintains a separate set of practices, whether or not codified, that may be hidden from the outside world and calculated to bring it a strategic advantage. Such states could employ a systematic program of appropriating foreign property (wholesale or selectively), while publicly directing attention to its more transparent and non-discriminatory law. WTO members may have incentives to hide their unfair practices of violating national treatment or most favored nation obligations in order to avoid WTO proceedings. If WTO members are not required to be adequately transparent, they may also be able to hide their practices from this type of scrutiny.

The impact of misappropriation of IP is substantial. Besides the obvious direct losses to the firms (and their countries of origin) that would have received

revenue and profit from their IP, there exist indirect losses to firms, states, and the global economy that may be much larger. Economies that violate or allow violation of IP rights may enjoy a cost advantage over states that honor IP rights. The overall market value of IP will, however, be reduced, lowering the incentives to innovate and leading to an overall reduction in innovation. States with lower costs due to IP rights violations will enjoy systemic competitive advantages across a range of sectors, not just those whose IP right is directly infringed. This lowers the profitability and increases the bankruptcy risks of firms in countries that honor IP rights. Companies may be disciplined to license out to the most efficient manufacturer utilizing their technology, which could thereby also affect consumer interests. Targeted IP appropriation over time could lead to ‘hollowing out’ certain sectors within IP right-honoring countries. Small innovative firms that have the least access to the information and resources needed to pursue IP rights enforcement abroad, may also be disproportionately threatened by IP theft.

As the recent US-China trade war has shown, IP rights violations, as they accumulate and become transparent at scale, may ultimately lead to policy backlash or interstate conflict a similar way that land appropriation leads to interstate conflict. On the other hand, trade losses may also become exaggerated in order to drive a political point.<sup>1</sup> Therefore, IP rights should be monitored for those problems to be identified and addressed before they become large enough to trigger major conflicts. Violations of IP rights create substantial consequences, despite difficulties in observation compared with physical actions within country borders. Legal scholars and trade officials typically focus on legal codes since they are relatively easy to measure and understand. However, what actually happens on the ground is what really matters to the economy and its participants.

While measuring IP rights discrimination and enforcement across countries is critical for international trade, monitoring it within countries is equally important. Uneven IP rights prosecution or enforcement within a country may erode IP within certain sectors and groups. For example, certain sectors, such as biotechnology, may enjoy strong protection, while others, such as high tech, may experience weak protection. Such differences could affect the market structure within a country, and such differences may also exist within sectors. For example, in the health sector, pharmaceutical patents enjoy enforcement in many countries, while patents covering medical procedures do not. Such discrimination within the health sector yields an incentive structure favoring investment into pharmaceuticals over medical process innovation. In addition, certain groups within sectors may have unequal treatment from IP rights institutions. For example, individuals and small firms may not have the resources to obtain or protect IP rights when barriers or costs are high. This would reduce the incentives for small firms to innovate or remain viable, leading to dominance by larger firms and a more concentrated market (Gmeiner, 2019). As large firms operate at a large scale, they may also have fewer incentives to innovate as they increasingly rely upon their market dominance to maintain profitability. Dominant, non-IP reliant firms may therefore resist challenges by newer market entrants who rely on the exploitation or commercialization of IP rights (Barnett 2020).

Although measuring real-world IP rights discrimination and enforcement presents a challenging task, it is possible to leverage existing data sources to systematically measure losses of exclusivity globally. Patent rejections and invalidations across countries and sectors can be measured, and claims from one country or sector can be compared to identify reduction in the scope

---

<sup>1</sup> See China IPR blog post by Mark Cohen, “[The 600 Billion Dollar China IP Echo Chamber](#)”.

of coverage. Increased harmonization among IP systems makes it easier to make cross-jurisdictional comparisons. Enforcement outcomes can be measured to the extent that cases are published or otherwise made available or that companies feel obligated to report upon. Industry, customs and patent office data tracks royalty transactions and related data regarding IP values of imported goods and patent assignments. For certain sectors, such as pharmaceuticals, measuring whether products in the market violate IP rights can be straightforward. In other sectors, online and offline retailers can be leveraged to approximate appropriation. In short, measuring losses of exclusivity due to infringement of real-world IP rights violations is an addressable problem given appropriate resources and attention.

