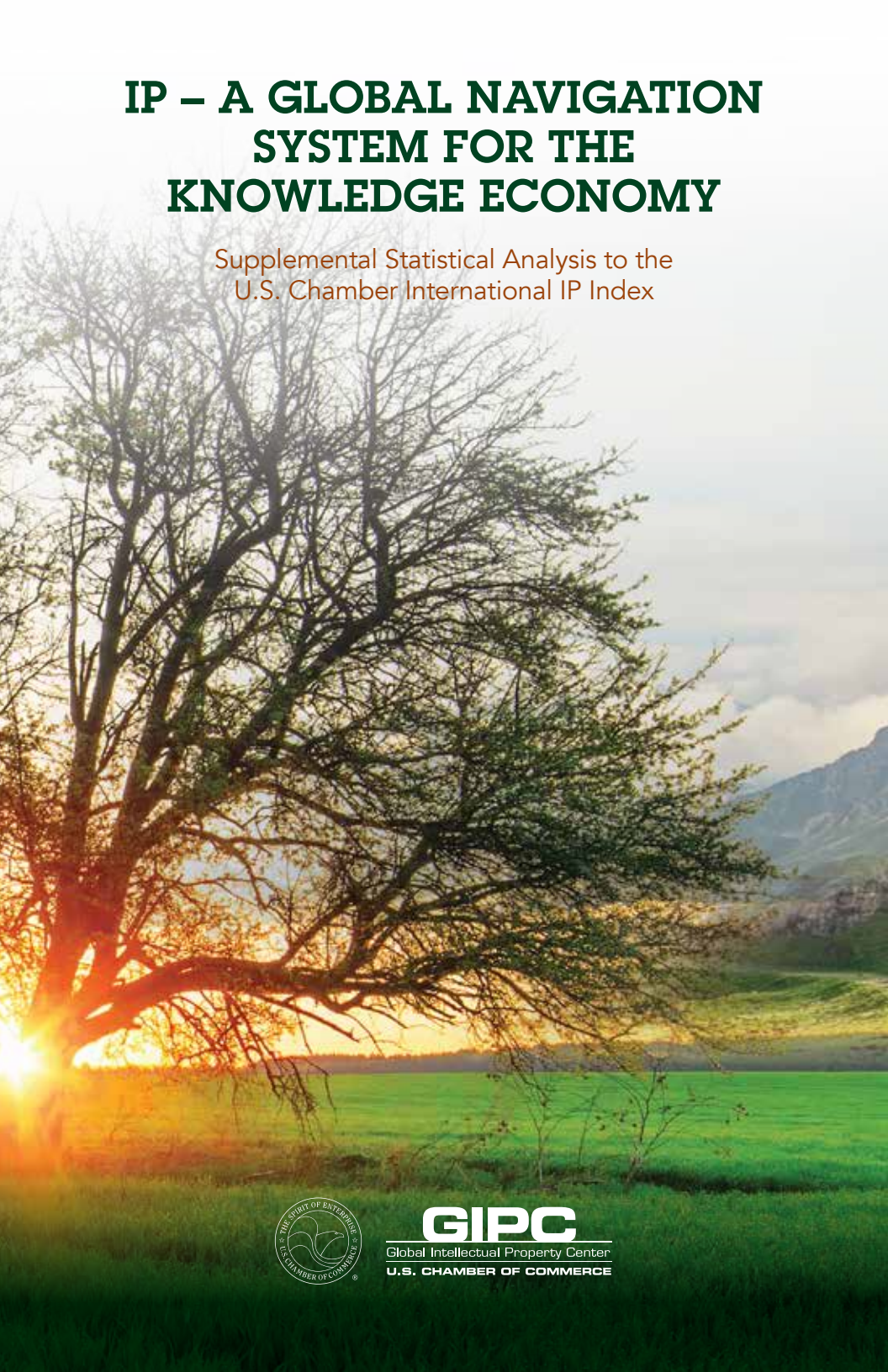
IP – A GLOBAL NAVIGATION SYSTEM FOR THE KNOWLEDGE ECONOMY

Supplemental Statistical Analysis to the
U.S. Chamber International IP Index



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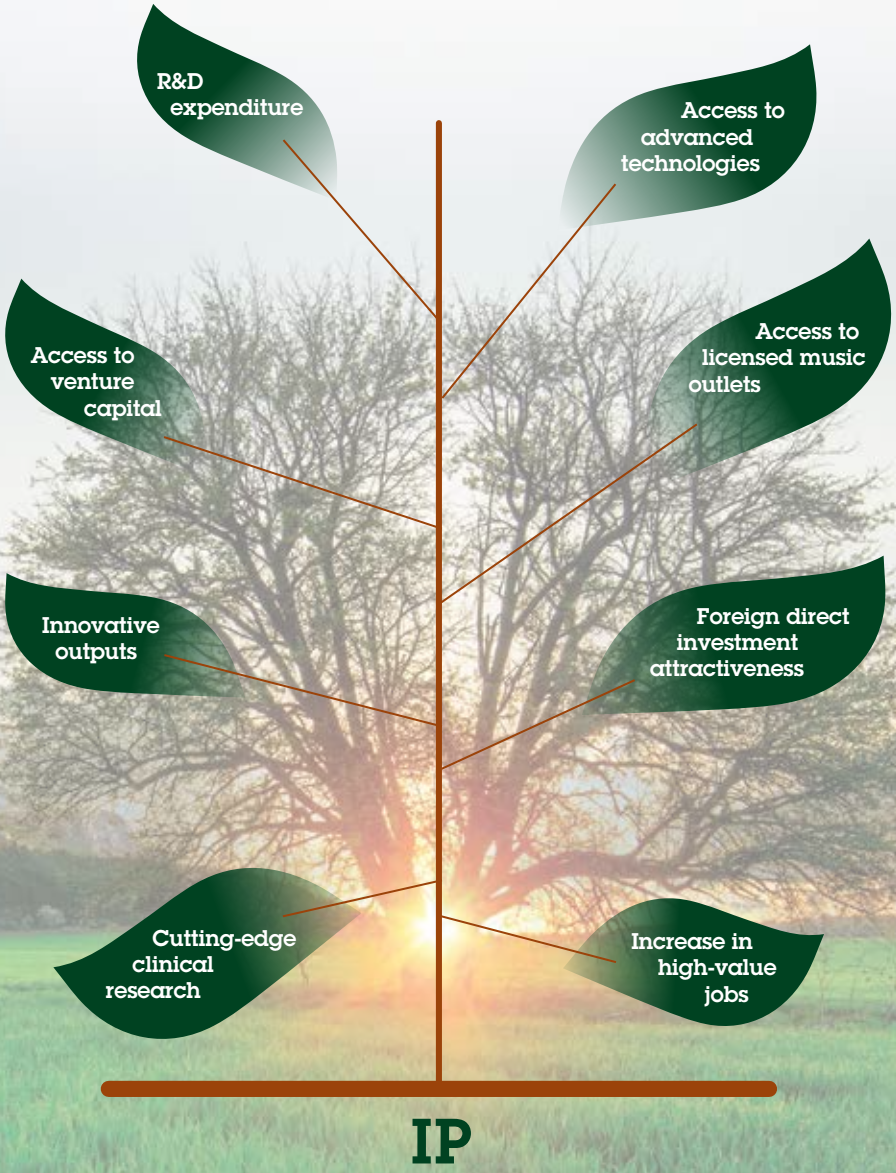

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Introduction – An Innovation Life-Cycle Perspective of the Benefits of IP Rights: From Laboratory to Market

The debate on intellectual property (IP) rights and their impact on innovation, access to technologies, and economic growth raged on in 2016, with developments underscoring ongoing skepticism at both the multilateral and national levels regarding the utility of IP rights and a persistent view that IP protection amounts to a tax on access to innovation. One high-profile example was the United Nations High-Level Panel on Access to Medicines report that encouraged broad use of Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement "flexibilities" to work around IP rights. The fifth edition of the U.S. Chamber International IP Index ("the Index") highlights a number of other developments in different economies, including a narrowing of patentability criteria, use of compulsory licensing, and erosion of IP enforcement, that promote limitations on IP rights as a means to encourage local economic activity and increase access to technologies.

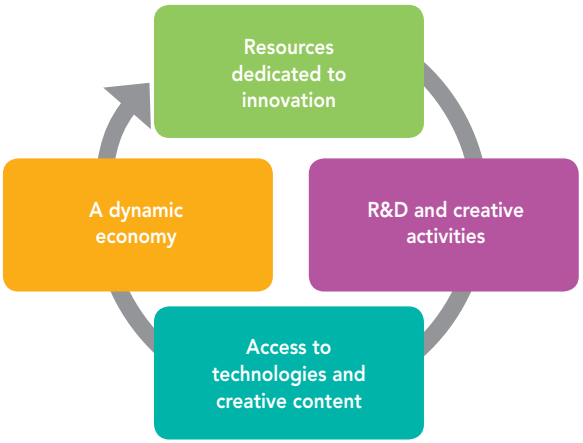
Yet the empirical evidence on the impact of IP rights on economic activity continues to suggest that such views are misguided. The most up-to-date data on the benefits of IP protection reveal that IP is, in fact, a critical instrument for countries seeking to enhance access to innovation, grow domestic innovative output, and enjoy the dynamic growth benefits of an innovative economy. Conversely, weak IP protection stymies long-term strategic aspirations around innovation and development. The past three editions of the Index have included a dedicated section that explores the relationship between national IP environments and the development of innovative and competitive economies by comparing the Index scores with a wide range of economic variables using correlations analysis (statistical measures of the likelihood of two elements occurring together). This edition's Annex expands on the data and discussion included in the fifth edition report as well as previous editions of the Index to provide a fuller picture of the relationship between IP rights and a wide range of socioeconomic benefits.

Taken together, the 21 correlations included in this Annex present a clear picture: IP protection goes hand in hand with the aspirations at the top of government agendas around the world. As Table 1 suggests, a robust national IP environment correlates strongly (having a strength of 0.6 or above) with a wide range of macroeconomic indicators that fall under the umbrella of innovation and creativity—

the very same indicators that are found in national strategies for economic development of many economies today. This message has only become stronger over the past 3 editions of the Index: adding several new variables each year and expanding the sample size by 50% (from 30 to 45 economies), the strength of the relationship between IP rights and crucial economic activities has grown.

This edition of the Annex amplifies these findings about the benefits of IP protection by examining the correlations (both those from the previous editions plus new correlations) from the perspective of an "innovation and creativity life-cycle." This is because maximizing the benefits of IP rights is about understanding not just the outcomes they help to generate but also how they do so. Effective innovation strategies comprise policies that account for not only the end objectives but also the path that leads to these outcomes, the way in which innovation and creativity occur, and the necessary enabling factors. For example, IP rights display a strong relationship with the growth of knowledge-intensive jobs (0.72) and the development of competitive local high-tech sectors (0.80). But the correlations also reveal that IP drives the research, partnerships, and technology development that support these sectors. In fact, the correlations show that IP plays a role in facilitating many of the necessary "inputs" to the knowledge-based economy. On this basis the correlations are divided into four themes or phases of the innovation and creativity life-cycle (as illustrated in Figure 1):

Figure 1: The Innovation and Creativity Life-Cycle



Source: Pugatch Consilium

1) **Resources dedicated to innovation:** The correlations in this theme show that IP protection is a key enabling factor of research & development (R&D), working in tandem with other factors such as financing (including spending directed to R&D and a vibrant venture capital and private equity market), human capital (like researchers and technicians), and technological infrastructure. Economies that provide a robust IP environment are also more likely to embrace policies that create a complete innovation "ecosystem" by investing in other key building blocks.

2) **R&D and creative activities:** The correlations in this theme indicate that IP rights are linked to actual innovation—to discovery, development, and production of new technologies and creative works. Economies that exhibit a steady buzz of innovation and creativity are, with few exceptions, those that have put in place strong IP environments—both generally and for specific high-tech sectors. The opposite is also true: on the whole, those economies with relatively weaker IP environments do not tend to experience the levels of R&D and release of new content that economies with more secure and stable IP environments do.

3) **Access to technologies and creative content:** Economies with strong IP protection are also those that tend to successfully commercialize R&D and enable distribution and sale of resulting products and services. The correlations in this theme suggest that IP protection displays a strong relationship with greater access to end products and services that make novel technologies and content available to consumers. The correlations support the economic notion that IP is an important platform driving and enabling innovative entities to actually develop new technologies into valuable and useful products and make them broadly available to an economy's customers.

4) **A dynamic economy:** The final theme captures the endgame—the socioeconomic impact of innovation and creativity in terms of the ability to address critical global challenges, ensure a reliable stream of investment, create high-value jobs, and raise income and productivity. Here, as in the other themes, IP is strongly related to measures of foreign direct investment (FDI), business and industrial growth, jobs, and gross domestic product (GDP), ultimately providing the basis for reinvestment of resources as the virtuous cycle begins anew.

The correlations within each theme examine the impact of IP on the overall economy as well as on specific IP-related sectors, including the biomedical, information and communications technology (ICT), and creative content sectors. This not only allows for a clear picture of the wider socioeconomic benefits of a supportive IP environment overall but also illustrates the advantages for key high-tech sectors when specific rights important for a given sector are provided.

Table 1 presents the main findings of the analysis in this Annex.