## **The development of in-depth measures of IP rights discrimination and enforcement is possible: the case of pharmaceuticals**

Innovation at scale in the pharmaceutical industry depends on the IP rights protection system. Significant investments are required to develop new compounds, shepherd them through high-cost regulatory systems and clinical trials, and then ultimately market those products to physicians and patients. While the cost of developing a new therapeutic continues to escalate, the cost of copying a new therapeutic remains relatively low. According to PhRMA, it takes a pharmaceutical company more than ten years of R&D on average to create a new drug, with the average cost to develop a drug at about \$2.6 billion during the 2000s to early 2010s. It may cost a tiny fraction of that amount to copy a pharmaceutical and rely on the previous marketing expense of a pioneer that discovered the drug, tested for its safety and efficiency, and has educated the market on the attributes of the product. New drug development would be drastically reduced without the incentives of a market-exclusivity period and its

concordant benefit of price premiums. Thus, IP rights remain the primary driver by which this innovative cycle is maintained in the pharmaceutical industry.

Certain aspects of the pharmaceutical industry make it more amenable to IP infringement tracking. Most countries regulate pharmaceuticals, approving products on a one-by-one basis, and as a result, all products on the market are easily known. Regulators typically demand that pharmaceutical companies release substantial amounts of information about their products. This information typically suffices to identify IP infringement; however, chemical, and biochemical analysis can also identify infringing compounds. The regulatory approval process can dramatically affect the value of relevant inventions and indeed of whole companies. Losses due to infringing generic market entry may also be documented with relative simplicity.

In some countries, generic drug manufacturers may apply for marketing approval without the patent owner's permission and prior to the expiration of the patent, which also affords them an advantage. Many countries have established "patent linkage" regimes where drug regulatory authorities deny marketing approvals if there is a generic pharmaceutical product that is infringing, and incentives are given to a non-infringing generic to challenge the patent of innovators. The TRIPS Agreement does not require establishing a linkage regime, and some regions, such as the EU, do not support patent linkage. In such instances, the availability of injunctive relief against generic infringers may be crucial.

Regardless of whether a country employs a linkage regime, measuring IP rights violations remains possible in most cases involving pharmaceutical products. Disclosures of pharmaceutical active ingredients, required by regulators, often prove sufficient to identify infringers. Anthony Chen of Jones Day and Matthew Chervenak, an author

of this paper, developed an index, called Pii (Pharmaceutical IP Index) to track pharmaceuticals' real-world exclusivity period. The Pii value is calculated by measuring the actual amount of time any particular drug enjoys exclusivity in each market. This exclusivity period, rather than pronouncements or written laws, matters to and motivates pharmaceutical companies to innovate and drive the innovation into the marketplace. The exclusivity period is determined by multiple factors: patent duration, claims scope, patent discrimination, patent office delays, regulatory delays, preferential or detrimental policies, infringements, and the competitive landscape. Ultimately, the index answers a simple question: how long was the molecule exclusive in the market before a competitor launched a generic? This kind of data, drawn from a wide range of products across a wide range of countries, creates true transparency. This measurement of exclusivity period provides a key input into measuring the economic gains due to legitimate sales of non-infringing products and a key input into calculating the economic losses due to sales of infringing products. USTR has made similar efforts to broadly consider the impact of China's IP environment on "legitimate sales" of IP-intensive goods, including goods that may be dependent on regulatory approvals in China (such as motion pictures) as a way to go beyond 'inputs' to similar types of outcomes.

The Pii was implemented in a trial scale in the United States and People's Republic of China. The findings revealed several pharmaceutical patents approved in one country but rejected in another or, if approved, later invalidated. The analysis showed that infringing generics were launched, despite the existence of innovator patents. It revealed instances where the scope of therapeutic use narrowed during the patent prosecution. The index further identified that products with the highest market values or market potential in developed markets

were most likely to see their Pii values, that is, their market exclusivity periods, reduced. Some products received a Pii value of zero, indicating no exclusivity; some had two or five years. While the pilot had been applied to just a sample of products, the data provided valuable new insights.

The market opportunities afforded by real-world exclusivity for products or services is what matters for innovators, creators and investors. The Pii methodology allows exclusivity periods for pharmaceutical products to be compared within countries and between countries. Such analysis, applied at scale across a large number of products, would clarify how IP rights are granted and protected across sectors and across countries. Similar measures could be applied to assess the impact of regulatory issues such as delayed censorship approvals on copyright in reducing the effective exclusivity periods through creation of infringing markets. Such indices create a systematic way of comparing the IP rights performance of countries without debate around legal language, intent, or cause.

## Comparing the existing measurements of IP rights

Measurements of IP rights protection have been developed by various scholars and organizations. Some of those measures compare laws; others also try to capture and compare enforcement practices across countries. Some of the measurements focus on a particular form of IP; others aggregate several forms into one index. This section conducts a comparative analysis of the most recently developed IP rights indices for the purpose of developing basic standards for improving the development of such measurements in the future.

## Overview of several existing measurements

Many studies have been conducted to develop measurements for IP rights, published by academics, businesses, and non-profit policymaking organizations. One of the early studies was conducted by Rapp and Rozek (1990). The authors use patent laws as a proxy for IP rights, measuring their strength in 159 countries. Seyoum (1996) constructed measures from surveys sent to IP rights practitioners in 23 countries, also focusing only on patent laws. Sherwood (1997) constructed an index, combining personal knowledge and experience with professional interviews in 18 countries, including four forms of IP rights in the index. For more details and a comparison of the indices mentioned above, please, see Ostergard (2000) and Lesser (2011).

This study focuses on recently developed indices, which also offer measurements for the post-TRIPS period. In particular, the following four indices will be analyzed:

- International IP Index (IIP), by the US Chamber of Commerce, evaluates the IP framework across several countries using a variety of indicators.
- Global IP Index (GIPI), by Taylor Wessing LLP, provides a comprehensive assessment of IP regimes across countries using various criteria.
- Index of Patent Rights (IPI), by Park (and Ginarte and Wagh), is an unweighted sum of five separate scores, designed to provide an indicator of the strength of patent protection

- Patent Enforcement Index (PEI), by Papageorgiadis and Sofka, tracks differences in patent enforcement, calculated using three types of transaction costs originating from patent enforcement.

For the post-TRIPS period, many other indices have contributed to measuring IP rights across the globe. They have not been included in the comparative analysis below due to their conceptual and methodological differences. For example, the Domestic IP Index (Gold et al., 2019), also known as Transplant Index, evaluates the strength of IP rights protection in developing countries for the years 1995–2011, measuring the extent to which developing countries have transplanted IP rules established in and specifically promulgated internationally by the United States. The International Property Rights Index, built by the Property Rights Alliance, includes a component for IP rights, which is calculated based on the secondary data sources, such as the Global Competitiveness Index of the World Economic Forum, the BSA Global Software Survey on the Compliance Gap, and the Index of Patent Rights mentioned above. To learn about many other studies, which contributed to the efforts of developing IP rights measurements, see Papageorgiadis and McDonald (2019). There have also been attempts to measure IP volume created annually across countries, such as the Global Innovation Index (GII) developed by the WIPO, ranking country’s innovation performance. Although the GII provides valuable information on IP filings and commercialization, it does not consider the protection of IP rights as a distinct component in its metrics.