Table 1: Economic Benefits of Improving IP Protection: Findings from 21 Correlations

Macroeconomic Indicator Correlated to IP Rights	Correlation Strength	Economies with Robust IP Protection (scoring above the median level of the Index) on Average Tend to Experience the Following Benefits Compared to Economies Scoring below the Median Level
Resources dedicated to innovation		
Human capital	0.82	Over 6 times more R&D-focused personnel
R&D expenditure	0.70	Over 40% more likely to secure private investment in R&D
Access to venture capital (VC)	0.77	45% more likely to attract VC and private equity (PE) funds
R&D and creative activities		
Innovation output	0.88	80% more knowledge-based, technological, and creative outputs
Inventive activity	0.75	140 triadic patent applications per million population (versus an average rate of only 3)
Biotechnological innovation	0.77	Much more likely to provide environments that are conducive to biotech innovation
Development of biologic therapies	0.70	Host nearly 15 times more clinical trials on innovative biologic drugs
Cutting-edge clinical research	0.73	Attract more than 20 times the number of early-phase clinical trials
Creative outputs	0.86	75% more likely to have larger and more dynamic content and media sectors
Online creativity	0.85	More than 4 times the amount of online creativity

Access to technologies and creative content		
Access to advanced technologies	0.83	30% more likely to benefit from access to the most recent technologies
Access to licensed music outlets	0.78	Greater access to new, licensed music content with a wider array of choice and over secure platforms
Greater consumption of new audiovisual content	0.73	Likely to see at least 3.5 times more theater screenings of feature films, and generate more tax revenue from ticket sales
Wider and more convenient access to video content	0.61	More than double the level of advanced and easy-access home entertainment
The dynamic economy		
Growth of high-tech sectors	0.80	Production of up to 82% more knowledge and technology outputs
Overall business environment	0.80	68% more likely to have a supportive business climate
Foreign direct investment-attractiveness	0.78	Nearly 50% more attractive to foreign investors
Biomedical foreign direct investment	0.67	15 times more investment in the life sciences
Increase in high-value jobs	0.72	Nearly double the workforce concentrated in knowledge-intensive sectors
Growth of knowledge-based economies	0.82	40% greater capacity to generate positive value from ICT, such as through job creation, access to public and private services, and creation and use of ICT-based technologies
Added value of properly licensed software	0.85	As much as 10 times greater positive impact on GDP of strong ICT-related IP

Methodological Overview

The statistical analysis used to test the relationship between the Index scores and other economic variables in this Annex is the Pearson Correlation Coefficient. Simply put, the Pearson Correlation Coefficient is a widely used statistical method of establishing whether two variables are related to each other, or correlated. This statistical test provides a value between -1 and 1, which represents the strength of this correlation. Thus, the Pearson Correlation Coefficient tells us whether a linear relationship exists between two variables and if it is positive or negative.[1]

In this annex, the strength of a given positive correlation follows this legend:

- .00 to .19: "very weak"
- .20 to .39: "weak"
- .40 to .59: "moderate"
- .60 to .79: "strong"
- .80 to 1.0: "very strong"

Each individual test of the correlation between two variables was performed under a confidence level of 0.95, which means that if this procedure was repeated on multiple samples, the calculated confidence interval (i.e., a range estimation that is calculated from the observation, and therefore would be different for each sample) would encompass the true parameter 95% of the time. In other words, the confidence interval represents values for the parameter, for which the difference between the parameter and the observed estimate is not statistically significant at the 5% level.

However, it is important to note that correlation—a statistical test of the existence of a linear relationship between two variables—does not imply causation (i.e., the fact that two variables are very strongly correlated does not mean that one has caused the other). That said, a strong to very strong correlation does imply that a linear relationship exists between the two variables, the nature of which depends on the variables.

Resources Dedicated to Innovation

Key Finding: IP is essential to the building blocks of R&D and innovation

Why do some economies have stronger "fundamentals" when it comes to enabling innovation than others? Regardless of one's views on the effect of IP rights on innovation—positive or negative—few would disagree that a prerequisite for high-tech R&D and technological innovation is getting the "basics" right. Specifically, this means having the right resources: human capital, R&D infrastructure, and financing.

Building Block One: Human Capital – High-skilled and technically trained human capital is one of the most fundamental features that successful innovation policies rely on. Apart from practical experience, a number of studies have found that without the right human capital, it is virtually impossible to create the conditions in which innovation can take place. For example, the National Science Foundation's *Science and Engineering Indicators* report places a strong emphasis on levels of education, strength of higher education, and number and quality of researchers.[2] Without highly educated and trained researchers and holders of advanced degrees, there is little chance that an industry or sector—let alone an economy—can compete or innovate at a high level.

Building Block Two: R&D Infrastructure – Combined with having adequate, educated, and technically proficient levels of human capital, R&D infrastructure and capacity is critical to successfully fostering innovation and activity in high-tech sectors. Without dedicated levels of capital and R&D investment—particularly industry- and private sector–led—the necessary R&D infrastructure, such as research laboratories, hospitals, clinics, and research centers, would not be built or used.

Building Block Three: Financing – Finally, the availability and allocation of capital into new R&D ventures is a critical component of the development and eventual commercialization of new products and technologies. Transforming a nascent technology into a tangible product requires investment and support. Venture capital and private equity funds provide a significant proportion of this needed support, particularly at an early stage and in high-risk sectors and industries such as biotechnology and ICT. One of the reasons the United States has been so successful in building and developing innovative industries is the

availability—and often close physical proximity—of investors to the start-ups, companies, and researchers that are developing these new technologies.

But what do IP rights have to do with these building blocks or structural characteristics of a given economy?

At face value, the protection of IP should have little to do with levels of human capital, the number of researchers in R&D in a given economy, rates of R&D spending, or the relative attractiveness and development of an economy's venture capital and private equity markets. Yet, digging a bit deeper, it is clear that the economies that tend to have the strongest scores on the Index also tend to do better on indicators relating to human capital, propensity for private sector R&D investment, and access to private capital.

For example, the availability of human capital—measured here by the number of researchers in R&D (adjusted per million population)—tends to go hand in hand with the strength of the national IP environment: economies with favorable IP environments possess, on average, over 6 times more R&D-focused personnel than economies whose IP environments require improvement.[3] This positive relationship, at a coefficient strength of 0.82, is also evident on a regional scale: the higher the average Index score in a given region, the greater the average number of researchers in R&D in that region. Conversely, economies in regions with low average Index scores—such as Latin America, Africa, and the Middle East—correspondingly see substantially lower averages of human capital availability. The strong R&D sector in terms of human capital within small, economically dynamic markets like Singapore and Israel suggests that the promotion of innovation-enabling policies, such as strong IP protection, encourages domestic capacity building, greater innovative activity, and ultimately job creation.

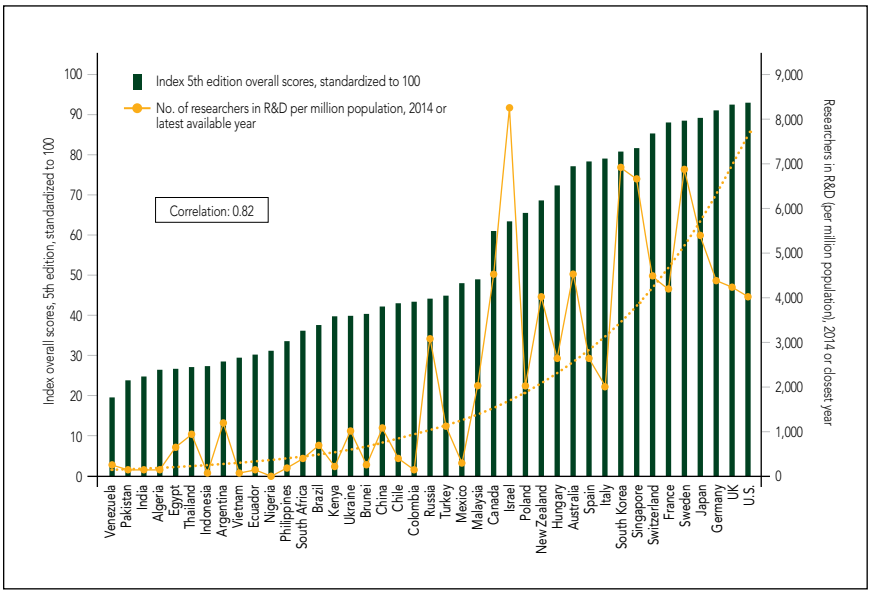
Moreover, robust IP protection works as a catalyst for companies' propensity to invest in R&D, an important facilitator in local innovative activity and economic growth. Companies in economies that provide robust IP environments, scoring in the top half of the Index, are over 40% more likely to invest in R&D activities compared with companies in economies with less supportive IP environments, which score in the bottom half of the Index. Interestingly, market size—which should be a key driver in executives' decisions as to where in the world to allocate R&D investment—is important but seems to not be the deciding

factor. Instead, the ability to protect the potential technology or product being developed through local IP rights is critical. Small economies such as Israel, Singapore, and Switzerland are viewed as being more attractive than large, dynamic, and fast-growing markets such as India and China. The latter—while outperforming their Index scores—should be many times more attractive than these smaller economies, given their market size, rates of growth, and corresponding economies of scale.

Finally, examining the relationship between the national IP environment and economies' attractiveness to venture capital (VC) and private equity (PE) funding shows that economies that maintain robust IP regimes are on average about 45% more likely to attract VC and PE funds compared with economies whose IP regimes lag behind. The link between IP protection and VC attractiveness is further bolstered by its presence in additional distributions. For example, upper-middle-income economies that provide inadequate IP regimes are less attractive for VC and PE funds by 60% on average compared with upper-middle-income economies maintaining stronger IP regimes (which are, in turn, nearly 50% less attractive for VC and PE funds on average than top 10 Index economies). Thus, a healthy IP regime plays a key role in creating an attractive venture capital and private equity climate that is vital for the growth of local innovative companies and start-ups. Indeed, thinking about this relationship at its most fundamental level, a private investor (whether a venture capitalist or private equity fund manager) is unlikely to invest in any company that cannot prove it has the requisite protection for its developing technologies. In this sense, if the protection of IP assets is poor in a given economy, it will be more difficult for creators and innovators to attract required investment and capital to develop their technologies and ideas into real, actual commercial products.

Robust IP protection goes hand in hand with growth of human capital

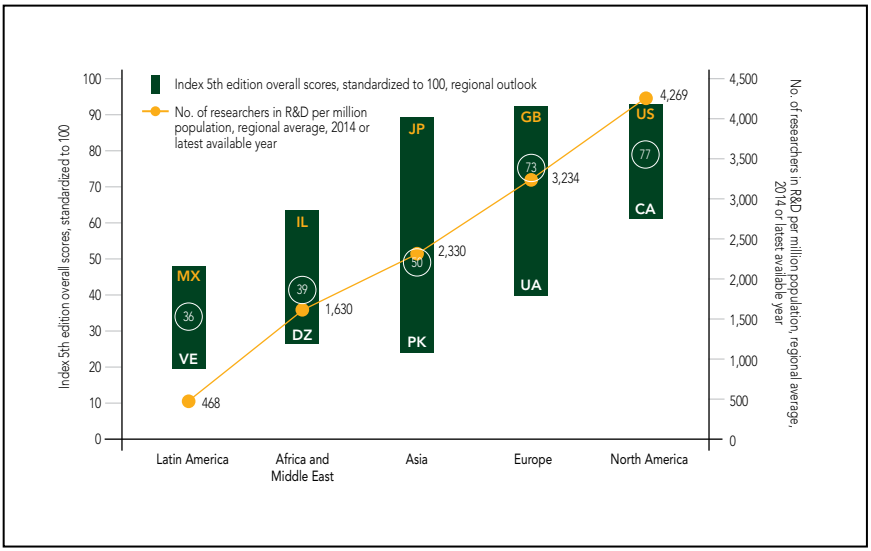
Association between the Index scores and the number of researchers in R&D



Sources: World Bank (2016)[H]; GIPC (2017)
Note: Data are not available for Peru, Saudi Arabia, Taiwan, and UAE.

Economies with favorable IP environments possess, on average, over six times more R&D-focused personnel than economies whose IP environments require improvement.

Association between the Index scores and the number of researchers in R&D: Top and bottom Index performers by region and regional average



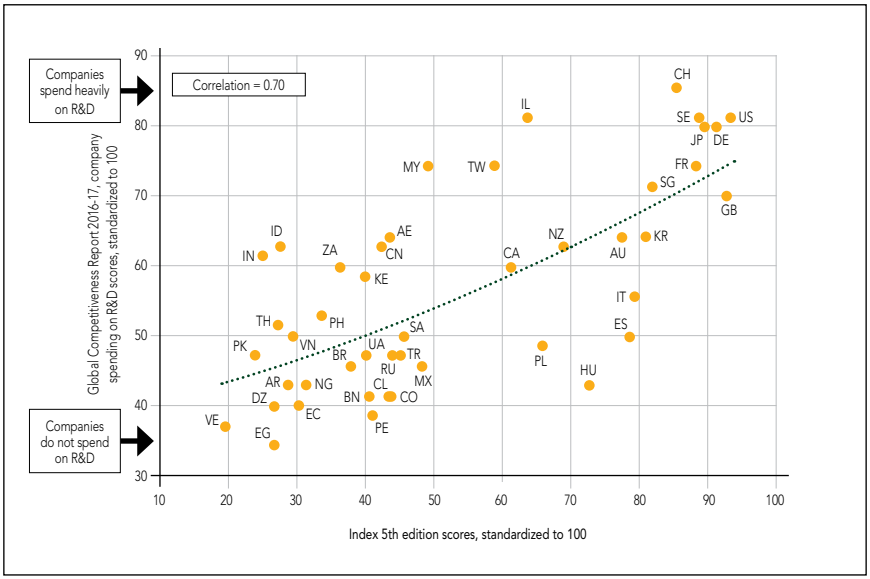
Sources: World Bank (2016); GIPC (2017)

Legend: Top and bottom economies in each bar reflect top and bottom scores in a given region. Circled score is average score per region. CA – Canada, DZ – Algeria, GB – United Kingdom, IL – Israel, JP – Japan, MX – Mexico, PK – Pakistan, UA – Ukraine, US – United States, VE – Venezuela.