Table 1: Period of coverage for each index, and the intervals of coverage.

Name (Abbreviation)		Author	Periods	Intervals
International IP Index	IPII	US Chamber of Commerce	2012-2019	1 year
Global IP Index	GIPI	Taylor Wessing LLP	2008-2016	2-3 years
Index of Patent Rights	IPR	Park (and Ginarte and Wagh)	1960-2015	5 years
Patent Enforcement Index	PEI	Papageorgiadis and Sofka	1998-2017	1 year

The Sunwater Institute and the Berkeley Center for Law and Technology hosted a conference event in January 2022, which included a session devoted to the measurements of IP rights protection, including developers of various IP rights indices who shared the challenges they encountered in their work and evaluated their indices based on the assessment criteria presented in the conference and below.<sup>2</sup>

## Assessment criteria

For evaluating IP rights measurements, this study proposes seven assessment criteria, each of which touches different conceptual and measurement issues.

- I. **IP forms (scope):** assesses whether several forms of IP have been taken into account in the index or only one.<sup>3</sup>
- II. **Legislation:** assesses whether the index evaluates IP laws dealing with the rules for securing and enforcing legal rights of the creators and owners of the IP.
- III. **Enforcement:** assesses whether the index includes a component for enforcement or not, reflecting either the potential to enforce IP rights laws or the actual performance of enforcement practices.
- IV. **Discrimination (against foreigners):** assesses whether an index includes a component capturing antiforeign bias, reflecting the likelihood of preferential treatment to domestic applications.

- V. **Internal consistency:** assesses whether an index allows comparisons over time. Internal consistency becomes important particularly when the index needs to be used to analyze IP rights regime change within countries over a period of time.<sup>4</sup>
- VI. **Replicability:** assesses the practicality of duplicating the measures. Indices constructed based on interviews and containing elements of subjectivity introduced by the authors make the measurement's reproducibility impossible and cast doubt on its validity.<sup>5</sup>
- VII. **Geographical breadth:** assesses the geographical coverage via the number of countries and territories included in each study. Measurements covering only a limited number of countries limit their possible use in comparative cross-country analysis.

For illustrative purposes, Table 2 assesses the four indices of Table 1 against each criterion. The plus sign (+) indicates sufficient progress made to overcome the conceptual and measurement issue, while the minus sign (-) indicates insufficient progress or inability to address the issue. The assessment of criterion VII shows the number of countries included in each index; higher numbers indicate larger geographic coverage. Note that although a part of the assessment contains objective measures, the evaluations are mainly qualitative and are not necessarily supported by quantitative analysis, thereby may contain an element of subjectivity.

---

<sup>2</sup> See the event agenda at <https://sunwater.org/event-intellectual-property-rights-measuring-global-protection-and-quantifying-economic-loss>.

<sup>3</sup> Note that indices integrating several forms of IP into one may not capture narrowly focused changes in an IP rights system. For example, software and fintech patent protection has become significantly weaker in the United States in recent years. The EU generally has robust design protections, and China has been improving its legislative framework in a range of rights, including design protection.

<sup>4</sup> However, note that static methodology applied each year raise risks of failing to account for newly emerging issues. For example, a hypothetical index established at the time of the TRIPS Agreement would likely not account for the growth of e-commerce, including copyright protection over the internet. As infringement has moved into the online environment, it becomes important to adjust the methodology of such an index.

<sup>5</sup> However, note that focusing on the ease of replicability may bias a given study towards quantitative criteria or de jure changes. Qualitative assessments, which are less replicable, may also be significantly more important where there is incomplete transparency to effectively judge how laws are actually applied by courts or administrative agencies.

Table 2: An assessment of indices against each criterion.

	I	II	III	IV	V	VI	VII
<b>IIPI</b>	+	+	+	-	-	-	11-53
<b>GIPI</b>	+	+	+	-	-	-	22-43
<b>IPR</b>	-	+	-	-	+	+	110-122
<b>PEI</b>	-	-	+	-	+	+	51

While the focus of the Index of Patent Rights (IPR) and Patent Enforcement Index (PEI) are on patents only, the International IP Index (IIPI) and the Global IP Index (GIPI) include several forms of IP. Those two indices also include a component for enforcement, while the IPR was designed to provide an indicator of the strength of patent laws and not the quality of patent protection. The PEI, on the other hand, was designed to capture patent enforcement particularly. To the best of the authors' knowledge, no index contains a component specifically designed and calculated to quantify discrimination against foreigners.

Due to alterations in the methodology and the varying number of indicators used for the construction of the IIPI each year, the measurements cannot be compared across years.<sup>6</sup> That is also the case for the GIPI. On the other hand, the PRI considers the same five indicators in each period and provides a legitimate measure for capturing shifts over time in intellectual property regimes. Similarly, the PEI, calculated using the same three types of transaction costs in each period, makes the intertemporal comparisons valid.<sup>7</sup>

Another measurement concern is the replicability of the indices. The results of the study conducted by Taylor Wessing LLP are partly based on a worldwide survey of assessments given by IP owners and users, and it is unclear how the raw data were reduced to specific ratings. The study for the IIPI is conducted by Pugatch Consilium consultancy, which provides in-depth explanations of the scoring methodology for each indicator used in the study. Although most of the indicators can be easily duplicated based on the described methodology, some of the indicators are measured based on the author's expertise; hence the ability to replicate those results without that vast experience is limited. The replications of the IPR and the PEI are relatively straightforward due to the limited number of indicators included in the measurements and the simplicity of the scoring methods.

The number of countries included in the study of each index indicates a trade-off between the geographical breadth and the methodological depth of such studies. Note that the indices that include a component of enforcement also include fewer countries, making them impractical for globally-focused, large-scale cross-country analysis.

<sup>6</sup> Although the US Chamber's GIPC annual reports compare each newly released International IP index with the previous year's index, the results of such comparative analysis should be interpreted with caution.

<sup>7</sup> Note that even if the same criterion are imposed over successive reports, delays in reporting may also affect accuracy.

## Correlations of the measurements

Correlations between the indices are calculated for 2015, the year in which all four indices present data. Table 3 shows the pairwise correlations between each pair of indices, reporting the Spearman correlation coefficients, which are calculated based on the ranked values for each index. The table also depicts the number of countries used for the calculation of each pairwise correlation. The stars indicate correlation coefficients significant at the p-values equal to 0.01 or lower.<sup>8</sup> Note that all the coefficients are significant at the 99% level or higher despite the small size of observations.

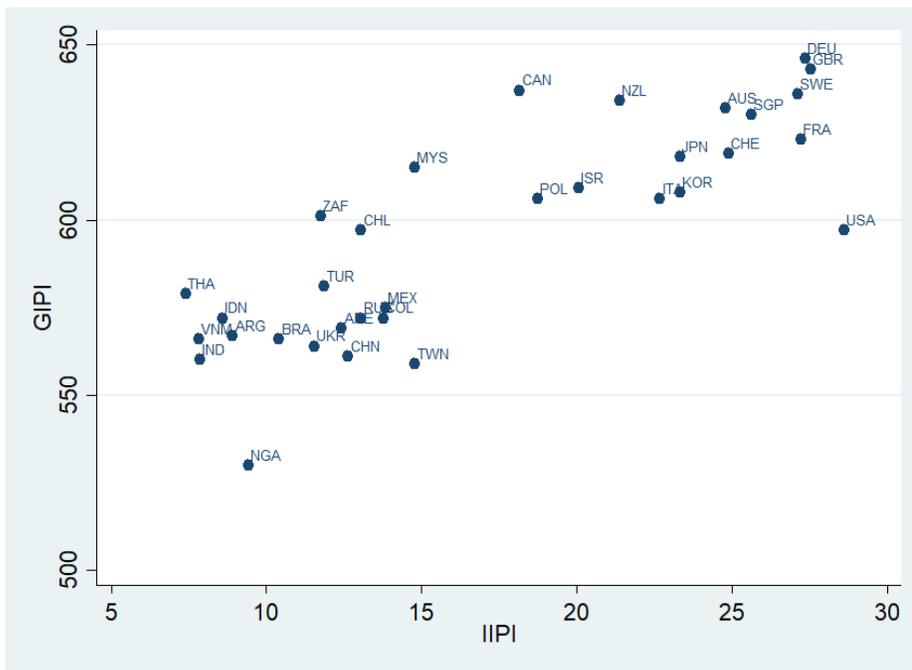
The correlation coefficients are large in magnitude and have positive signs. Despite coming from independent sources, the indices are strongly and positively correlated with each other.