The more favorable the IP environment is on average in a given region, the greater the average number of researchers in R&D in that region.

Robust IP protection is a catalyst for private sector R&D investment

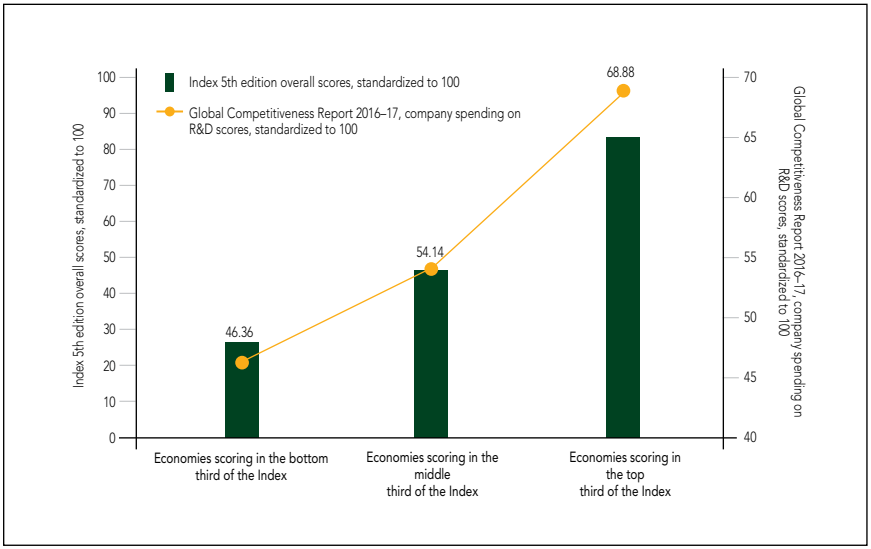
Association between the Index scores and companies' spending on R&D[5]



Sources: World Economic Forum/Executive Opinion Survey (2016); GIPC (2017)
Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BN – Brunei, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Companies in economies that provide robust IP environments, scoring in the top half of the Index, are over 40% more likely to invest in R&D activities compared with companies in economies with less supportive IP environments, which score in the bottom half of the Index.

Association between the Index scores and companies' spending on R&D

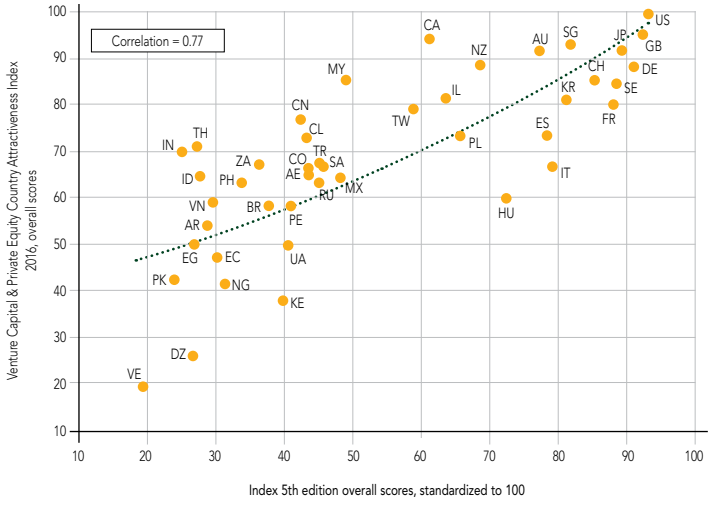


Sources: World Economic Forum/Executive Opinion Survey (2016); GIPC (2017)

Economies scoring in the middle third of the Index are about 20% more likely to secure private sector investment in R&D compared with economies scoring in the bottom third. In turn, economies scoring in the top third of the Index are nearly 30% more likely to have private sector R&D investment than economies in the middle third.

A strong IP regime bolsters economies' venture capital climate

Association between the Index scores and access to venture capital and private equity[6]

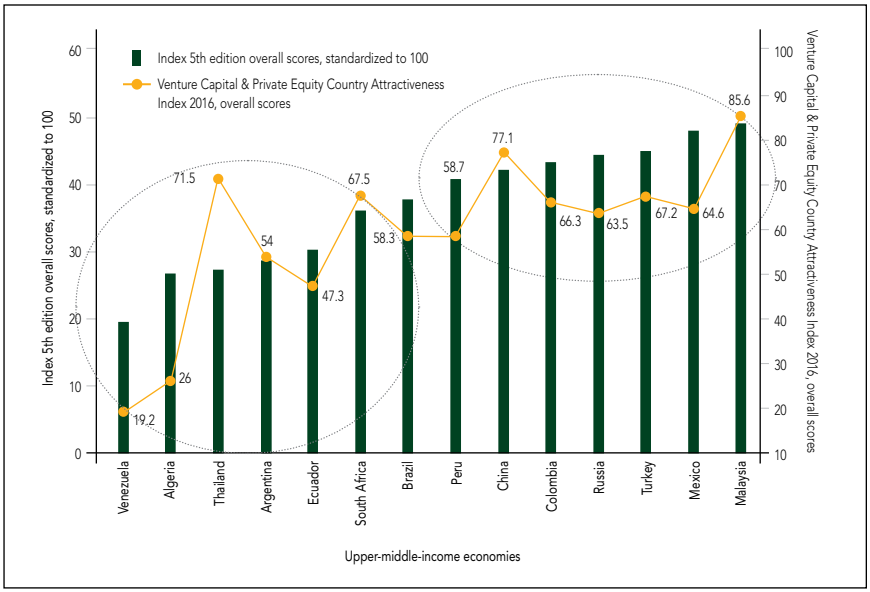


Sources: IESE Business School/Groh et al. (2016); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies that maintain robust IP regimes, scoring in the top half of the Index, are on average about 45% more likely to attract VC and PE funds compared with economies whose IP regimes lag behind, which score in the bottom half of the Index.

Association between the Index scores and access to venture capital and private equity in upper-middle-income economies



Sources: IESE Business School/Groh et al. (2016); The World Bank (2016); GIPC (2017)

Upper-middle-income economies that provide inadequate IP regimes are less attractive for VC and PE funds by 60% on average compared with upper-middle-income economies that maintain stronger IP regimes.

R&D and Creative Activities

Key Finding: IP protection is a fundamental incentive driving the discovery, development, and production of new technologies and creative works

The ability to generate new innovations and creative content on a large scale relies heavily on the research and development phase—an often lengthy, costly, and risky process involving multiple actors and a great deal of investment. Basic research and the conception of creative works are inherently crucial components, but the translation of inventions into commercially viable technologies, the production of a film or album, and the scaling-up of new technologies and works are what yield tangible, fully fledged innovations. Such activities require frameworks that incentivize and support the necessary level of investment—and, by and large, IP protection represents a primary component of these frameworks. The exclusivity underlying IP rights provides an unsurpassed guarantee of return and ability to cover the costs of failures, particularly for the most expensive and risky R&D investments. In addition, IP protection is a well-established platform for licensing and diffusion of technologies, and maintains its relevance as R&D increasingly becomes global and horizontal (involving different partners). Indeed, the correlations in this section indicate that IP rights are strongly linked to the discovery, development, and production of new technologies and creative works.

IP rights and general R&D and creative efforts

At a general level, IP protection strongly correlates with actual levels of innovation. Innovation may be defined in different manners and therefore measured in a number of ways but one measure available today is the Global Innovation Index Innovation Output Subindex—an aggregate measure that looks at a wide variety of indicators reflecting knowledge creation and development, including intangible assets, research publications, and high-tech production. Innovation output and IP rights display a very strong correlation of 0.88, a strength that has risen (from 0.83 in the 3rd edition) in each edition of the Index as the sample expands. This suggests that economies with robust IP regimes experience 80% more knowledge-based, technological, and creative outputs than economies whose IP regimes trail behind (though there are a few exceptions[7]). Even economies that have made improvements to their IP environments on a smaller scale tend to see distinct rises in levels of innovation

outputs. For example, looking at Latin America, economies with relatively more supportive IP frameworks, such as Mexico and Chile, exhibit roughly 25% greater volume of innovative outputs than economies whose IP systems still display significant gaps, including Venezuela and Argentina.

Focusing on a quintessential measure of innovation that at once captures the early phases of R&D as well as its future potential for development—patenting rates—suggests that the relationship stands. The stronger the IP environment, particularly in the area of patent protection, the more likely economies are to create, register, and possess a store of high-value inventions that serve as springboards for cutting-edge R&D and crucial levers for new local innovative firms. This is particularly true when measuring patenting by rates of triadic patenting: the volume of patents registered in the 3 major patent offices in the world—the U.S. Patent and Trademark Office, the European Patent Office, and the Japanese Patent Office—which tends to reflect patent applications of high value.[8] The Index scores display a strong relationship (a correlation of 0.75), with triadic patenting rates standardized by population. For instance, between the top 10 and bottom 10 economies in the Index, there is a substantial gap in triadic patenting rates: the top 10 economies average about 180 triadic patent applications per million people (which has grown since the last edition of the Index), compared with an average rate of only 1 among the bottom 10 economies (a decrease of 75% from the last edition).[9] Putting it another way, economies scoring in the top half of the Index experience a nearly 50 times greater volume of triadic patent applications compared with economies scoring in the bottom half.

IP rights and sector-specific R&D and creative activity: Life sciences and the creative content sector

The importance of IP for innovation is also striking when looking at a key high-tech sector, biotechnology. Biotech is one of the most R&D-intensive among high-tech sectors, and the market exclusivity period provided by IP rights gives firms the protection and incentives needed to recoup R&D investments and enables development and commercialization of biotechnologies. Not surprisingly, economies considered to be biotech leaders (for instance, as rated by the *Scientific American Worldview Scorecard*) tend to maintain high IP protection standards, and those with weaker IP rights are less competitive in biotech. In this context, the Index and Worldview scores correlate strongly at 0.77. In fact, economies scoring in the top half of the Index are on average 98%

more likely to provide environments that are conducive to biotech innovation than economies scoring in the bottom half of the Index.

One of the areas within biotech innovation that requires some of the most heavy lifting in terms of investment is clinical research, and here IP is also of real importance. Clinical research represents a huge chunk—an estimated 60%—of global R&D investment in biopharmaceuticals.[10] IP rights, particularly patents and other forms of exclusivity for biopharmaceuticals such as regulatory data protection, provide research-based companies with an incentive to invest vast sums in R&D, and display a strong relationship (0.70) with clinical trials in the area of biologics. On average, economies within the upper half of the Index when looking just at life sciences–related protection host nearly 15 times more clinical trials on innovative biologic drugs compared with economies falling within the lower half of the Index.[11]

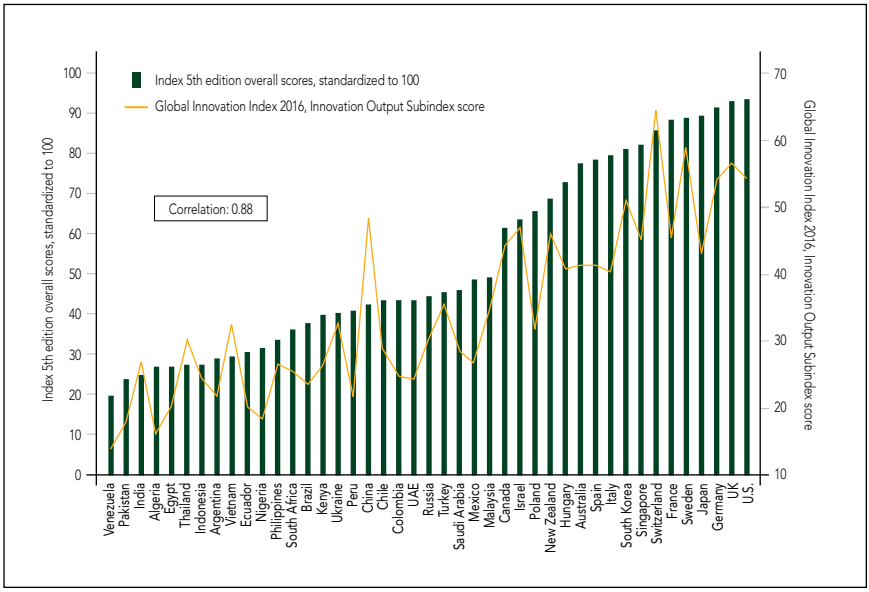
This is especially true for the early phases of clinical research—for biologics and for pharmaceuticals more generally. Phase I and II clinical trials typically involve the most R&D in terms of requiring cutting-edge infrastructure and highly skilled scientists and clinicians and having the highest failure rate (they also provide participating patients with early access to innovative treatments that in some cases may be their only resort). Thus, the ability to guarantee against free-riding on these and future investments (for instance, in registration and launch of the product) acts as a key incentive for investing in clinical research in a given economy. In that vein, the Index scores for life sciences–related indicators exhibit a strong correlation of 0.73 to rates of early-phase clinical trial activity. Economies that maintain robust IP environments tend to see more than 20 times more early-phase clinical trials on average compared with economies whose life sciences–related IP environments trail behind.

IP protection also contributes to the growth in creative activity within dynamic content sectors. Creative activity, including generation of related intangible assets, presence of substantial entertainment and media sectors, and active production of new works, is on the whole much more likely to occur where copyright protection is ensured. The association between copyright-related indicators in the Index and creative activity is very strong, at 0.86, and strengthened by nearly one-third from the 3rd edition of the Index despite an increase of 50% in sample size. More specifically, economies scoring in the top half of the Index copyright-related indicators are almost 75% more likely to benefit from the growth both in volume and value of the dynamic content and media sectors than economies falling into the bottom half of the Index.

This is particularly the case for the online sphere: a supportive copyright environment is crucial for the creation and diffusion of content online. People in economies that provide strong copyright protection, including for digital and online works, tend to contribute more to the global diffusion of knowledge by generating over four times more online content compared with people in economies whose copyright-related IP environments are lacking. Looking specifically at a slice of the sample—European economies included in the Index—a steady rise in copyright-related IP protection from the lowest scoring economy (Ukraine) to the highest (UK) tracks a similar increase in levels of online creativity.

IP protection is a strong driver of innovation

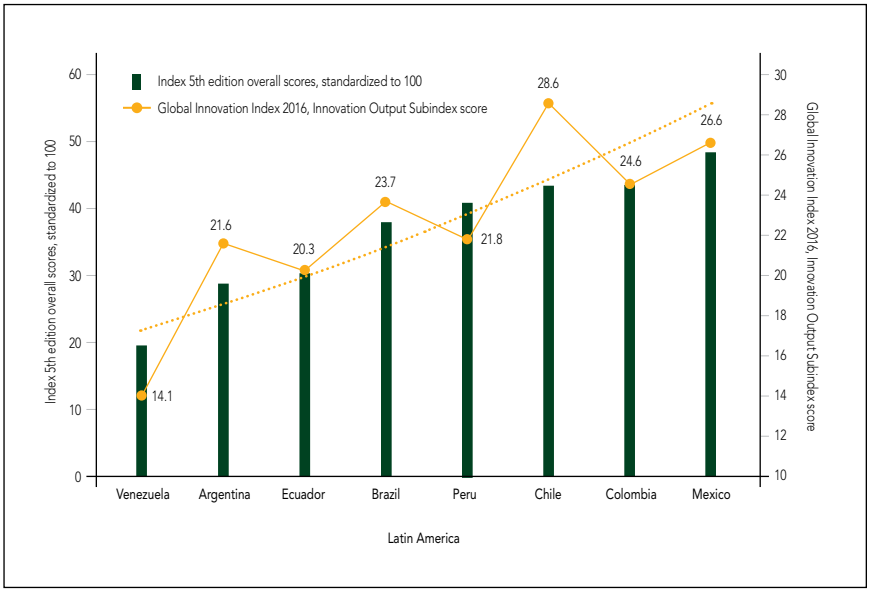
Association between the Index scores and the Global Innovation Index Innovation Output Subindex scores[12]



Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Economies with robust IP regimes experience 80% more knowledge-based, technological, and creative outputs than economies whose IP regimes trail behind.

Association between the Index scores and the Global Innovation Index Innovation Output Subindex scores: Focus on Latin America

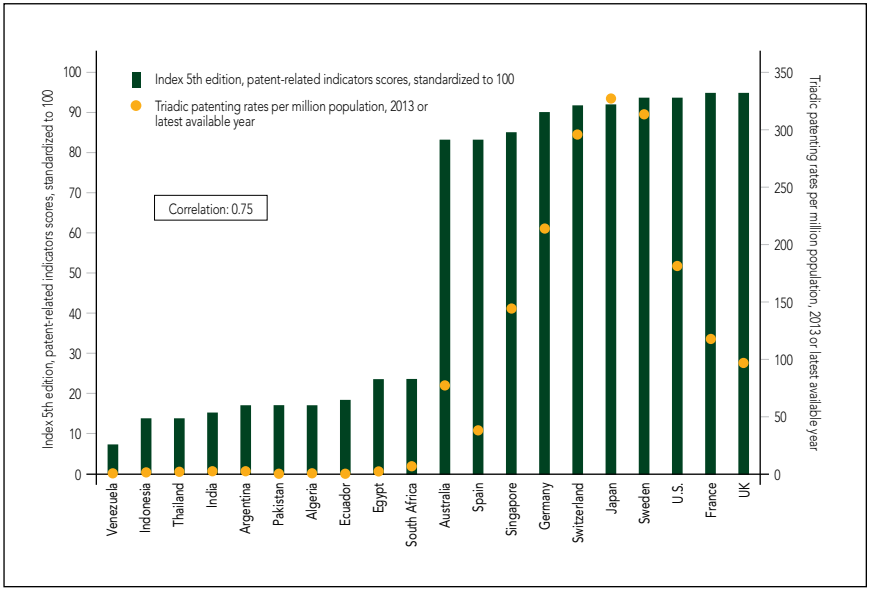


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Economies with relatively more supportive IP frameworks, such as Mexico and Chile, exhibit roughly 25% greater volume of innovative outputs than economies whose IP systems still display significant gaps, including Venezuela and Argentina.

Inventive intensity depends on strong patent protection

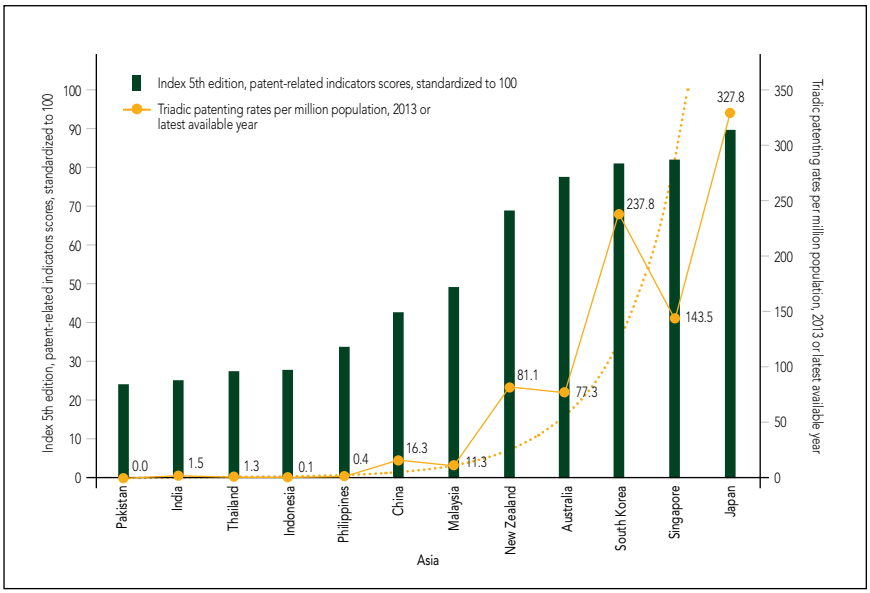
Association between the Index patent-related indicators scores and triadic patenting rates: Top 10 and bottom 10 economies



Sources: OECDStat, (2016); World Bank (2016); GIPC (2017)

Economies scoring in the top half of the Index display a nearly 50 times greater volume of triadic patent applications compared with economies scoring in the bottom half.

Association between the Index patent-related indicators scores and triadic patenting rates: Focus on Asia-Pacific

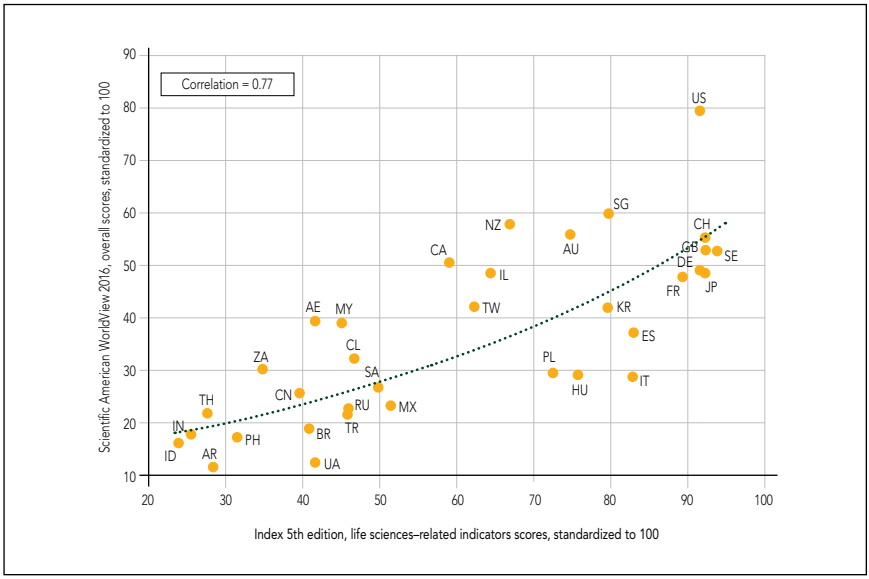


Sources: OECDStat, (2016); World Bank (2016); GIPC (2017)

Of economies in Asia, those with relatively strong IP environments on average record over 15 times greater volume of triadic patent applications than those Asian economies with relatively less supportive IP environments.

Leadership in biotechnological innovation requires robust IP protection

Association between the Index life sciences–related indicators scores and the Scientific American WorldView scores[13]

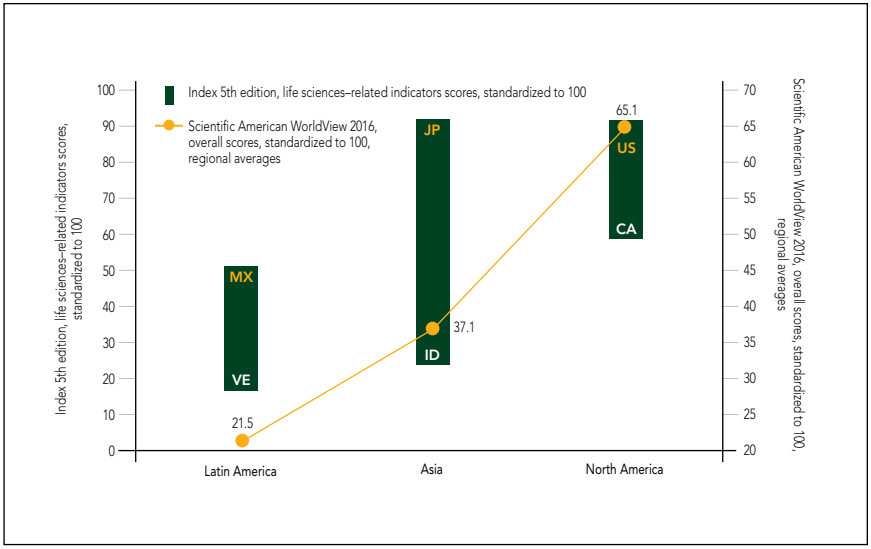


Sources: Scientific American (2016); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, DE – Germany, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KR – South Korea, MX – Mexico, MY – Malaysia, NZ – New Zealand, PH – Philippines, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, ZA – South Africa.

Economies scoring in the top half of the Index are on average 98% more likely to provide environments that are conducive to biotech innovation than economies scoring in the bottom half of the Index.

Association between the Index life sciences–related indicators scores and the Scientific American WorldView scores: Comparing a sample of key regions

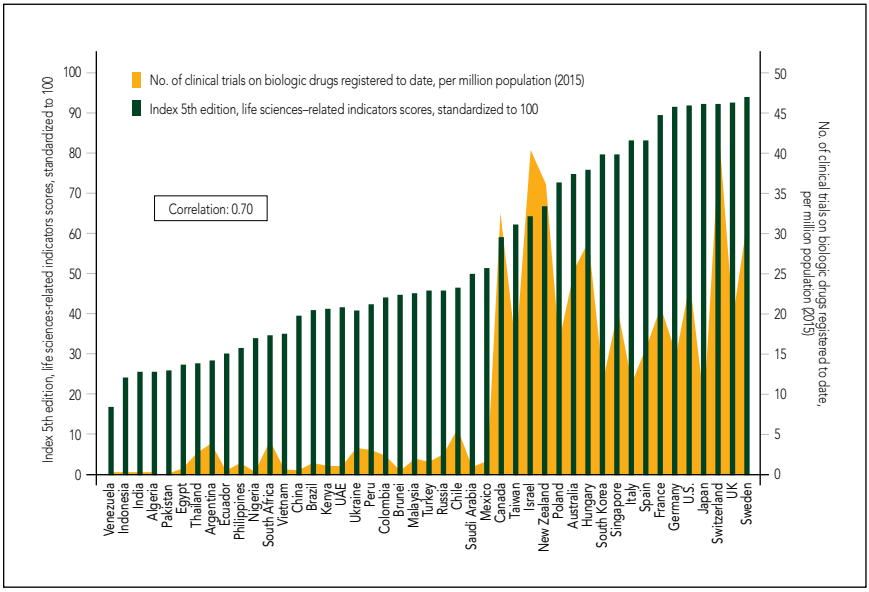


Sources: Scientific American (2016); GIPC (2017)
Legend: Top and bottom economies reflect top and bottom scores in a given region.
CA – Canada, ID – Indonesia, JP – Japan, MX – Mexico, US – United States, VE – Venezuela.

In regions where the IP environment is weaker on average, the biotech ecosystem is also relatively less supportive (on average) compared with regions displaying relatively more robust IP environments.

Development of biological therapies is closely linked to IP protection

AssocAssociation between the Index life sciences–related indicators scores and biological clinical research intensity

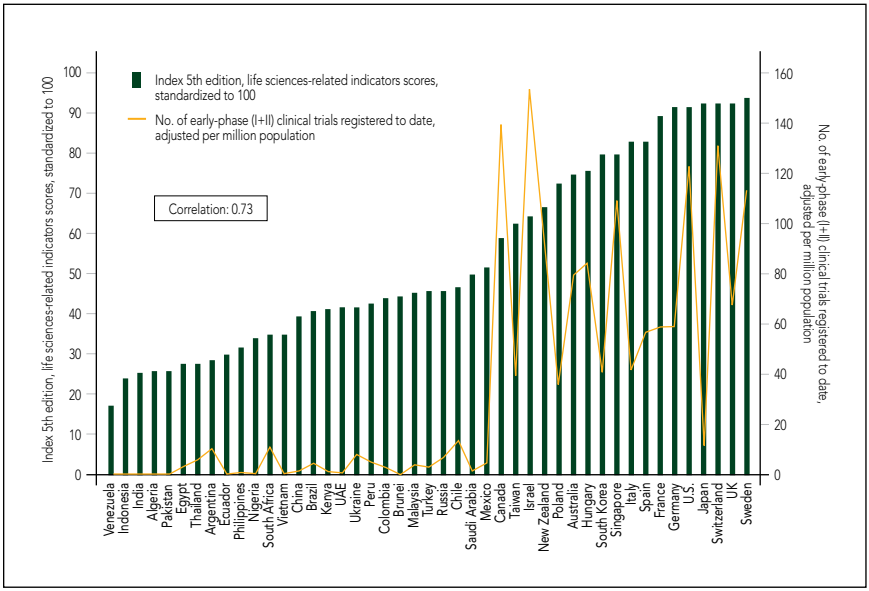


Sources: clinicaltrials.gov (2016); GIPC (2017)

On average, when looking at just life sciences–related protection, economies within the upper half of the Index host nearly 15 times more clinical trials on innovative biologic drugs compared with economies falling within the lower half of the Index.