Table 3: Pairwise correlation coefficients between indices

	IIFI	GIPI	IPR	PEI
IIFI	1.0000 38			
GIPI	0.7805* 33	1.0000 43		
IPR	0.7107* 36	0.6115* 42	1.0000 122	
PEI	0.8090* 31	0.8330* 38	0.5601* 49	1.0000 49

Graph 1 depicts the scatter plot of IIFI and GIPI, also demonstrating a positive relationship between the two indices. However, it reveals that countries which are highly ranked in IIFI are not necessarily highly rated in GIPI, for example, the United States, which is only in the middle of the distribution in this particular sample of countries in GIPI.

Graph 1: Scatter plot of International IP index (horizontal axes) and Global IP index (vertical axes), year 2015.

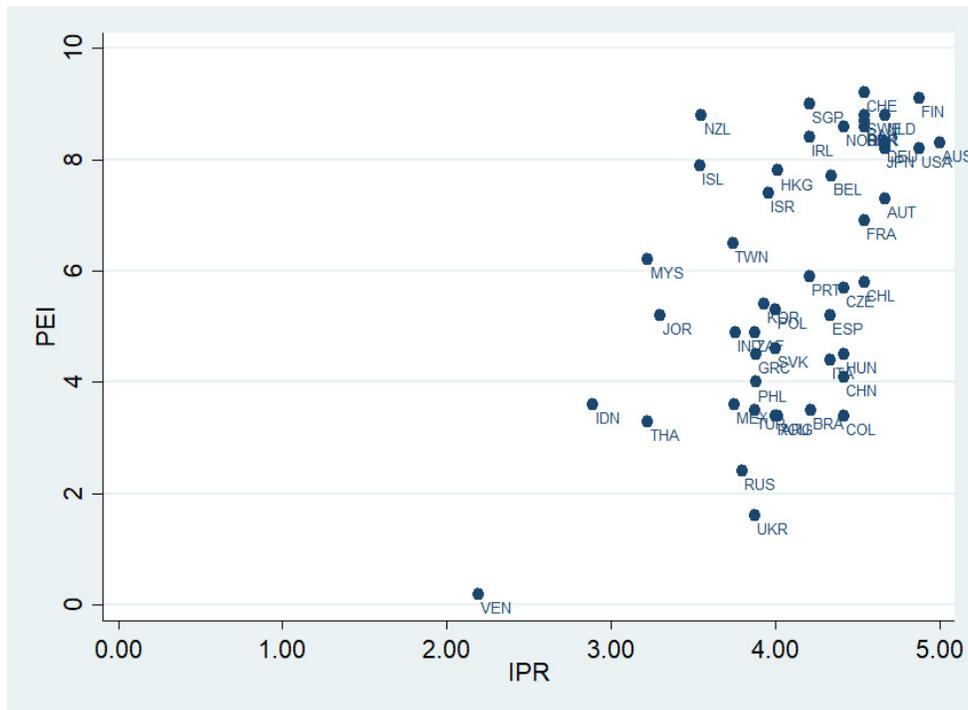


<sup>8</sup> p-value is the probability that the current result could be found even if the correlation coefficient were in fact zero (null hypothesis). If this probability is lower than 1% ( $p < 0.01$ ), the correlation is considered significant at the 99% level or higher.