IP protection is critical for greater investment in cutting-edge clinical research

Association between the Index life sciences–related indicators scores and early-phase clinical trial activity[14]

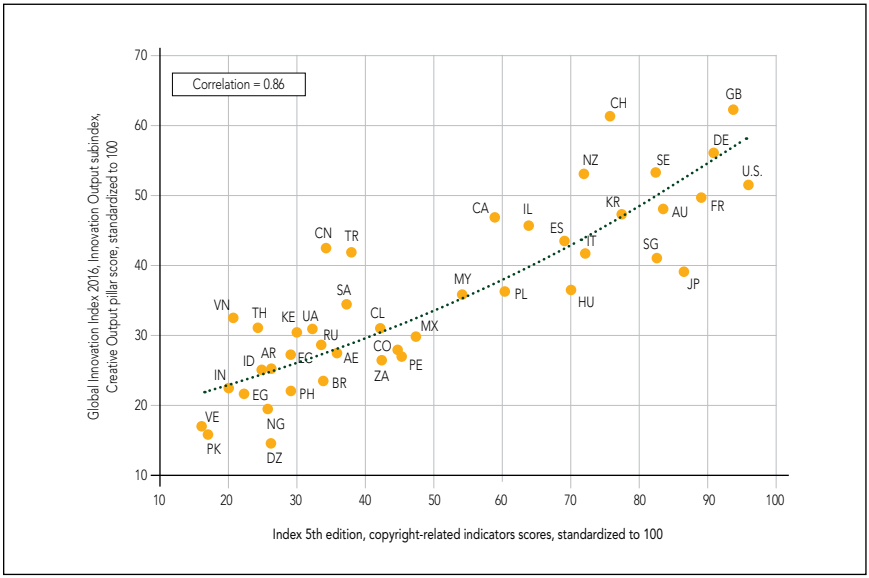


Sources: clinicaltrials.gov (2016); GIPC (2017)

Economies that maintain robust IP environments tend to see more than 20 times more early-phase clinical trials on average compared with economies whose life sciences–related IP environments trail behind.

Robust copyright protection promotes creative activity

Association between the Index copyright-related indicators scores and the Global Innovation Index Creative Output pillar scores[15]

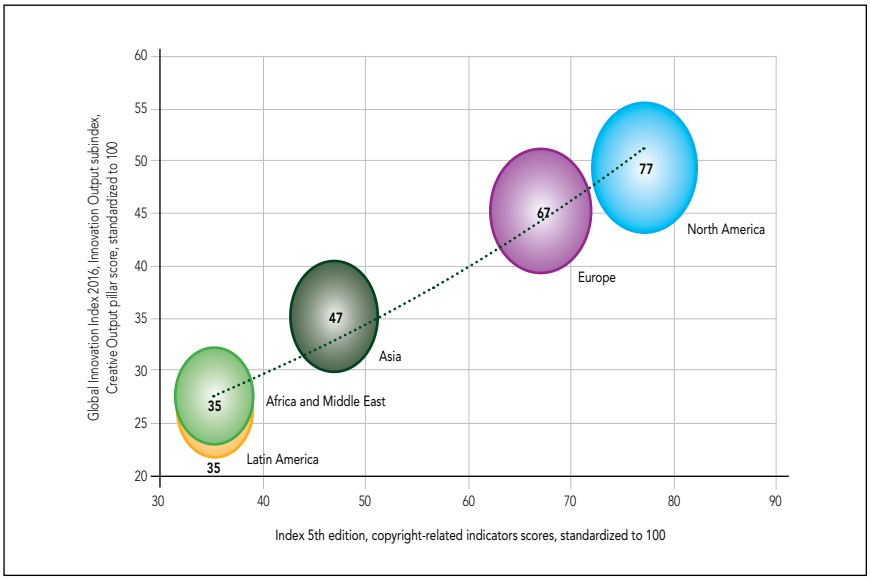


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies scoring in the top half of the Index copyright-related indicators are almost 75% more likely to benefit from the growth both in volume and value of the dynamic content and media sectors than economies falling into the bottom half of the Index.

Association between the Index copyright-related indicators scores and the Global Innovation Index Creative Output pillar scores: Regional averages

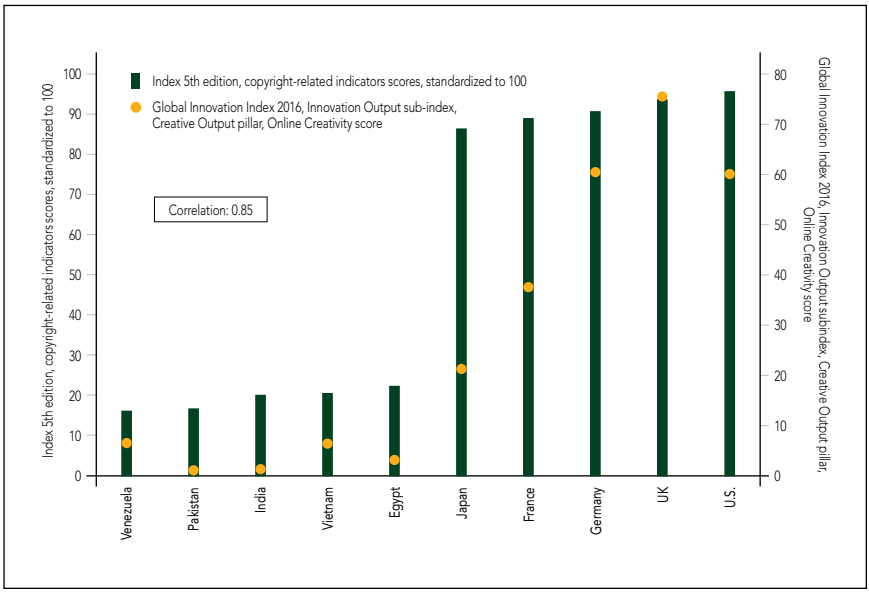


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)
Bubble size reflects the Global Innovation Index Creative Output pillar scores; boxed score reflects the average Index score per region.

Regions with stronger IP environments on average generate higher levels of creative outputs compared with regions with relatively weaker IP environments.

A supportive digital copyright environment encourages creative activity and diffusion of knowledge online

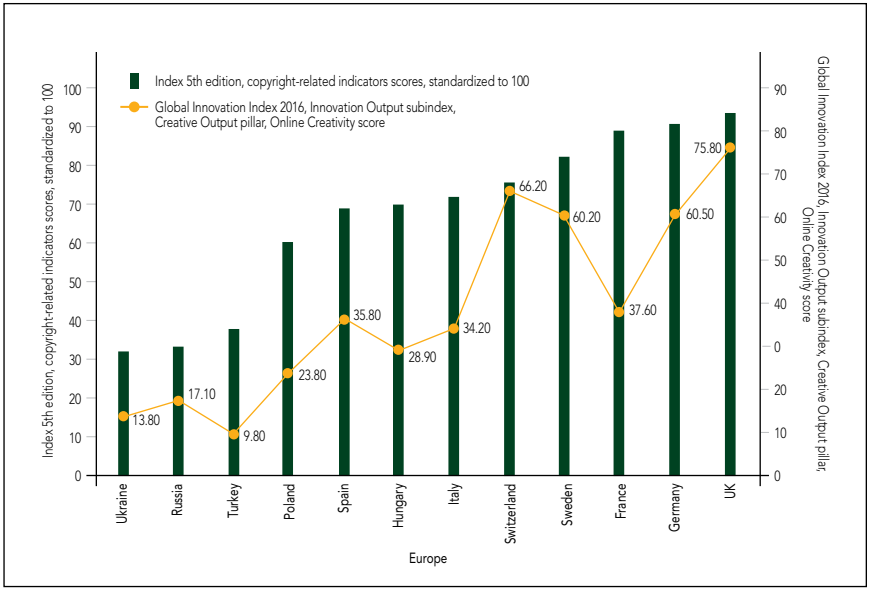
Association between the Index copyright-related indicators scores and online creativity (as measured by the Global Innovation Index Online Creativity subpillar scores): Top five and bottom five economies[16]



Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

People in economies that provide strong copyright protection, including for digital and online works, tend to contribute more to the global diffusion of knowledge by generating over four times more online content compared with people in economies whose copyright-related IP environments are lacking.

Association between the Index copyright-related indicators scores and online creativity: Focus on Europe



Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Of European economies included in the Index, a steady rise in copyright-related IP protection from the lowest scoring economy (Ukraine) to the highest (UK) tracks a similar increase in levels of online creativity.

Access to Technologies and Creative Content

Key Finding: IP protection is an enabler of early access to new technologies, products, and creative works

Early access to innovation—whether new software enabling more efficient and streamlined processes, the latest consumer gadgets, new video and music content, smarter technological products that enable fast global connections and trade, new life-saving medicines, or educational technologies and content for better learning—is an important factor in both a country's standard of living and its competitiveness.

The correlations included in this theme relate to the actual availability of such technologies both broadly—as viewed, for example, by executives on the ground—as well as specifically to certain types of content, including music and film.

These correlations reveal that the protection of IP is an enabler of early access. The data suggest that economies in which new content and technologies are protected are more likely to see these products released early in the marketplace. Conversely, economies that do not have strong IP protection are less likely to see the early launch of these new technologies and products.

As has been mentioned earlier, the biggest markets are not necessarily the most attractive. This is somewhat surprising in this theme, as these correlations in large measure relate to the launch of new products and technologies. So, one would expect the size of a given market to be a key driver in an economy's overall attractiveness and rate of activity. However, looking at some specific economy examples, it is clear that where IP protection is not that strong—regardless of market size—economies are viewed as less attractive.

For example, for both the availability of legal music services as well as more broadly the availability of the latest technologies, large, fast-growing markets such as the BRICS, Indonesia, and others are not viewed as being as attractive as developed markets with strong IP protection. Firms and consumers in economies scoring above the median level of the Index are 30% more likely to benefit from access to the most recent technological developments compared with

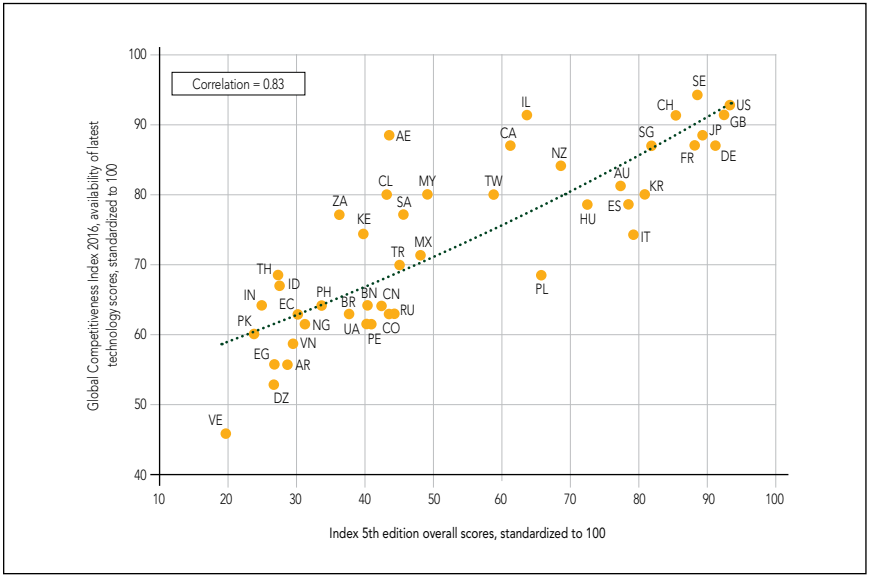
those in economies whose IP environments trail behind. Similarly, economies that maintain robust copyright environments enjoy substantially wider access to new music through legitimate and secure platforms. For example, the top 10 economies in the Index copyright-related scores provide access to more than 30 licensed online music outlets, on average, compared with an average of just 8 among the bottom 10 economies (in other words, more than 3 times greater access).

Further, consumers in economies that provide robust and comprehensive IP protection for creative content (such as videos, music, books, etc.) are more likely to be able to access new content and show a greater willingness to pay for it. For instance, economies in the top half of the Index in relation to creative content indicators are likely to see at least 3.5 times more theater screenings of feature films—and generate more tax revenue from ticket sales—than average or below average economies (those scoring below the median). A similar relationship is visible when looking at rates of penetration of video-on-demand and streaming services, which typically provide access to the latest films and video content. Economies scoring in the top half of the Index display more than double the level of video-on-demand and streaming services compared with economies falling into the bottom half of the Index. Looking at the trend more incrementally, economies scoring in the middle third of the Index display about triple the level of video-on-demand and streaming services available compared with economies in the bottom third, while those scoring in the top third enjoy a 50% higher rate compared with economies scoring in the middle third.

In short, availability of IP rights and ability to protect these IP assets is as important for accessing new products and technologies as it is an incentive to develop these products in the first place.

Access to advanced technologies is enhanced where supportive IP environments exist

Association between the Index scores and the Global Competitiveness Report scores on availability of latest technologies



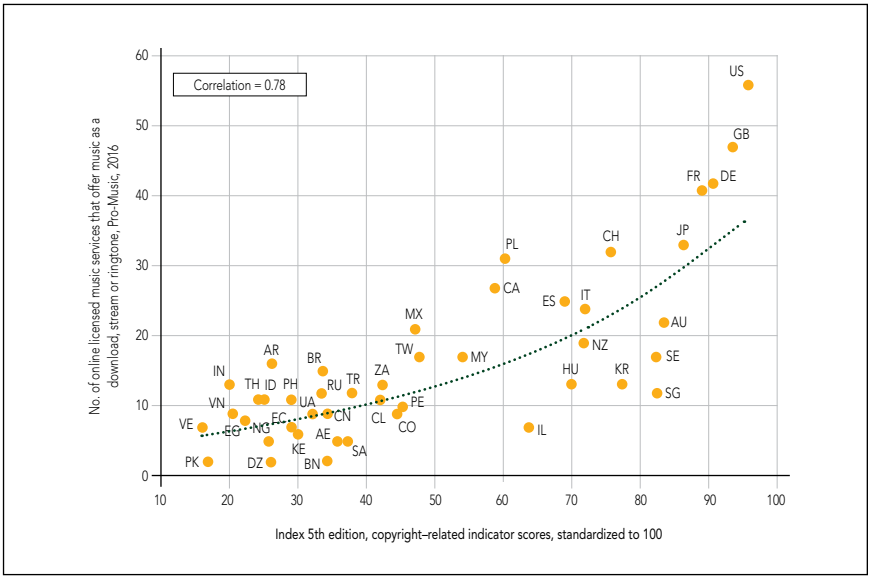
Sources: World Economic Forum/Executive Opinion Survey (2016); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BN – Brunei, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Firms and consumers in economies scoring above the median level of the Index are 30% more likely to benefit from access to the most recent technological developments compared with those in economies whose IP environments trail behind.

Strong copyright protection encourages increased availability of legitimate online music outlets

Association between the Index copyright–related indicators scores and volume of licensed online music services[17]



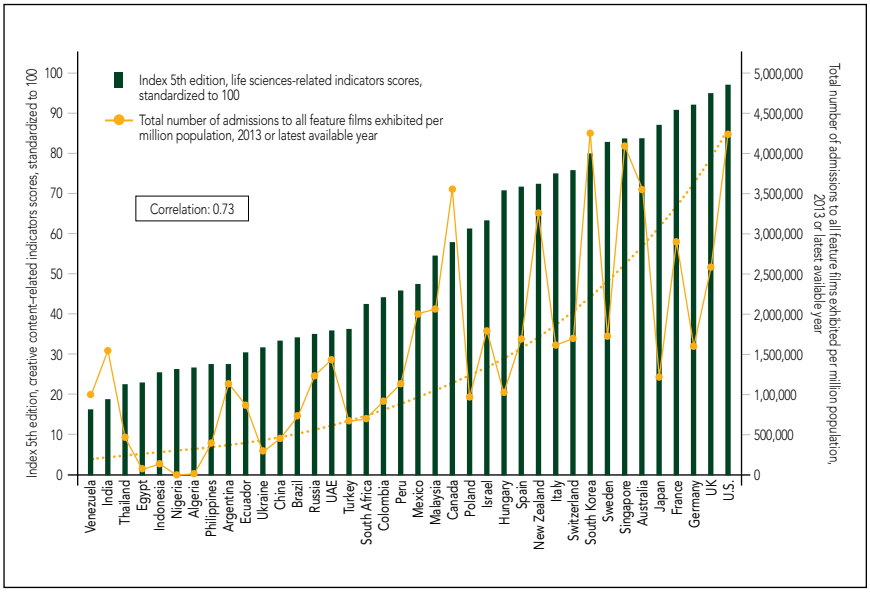
Sources: Pro-Music.org, (2016); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BN – Brunei, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies that maintain robust copyright environments enjoy substantially wider access to new music through legitimate and secure platforms. The top 10 economies in the Index copyright-related scores exhibit 3 times greater access to new, licensed music content compared with the bottom 10 economies.

Copyright protection supports greater consumption of new audiovisual content

Association between the Index creative content–related indicators scores and the rate of admissions to feature films[18]

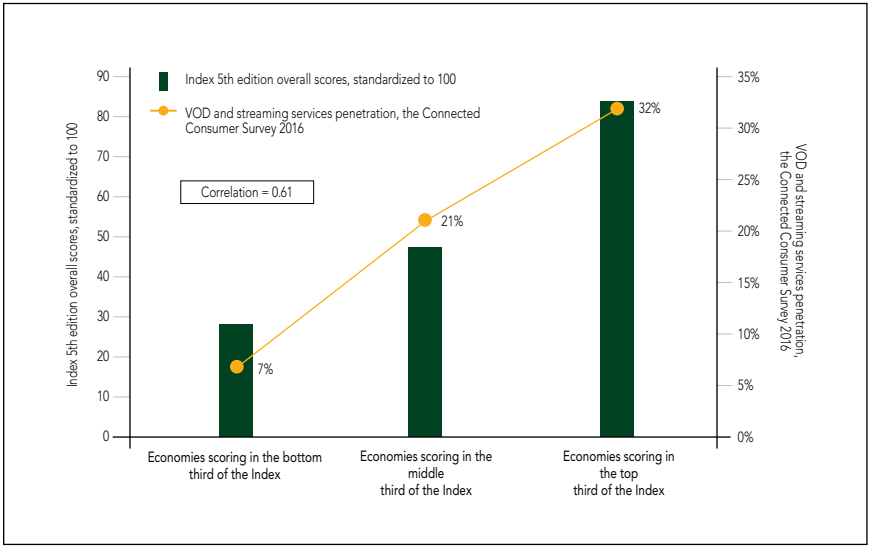


Sources: UNESCO Institute for Statistics (2015); GIPC (2017)

Economies in the top third of the Index in relation to creative content indicators are likely to see at least 3.5 times more theater screenings of feature films—and generate more tax revenue from ticket sales—than average or below average economies (those scoring below the median).

Mature IP environments experience wider and more convenient access to video content

Association between the Index scores and video-on-demand (VOD) and streaming penetration rates: Averages among three groups of Index performers[19]



Sources: Google Consumer Barometer (2016); GIPC (2017)

Economies scoring in the middle third of the Index display about triple the level of video-on-demand and streaming services available compared with economies falling into the bottom third of the Index. Economies scoring in the top third of the Index enjoy a 50% higher rate compared with economies scoring in the middle third.

A Dynamic Economy

Key Finding: IP protection is a cornerstone for building knowledge-based economies

Having examined the role of IP rights in resource allocation, innovative and creative activity, and dissemination of new products and technologies, respectively, a look at the wider socioeconomic impacts is necessary to provide a complete picture of the innovation ecosystem.

The correlations in this fourth and final theme seek to capture the macroeconomic benefits of IP rights. Looking at everything from the overall business environment to creditworthiness to knowledge-intensive job creation to sector-specific end results (including rates of biomedical FDI and the added value of licensed software), the correlations in this theme strongly suggest that economies with a stronger national IP environment tend to be more attractive and realize greater macroeconomic benefits.

For example, the relationship between knowledge and technology outputs—a strong indicator for the robustness and growth of the high-tech sector in a given economy—and the protection of patents has strengthened from 0.71 in the 3rd edition of the Index to 0.8 in this edition. With the growth of the number of economies from 38 to 45 these results suggest a very robust, statistically significant relationship between the 2 variables. In fact, economies with robust IP systems tend to produce up to 82% more knowledge and technology outputs.

Similarly, the stronger association between the Index scores and the World Bank *Ease of Doing Business 2017* economy rankings—rising from 0.68 in the Index's 3rd edition to 0.8 in this edition of the Index—shows how the protection of IP is an indispensable component of a supportive business climate—an environment that attracts private sector investment and encourages economic growth. On average, economies with a higher Index score are 68% more likely to have a supportive business climate compared with economies with less favorable IP regimes. Accordingly, those economies are also nearly 50% more attractive to foreign investors. This trend is amplified when looking at specific regions such as Asia-Pacific; a distinction is discernible between economies such as Singapore and South Korea that maintain a supportive IP regime and are also characterized by highly business-friendly environments. Conversely, economies with less

favorable IP regimes, such as Indonesia, Vietnam, and the Philippines, remain more challenging business environments for investors.

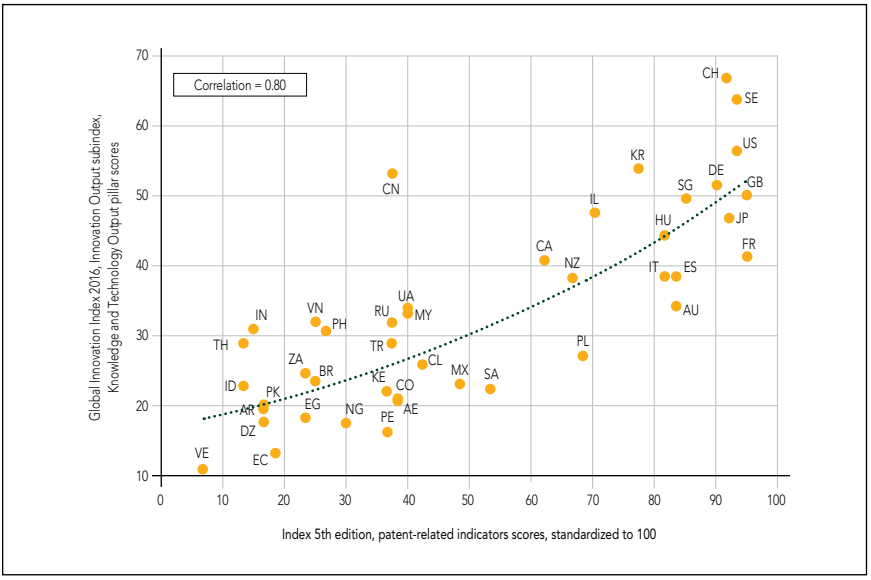
Looking at specific forms of foreign investment and high-tech R&D, it is also clear just how important IP rights are in attracting investment. The availability (or lack) of IP rights acts as a powerful incentive for attracting clinical research, which accounts for approximately 60% of biomedical foreign direct investment in R&D,[20] estimated in 2014 at about USD140 billion.[21] On average, economies scoring in the upper half of the Index host as many as 15 times more clinical trials compared with economies in the lower half of the Index.

A robust IP regime also promotes job creation in knowledge-intensive sectors that necessitate a highly skilled, well-educated workforce, such as in high-tech, law, and engineering—all key components of a growing, dynamic economy. The positive association between Index scores and knowledge-intensive jobs remains strong for the 3rd consecutive year at an average of 0.76 over 3 editions (2015–17), despite an increase of 50% in sample size since the Index's 3rd edition. This relationship suggests that nearly double the workforce is concentrated in knowledge-intensive sectors in economies with robust IP environments compared with economies that trail in terms of IP protection.

Beyond high-value job growth, strong IP rights are also associated with a greater leveraging of ICT to support economic growth and build knowledge-based economies. Economies scoring in the top half of the Index display a 40% greater capacity to generate positive value from ICT, such as through access to public and private services and creation and use of ICT-based technologies. In addition, economies with robust IP regimes see as much as 10 times greater positive impact on GDP of strong ICT-related IP compared with economies with weak IP protection.

Patent protection matters for the growth of domestic high-tech sectors

Association between the Index patent-related indicators scores and the Global Innovation Index Knowledge and Technology Output scores[22]

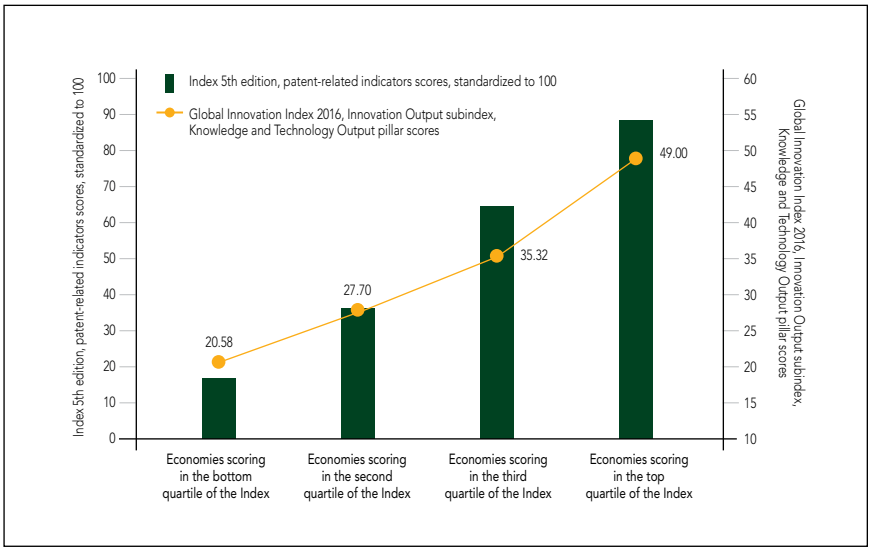


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies with robust IP systems tend to produce up to 82% more knowledge and technology outputs.