It is particularly interesting to compare the rankings between IPR and PEI, since one captures the differences in patent legislation, and the other in patent enforcement. Graph 2 depicts the scatter plot between these two indices. The country, which is the lowest-ranked in IPR is also the lowest-ranked in PEI. However, there are apparent differences among highly rated countries. Countries highly

ranked in terms of the legislation are not necessarily highly ranked in terms of enforcement, for example, Australia and United States. While Switzerland is the highest-ranked in terms of enforcement by PEI, it is not the highest-ranked in terms of legislation by IPR. Nevertheless, the scatterplot demonstrates that the two indices are positively associated.

Graph 2: Scatter plot of Index of Patent Rights (horizontal axes) and Patent Enforcement Index (vertical axes), the year 2015.



## Conclusion

Existing indices of IP rights differ significantly in the aspects of IP they purport to measure, the methods and transparency of their assessments, and the breadth of geographical coverage. For these reasons, no one index or data source is best for all purposes. All the indices make essential contributions in assessing the strength and quality of IP rights protection across countries and over time. However, each of them raises conceptual and measurement issues. There is an apparent trade-off between the depth and breadth of studies. The possibility of temporal comparisons and replicability of the indices is not obvious. Despite the differences in the data sources and implemented methodologies, the indices are positively and significantly correlated with each other. However, despite the high correlations, the rankings of countries vary significantly between indices; countries highly ranked by one index do not necessarily top the ranking of another index. Since

various governments cite and therefore presumably leverage these indices to make policy decisions regarding innovation and trade, it is important to increase awareness of their conceptual and measurement issues and how those limitations may influence policymaking.

More work is needed to create an index that accounts for both the law and the practice on the ground across countries and sectors. The Pii methodology, presented in this paper, demonstrates the practicality and usefulness of tracking real-world IP rights in the patent context, focusing on exclusivity periods for the pharmaceutical industry. Unlike many indices which focus on ‘inputs’, the Pii methodology aspires to measure the ‘outputs’. Without in-depth measurements of IP rights, individuals, firms, and countries are flying blind when making important decisions on innovation, resource allocation, and trade policy.