Association between the Index patent-related indicators scores and the Global Innovation Index Knowledge and Technology Output scores: Averages among four groups of Index performers

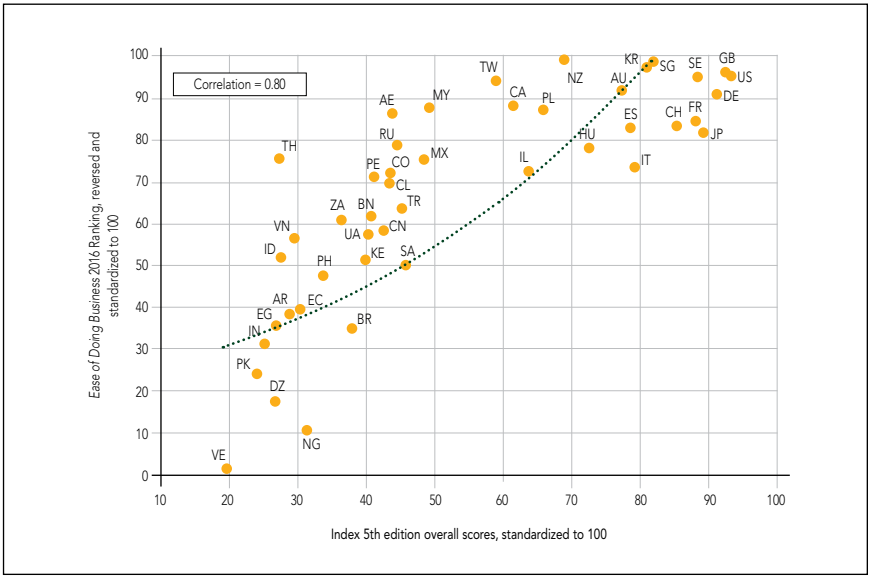


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

An incremental increase in the Index scores is associated with a similar rise in high-tech outputs when looking at the Index economies divided into quartiles.

IP protection is an integral part of a constructive business environment

Association between the Index scores and the World Bank *Ease of Doing Business* Report ranking[23]

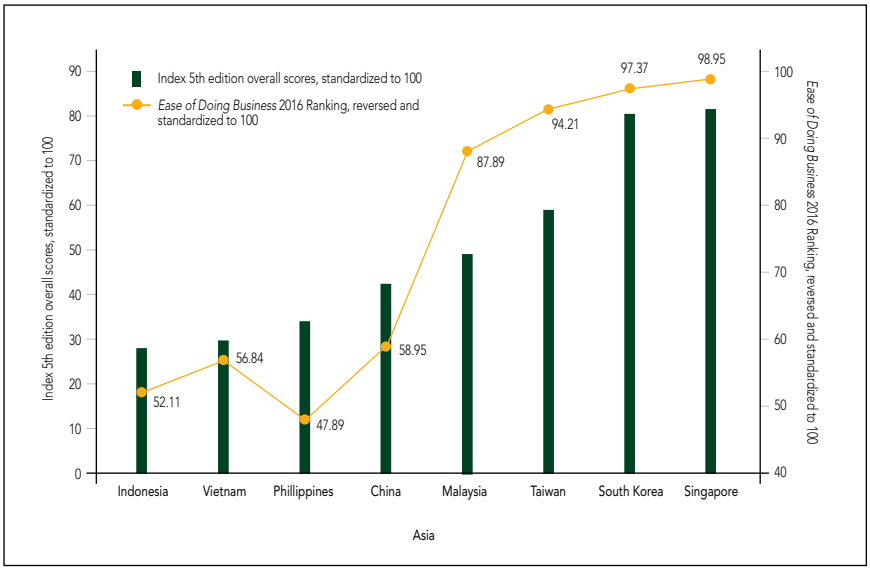


Sources: World Bank (2016); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BN – Brunei, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

On average, economies with a higher Index score are 68% more likely to have a supportive business climate compared with economies with less favorable IP regimes.

Association between the Index scores and the World Bank *Ease of Doing Business* Report ranking for a sample of Asian economies

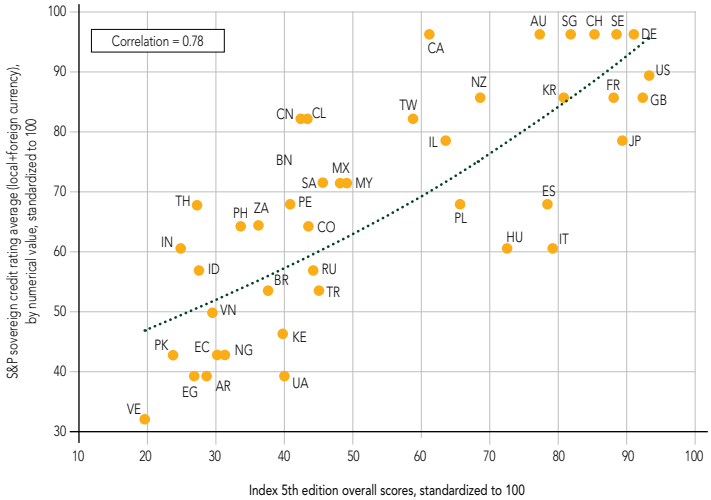


Sources: World Bank (2016); GIPC (2017)

Looking at Asia, economies such as Singapore and South Korea that maintain a supportive IP regime are also characterized by highly business-friendly environments. Conversely, economies with less favorable IP regimes, such as Indonesia, Vietnam, and the Philippines, remain more challenging business environments.

A healthy IP environment increases economies' attractiveness for investment

Association between the Index scores and Standard & Poor's (S&P's) sovereign credit rating[24]

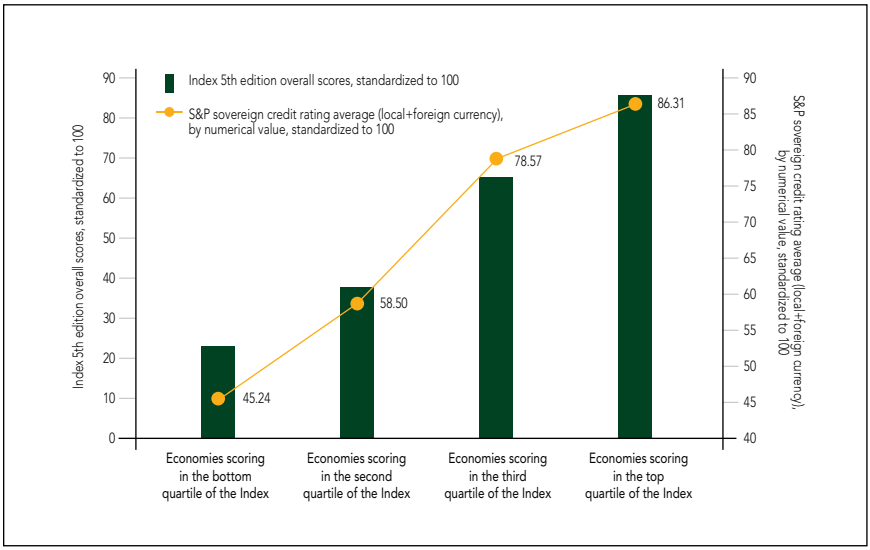


Sources: S&P (2016); GIPC (2017)

Legend: AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies with strong IP systems are a nearly 50% more attractive to foreign investors.

Association between the Index scores and Standard & Poor's sovereign credit rating: Averages among four groups of Index performers

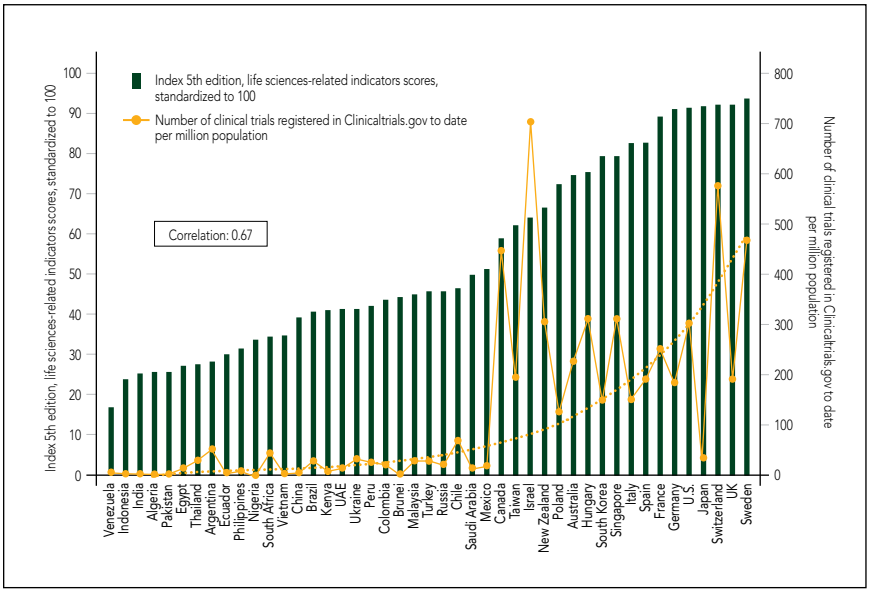


Sources: S&P (2016); GIPC (2017)

The stronger the level of IP protection afforded in a given economy (even if it is an incrementally stronger environment), the more the economy is likely to attract investment.

IP rights are crucial for biomedical FDI

Association between the Index life sciences–related indicators scores and clinical trial activity

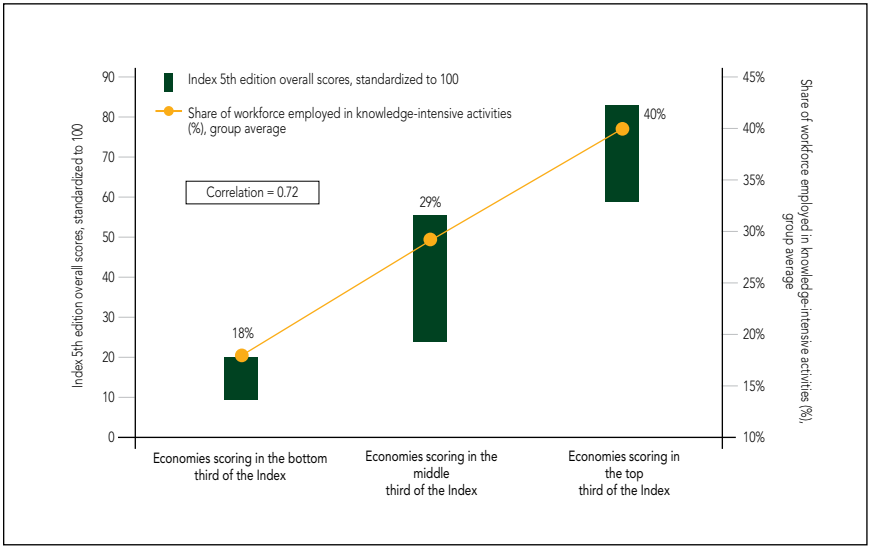


Sources: clinicaltrials.gov (2016); GIPC (2017)

On average, economies scoring in the upper half of the Index host approximately 15 times more clinical trials compared with economies in the lower half of the Index.

A robust IP regime promotes high-value job creation

Association between the Index scores and share of workforce employed in knowledge-intensive services[25]

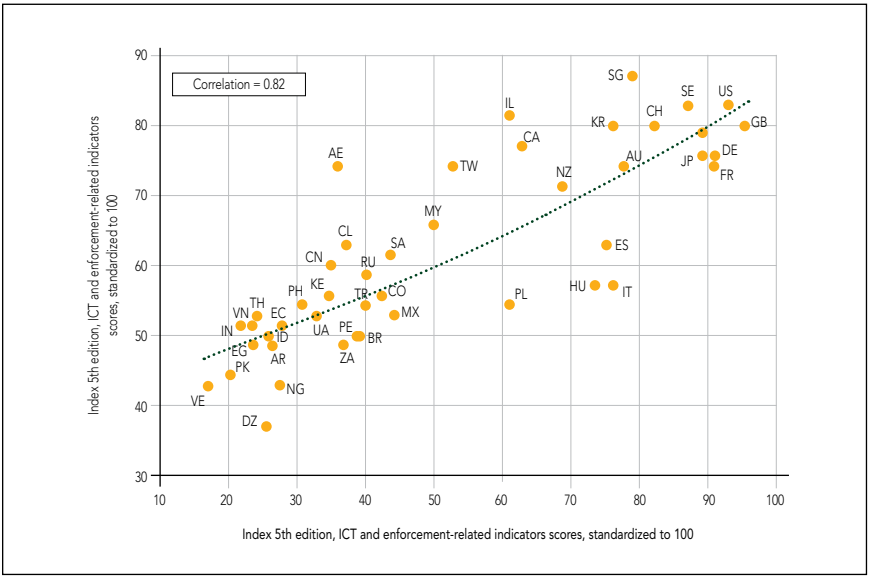


Sources: WIPO/INSEAD/Cornell, Global Innovation Index 2016; GIPC (2017)

Nearly double the workforce is concentrated in knowledge-intensive sectors in economies with robust IP environments (those scoring in the top third of the Index) compared with economies trailing in terms of IP protection (those scoring in the bottom third of the Index).

IP rights contribute to the growth of the ICT sector and knowledge-based economies

Association between the Index ICT and enforcement-related indicators scores and the Global Information Technology Report Network Readiness Impact scores[26]

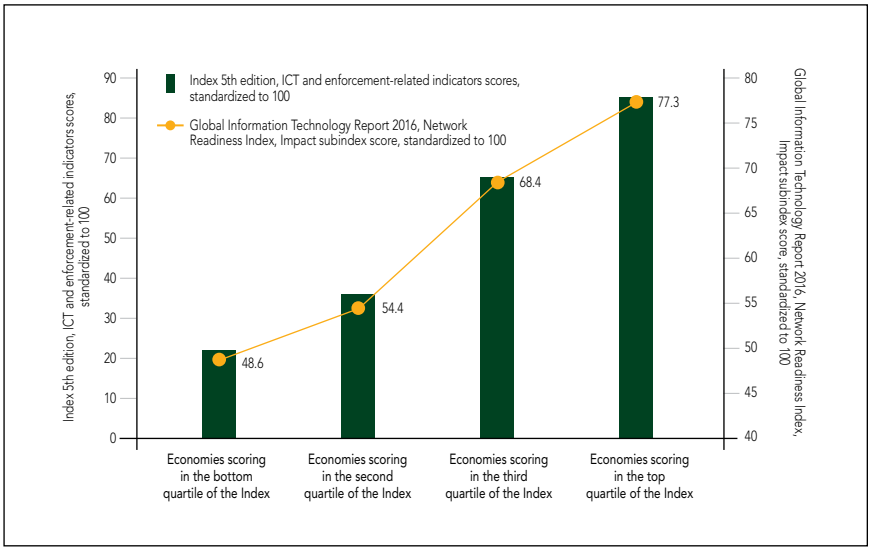


Sources: World Economic Forum, INSEAD (2015); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, TW – Taiwan, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies with higher levels of IP protection have a 40% greater capacity to generate positive value from ICT, such as through job creation, access to public and private services, and creation and use of ICT-based technologies.

Association between the Index scores and Standard & Poor's sovereign credit rating: Averages among four groups of Index performers

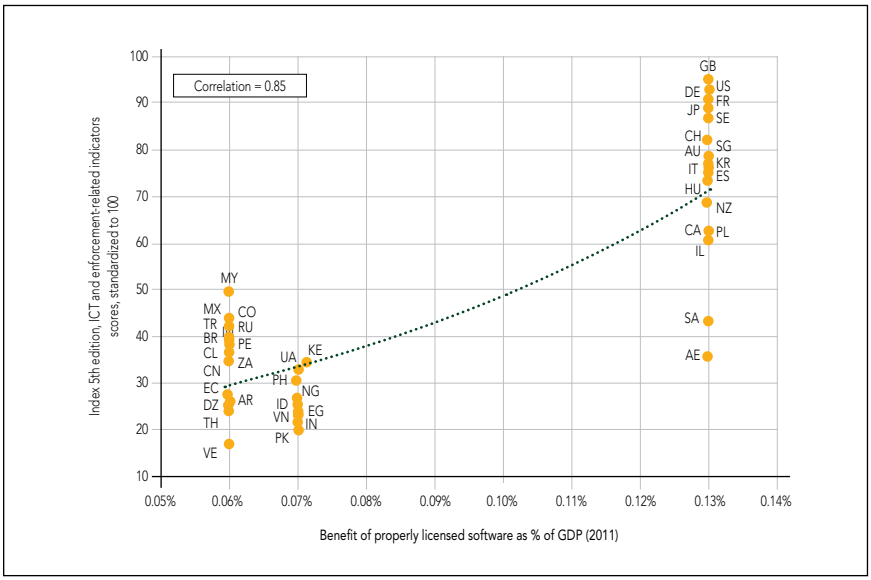


Sources: World Economic Forum, INSEAD (2015); GIPC (2017)

In terms of increasing capacity to leverage economic value from ICT in association with IP reforms, economies are likely to experience the largest gain—about 25% greater economic value—when making incremental improvements to their IP environments (that would allow economies to move from the 30th–40th percentile to the 60th–70th percentile in the Index).

IP rights enable economies to experience greater economic benefits of properly licensed software

Association between the Index ICT and enforcement-related indicators scores and the GDP benefit from a 1% increase in software use[27]



Sources: BSA (2015); GIPC (2017)

Legend: AE – United Arab Emirates, AR – Argentina, AU – Australia, BR – Brazil, CA – Canada, CH – Switzerland, CL – Chile, CN – China, CO – Colombia, DE – Germany, DZ – Algeria, EC – Ecuador, EG – Egypt, ES – Spain, FR – France, GB – United Kingdom, HU – Hungary, ID – Indonesia, IL – Israel, IN – India, IT – Italy, JP – Japan, KE – Kenya, KR – South Korea, MX – Mexico, MY – Malaysia, NG – Nigeria, NZ – New Zealand, PE – Peru, PH – Philippines, PK – Pakistan, PL – Poland, RU – Russia, SA – Saudi Arabia, SE – Sweden, SG – Singapore, TH – Thailand, TR – Turkey, UA – Ukraine, US – United States, VE – Venezuela, VN – Vietnam, ZA – South Africa.

Economies with robust IP regimes see as much as 10 times greater positive impact on GDP of strong ICT-related IP compared with economies with weak IP protection.

Endnotes

1 The Pearson Correlation Coefficient is a statistical measurement of the linear relationship between two variables. Thus, a correlation value of 0 (r = 0) implies only that the two variables are not linearly correlated.

2 National Science Foundation (2014), *Science and Engineering Indicators 2014* (2014), chapters 2–4.

3 Here and throughout this Annex, the division between economies based on performance in the IP Index is between economies scoring above the median level of the IP Index and economies scoring below the median level, unless stated otherwise.

4 Data are not available for Peru, Saudi Arabia, Taiwan, and UAE.

5 Company R&D spending score based on responses to the question, "In your country, to what extent do companies spend on research and development?" in the World Economic Forum's Executive Opinion Survey, 2016–17, where 1 = do not spend on R&D and 7 = spend heavily on R&D (standardized to 100).

6 The IESE and EMYLON Business Schools' Venture Capital and Private Equity Country Attractiveness Index measures economies' attractiveness to VC and PE funding by examining a range of factors including the capital market, taxation environment, investor protection, entrepreneurial culture, and deal opportunities. See: Groh, A., Liechtenstein, H., Lieser, K., & Biesinger, M. (2015), *The Venture Capital and Private Equity Country Attractiveness Index: 2015 Annual* (IESE Business School and EMYLON Business School 2015).

7 Thailand and Vietnam's disproportionate innovative output compared with their relatively weaker national IP environments is partly a result of their growing role in medium-tech and ICT exports, though these activities tend to center around end-stage, rather than innovative, operations. See: World Bank, A Review of Science, Technology and Innovation in Viet Nam, http://www.worldbank.org/en/country/vietnam/publication/a-review-of-science-technology-and-innovation-in-vietnam; United Nations Conference on Trade and Development (2015), *Science, Technology & Innovation Policy Review: Thailand* (United Nations Publication 2015) pp. 9–14.

8 Triadic patenting is generally considered as the best indicator of the perceived overall value and quality of a patent. The patent application is filed in those three separate locations and filing costs are quite high. Source: OECDStat, Patents by technology, Triadic patent families, Total patents, Inventor country of residence, Priority date, 2013 or closest available year; World Bank (Population).

9 Some exceptions to the association do exist, including Spain, Sweden, and Switzerland. See: European Commission (2014), *Research and Innovation Performance in Spain: Country Profile 2014; OECD (2015), OECD Reviews of Innovation Policy: Sweden 2016* pp. 10–11; Credit Suisse (2016), How Did Switzerland Become the World's Most Innovative Country?, https://www.credit-suisse.com/us/en/articles/articles/news-and-expertise/2016/03/en/innovation-switzerland.html.

10 See: IMS Health (2012), *Restoring Innovation as Global Pharma's Center of Growth: How to Optimize Clinical Trial Performance and Save $1 Billion Annually,* IMS White Paper (2012), p. 1.

11 New Zealand's relatively high rate of biological clinical research is mainly a result of a concerted government effort to improve its competitiveness in the field of clinical research, as well as its untapped, ethnically diverse population and international-standard health care institutions and professionals. See: Cranleigh Health (2010), *Select Committee Office Report on Improving New Zealand's Environment to Support Innovation through Clinical Trials* (2010), pp. 5–7, http://cranleigh.co.nz/application/files/2714/4122/6423/CranleighReportforClinicalTrialSelectCommittee.pdf.

12 Innovative output is measured by the Global Innovation Index (GII) Innovation Output Subindex score. The GII Innovative Output Subindex accounts for knowledge and technology outputs, knowledge impact including labor productivity and high-tech outputs, and the diffusion of knowledge including high-tech and ICT exports as well as licensing fees and FDI outflows. Data are not available for Brunei Darussalam and Taiwan.

13 Overall scores of Scientific American WorldView are based on performance in seven categories: Productivity, Intellectual Property Protection, Enterprise Support, Intensity, Education/Workforce, Foundations, and Policy and Stability. Data are not available for Algeria, Brunei, Colombia, Ecuador, Egypt, Kenya, Nigeria, Pakistan, Peru, Venezuela, and Vietnam. Source: Scientific American WorldView (2016).

14 Early-phase clinical trial activity is measured as the gross number of phase I and phase II clinical trials to date per economy, as registered in the clinicaltrials.gov database, standardized per million population; Sources: Clinicaltrials.gov (2016); World Bank (2016). A more detailed discussion on the components of the biopharmaceutical R&D process is provided at: Pugatch Consilium (2014), *Scaling Up Global Clinical Trial Activity: Key Trends and Policy Lessons* (2014), pp. 14–18. Life sciences–related indicators consist of indicators falling under the Patent category of the GIPC Index (excluding patentability of computer-implemented inventions), as well as indicators in Trademarks and Market Access, Enforcement, and International Treaties categories that are relevant to life sciences (specifically: 1–2, 4–8, 15–21, 22–24, 25, 27–31, and 33–35).

15 Creative output is measured by the score of the Creative Outputs pillar of the Global Innovation Index, Innovative Output Subindex, which captures outputs such as exports of creative services, entertainment, media and ICT spending, and local creation of webpages and audiovisual content. Data are not available for Brunei and Taiwan. Source: WIPO/INSEAD/Cornell, Global Innovation Index 2016. Copyright-related indicators consist of indicators falling under the Copyright category of the GIPC Index, as well as those indicators in Enforcement and International Treaties that are relevant to copyrights (specifically: 9–14, 23–24, 25–31, 32, and 35).

16 Online creativity is measured by the score of the Online Creativity subpillar of the Creative Outputs pillar under the Innovative Output Subindex of the Global Innovation Index, which captures local creation of webpages and online audiovisual content. Data are not available for Brunei and Taiwan. Source: WIPO/INSEAD/Cornell, Global Innovation Index 2016.

17 Availability of licensed online music services is measured by the number of online licensed music services per country that offer music as a download, stream, or ringtone, based on information from local industry groups compiled by the International Federation of the Phonographic Industry. Source: Pro-Music.org (2016).

18 Data are not available on Brunei, Chile, Kenya, Pakistan, Saudi Arabia, Taiwan, and Vietnam. Sources: UNESCO Institute for Statistics (2016); World Bank (2016). Creative content–related indicators consist of indicators falling under the Copyright category, as well as relevant indicators in Enforcement and International Treaties (specifically: 9–13, 22–24, 25, 27–31, 32, and 35).

19 VOD and streaming services penetration is gauged by responses to the question: "Thinking about the last month have you watched TV programs using VOD and streaming services?" in the Connected Consumer Survey 2016. Source: Google Consumer Barometer (2016).

20 See: IMS Health (2012), *Restoring Innovation as Global Pharma's Center of Growth: How to Optimize Clinical Trial Performance and Save $1 Billion Annually*, IMS White Paper (2012), p.1. Clinical trial intensity is measured as the gross number of clinical trials to date per economy, as registered in the clinicaltrials.gov database, standardized per million population. Sources: National Institutes of Health, Clinicaltrials.gov (2016); World Bank (2016).

21 IFPMA (2014), *The Pharmaceutical Industry and Global Health: Facts and Figures 2014,* (2014), p. 13.

22 Knowledge creation, impact, and diffusion is measured by the Global Innovation Index Innovation Output Subindex, Knowledge and Technology Outputs pillar score. This score comprises variables such as patenting activity, growth of high-tech businesses, and knowledge-based exports. Data are not available for Brunei and Taiwan. Source: Global Innovation Index 2016.

23 World Bank (2016), *Doing Business 2017: Equal Opportunity for All*, 14th edition (International Bank for Reconstruction and Development/World Bank 2016).

24 This correlation is based on an average of sovereign's "local currency LT" and "foreign currency LT" S&P credit ratings. A total of 28 possible ratings exist (ranging from the highest, AAA+, to the lowest, D). Each rating was assigned a numerical value and was then standardized to 100. In cases where the "local currency LT" and "foreign currency LT" ratings were adjacent (e.g., AA and AA+), the lower rating was used. Ratings for Algeria, Brunei, and UAE were not available.

25 The share of workforce employed in knowledge-intensive activities is measured by the sum of employees in categories 1 to 3 according to the International Standard Classification of Occupations as a percentage of the total employed. Categories 1 to 3 in this classification include managers, professionals and associate professionals, legislators and senior officials, administrative and managerial work¬ers, and clerical and related workers. Source: WIPO/INSEAD/Cornell, Global Innovation Index 2016.

26 The Impact Subindex of the Network Readiness Index measures economic and social impacts of ICT, including value added, employment, and access to public and private services. Source: World Economic Forum, INSEAD, Global Information Technology Report and Network Readiness Index 2016. ICT-related indicators consist of indicators falling under the Patent, Copyright, and Trade Secrets categories, as well as relevant indicators in Enforcement and International Treaties (specifically: 3, 8, 9–14, 20–21, 22–24, 25–31, 32, and 34–35).

27 BSA/INSEAD (2013), *Competitive Advantage: The Economic Impact of Properly Licensed Software* (2013). Data are not available on Taiwan and Brunei.

The U.S. Chamber of Commerce's Global Intellectual Property Center (www.theglobalipcenter.com) is working around the world to champion intellectual property rights as vital to creating jobs, saving lives, advancing global economic growth, and generating breakthrough solutions to global challenges.

The U.S. Chamber of Commerce is the world's largest business federation representing the interests of more than 3 million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations.

This report was conducted by Pugatch Consilium (www.pugatch-consilium.com) a boutique consultancy that provides evidence-based research, analysis, and intelligence on the fastest growing sectors of the knowledge economy. Authors of this report are Meir Pugatch, Rachel Chu, and David Torstensson.

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