## References

- Barnett, J.M., 2020. *Innovators, Firms, and Markets: The Organizational Logic of Intellectual Property*. Oxford University Press.
- Ginarte, J.C. and Park, W.G., 1997. Determinants of patent rights: A cross-national study. *Research Policy*, 26(3), pp.283-301.
- Gmeiner, R., 2019. Innovation, Theft, and Market Structure. *Atlantic Economic Journal*, 47(3), pp.243-260.
- Gold, R., J-F Morin and E. Shadeed, 2019. Does Intellectual Property Lead to Economic Growth? Insights from an Improved IP Dataset” *Regulation & Governance*, vol. 13(1): 107-124.
- Lesser, W., 2010. Measuring Intellectual Property Strength and Effects: An Assessment of Patent Scoring Systems and Causality. *J. Bus. Entrepreneurship & L.*, 4, p.345.
- Lehmann-Hasemeyer, S. and Streb, J., 2020. Discrimination against foreigners: The Wuerttemberg Patent Law in administrative practice. *The Journal of Economic History*, 80(4), pp.1071-1100.
- Maskus, K.E., 2012. *Private rights and public problems: the global economics of intellectual property in the 21st century*. Peterson Institute for International Economics.
- Madigan, K. and Mossoff, A., 2016. Turning gold into lead: How patent eligibility doctrine is undermining US leadership in innovation. *Geo. Mason L. Rev.*, 24, p.939.
- Ostergard, R.L., 2000. The measurement of intellectual property rights protection. *Journal of International Business Studies*, 31(2), pp.349-360.
- Papageorgiadis, N. and McDonald, F., 2019. Defining and measuring the institutional context of national intellectual property systems in a post-TRIPS world. *Journal of International Management*, 25(1), pp.3-18.
- Papageorgiadis, N. and Sofka, W., 2020. Patent enforcement across 51 countries—Patent enforcement index 1998–2017. *Journal of World Business*, 55(4), p.101092.
- Park, W.G. and Wagh, S., 2002. Index of patent rights. *Economic freedom of the world: 2002 annual report*, pp.33-43.
- Park, W.G., 2008. International patent protection: 1960–2005. *Research Policy*, 37(4), pp.761-766.
- Property Rights Alliance. International property rights index.
- Rapp, Richard and Richard P. Rozek. 1990. Benefits and Costs of Intellectual Property Protection in Developing Countries. *Journal of World Trade*. 75/77: 75-102.
- de Rassenfosse, G. and Hosseini, R., 2020. Discrimination against foreigners in the US patent system. *Journal of International Business Policy*, 3(4), pp.349-366.
- Scotchmer, S., 2004. *Innovation and incentives*. MIT press.
- Seyoum, Belay. 1996. The Impact of Intellectual Property Rights on Foreign Direct Investment. *Columbia Journal of World Business*. Vol 31: 51-59.
- Sherwood, Robert M. 1997. Intellectual Property Systems and Investment Stimulation: The Rating of Systems in Eighteen Developing Countries. *IDEA*. Vol. 37 No. 2: 261-370.
- Taylor Wessing, L.L.P., Global Intellectual Property Index.
- U.S. Chamber of Commerce. International IP Index, Global Innovation Policy Center.
- U.S. Trade Representative. 25th U.S.-China Joint Commission on Commerce and Trade – U.S.-China Joint Fact Sheet.
- Webster, E., Jensen, P.H. and Palangkaraya, A., 2014. Patent examination outcomes and the national treatment principle. *The RAND Journal of Economics*, 45(2), pp.449-469.
- World Economic Forum. The Global Competitiveness Report.

## Authors

**Ani Harutyunyan, PhD** is a Scholar at the Sunwater Institute. She conducts research on innovation policy, focusing on the measurements of intellectual property rights and advocating for data-driven public policies. Ani is also Edison Innovation Law and Policy Fellow at George Mason University, Antonin Scalia Law School. Dr. Harutyunyan holds a PhD degree in Economics and published in a variety of peer-reviewed scientific journals, including *Economics Letters*, *Comparative Economic Studies*, *Eurasian Economic Review*, *International Migration Review*, *European Journal of Development Research*, and *Proceedings of the National Academy of Sciences*.

**Matthew Chervenak** is an entrepreneur and investor in data, healthcare, real estate, and public policy. He is the founder and President of the Sunwater Institute. Matt is also the founder and General Partner of Sunwater Capital, an investment firm focused on real estate, healthcare, and data in the United States and China and of GBI, a Shanghai-based intelligence company serving pharmaceutical and medical device industries. Prior to his entrepreneurial and investment activities, Mr. Chervenak worked as a strategy consultant and conducted neuroscience research.

**Mark Cohen** is a Senior Fellow at Berkeley Center of Law and Technology and Director of BCLT's Asia IP Project. He has over 30 years' experience as a law firm attorney, in-house counsel, government official, and adjunct and visiting professor of law. Mr. Cohen was previously Senior Counsel and Senior Advisor to the Undersecretary of Commerce/Director of the USPTO. As Director of the BCLT Asia IP Project, Mr. Cohen develops collaborative relationships with academic institutions and other partners in Asia, including organizing events that bring data-driven insight to the complex IP landscape in China and other Asian fora. He has also published books and articles on China's IP system, antitrust law in China, civil and administrative enforcement of IP, and foreign law firms practicing law in China.

