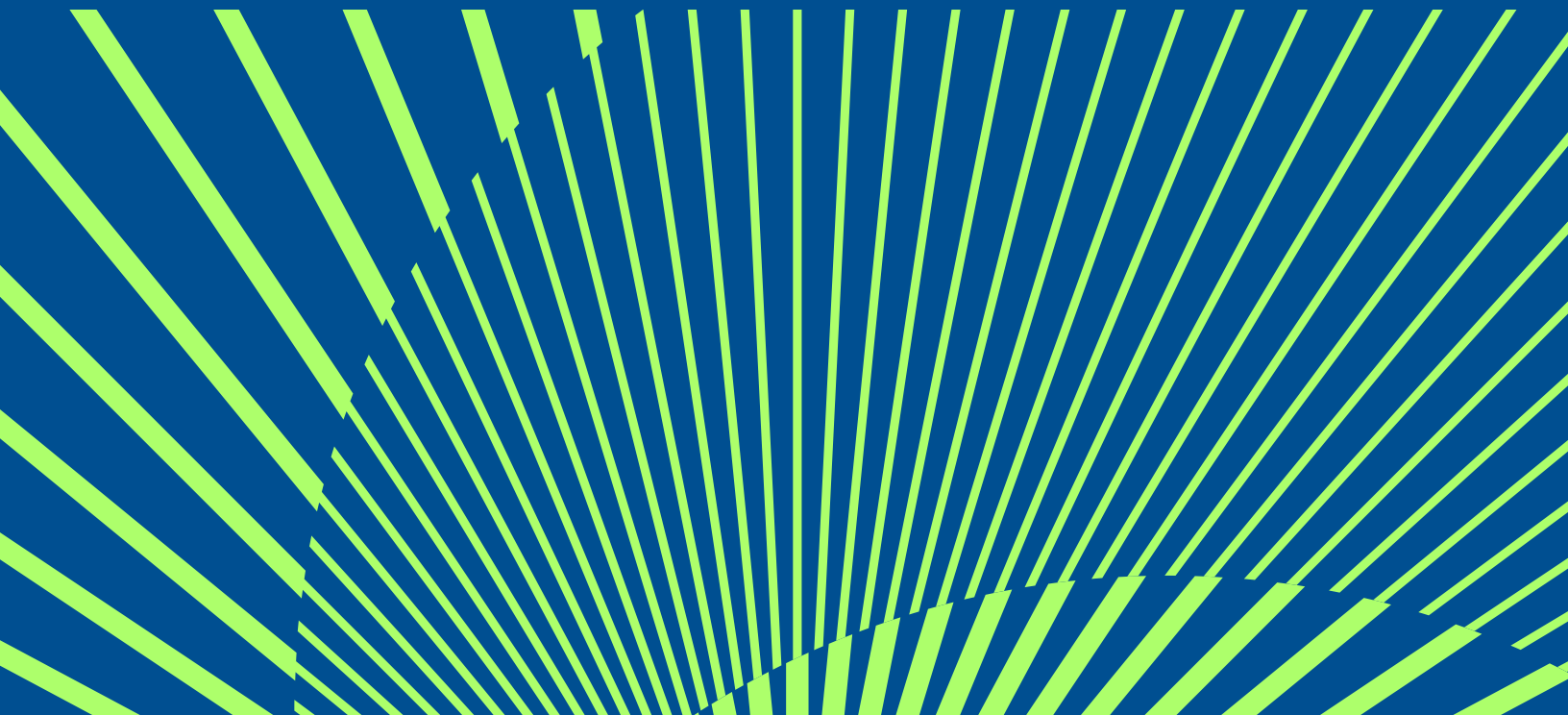
U.S. Chamber of Commerce
Global Innovation
Policy Center

2023 Eleventh Edition

International IP Index

Statistical Annex



Introduction

The Economic Rationale for IP Rights in a Post–COVID-19 World and Beyond

Since 2015, the International IP Index ("Index") has included a *Statistical Annex*, which investigates a series of correlations, or the statistical likelihood of two variables occurring together. The correlations examine the relationship between the strength of national IP environments, as measured by the Index scores, and different types of economic activity, including rates of R&D spending, innovation, technology creation, and creativity. The first *Annex*, which was published with the third edition of the Index, tested the relationships between the Index's scores of 30 economies and 15 economic variables. This year's *Annex* mirrors the growth of the wider Index and surveys the relationship between the Index's scores of 55 economies and a set of 31 economic variables, including two new variables produced by the Swiss business school International Institute for Management Development (IMD):

i. The *IMD World Competitiveness Ranking*

ii. The *IMD World Digital Competitiveness Ranking*

This represents an increase of more than 75% in the number of economies sampled and over a doubling in the number of economic variables included since the first edition of the *Annex*.

As more economies and social and economic variables have been added to the *Statistical Annex*, the picture becomes clearer: IP protection is a critical instrument for economies that seek 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 high-tech economic development. This is a particularly important message in light of the negative economic impact of the COVID-19 pandemic.

The 2023 *Statistical Annex*

This year's *Annex* and statistical correlations show, again, the strong, direct, and statistically significant relationship between the strength of the national IP environment as measured by the Index and rates of innovation, growth, and high-tech economic activity. Table 1 presents the main findings of the analysis in this year's *Annex*, including the two new correlations added.

Table 1: Economic Benefits Of Improving Ip Protection: Findings From 31 Correlations

	Strength of correlation					Economies with robust IP protection (scoring above 50% on the Index) on average tend to experience the following benefits compared with economies scoring below 50%
	2018	2019	2021	2022	2023	
Readiness for the Fourth Industrial Revolution						
Drivers of production	NA	.85[A1]	0.83	0.84	0.83	50% more likely to adapt to the Fourth Industrial Revolution and secure new growth opportunities
Technology & innovation	NA	0.87	0.85	0.85	0.84	54% more likely to be able to transform their economies using sophisticated, state-of-the-art technologies
Global trade & investment	NA	0.71	0.7	0.71	0.7	40% more open for business and attractive to foreign investment
Resources to innovate						
Innovation capability	NA	0.88	0.87	0.87	0.85	78% more likely to maintain sophisticated environments capable of producing innovative outputs
Enabling infrastructure	NA	0.79	0.79	0.82	0.82	62% more likely to experience the benefits of an innovation-driven economy, ranging from highly skilled and highly paid workers to increased R&D activity
Availability of R&D funding	0.71	0.71	0.69	0.7	0.69	32% more likely to see private sector investment in R&D activities

	Strength of correlation					Economies with robust IP protection (scoring above 50% on the Index) on average tend to experience the following benefits compared with economies scoring below 50%
	2018	2019	2021	2022	2023	
Access to venture capital and private equity funds	0.79	0.78	0.75	0.79	0.78	46% more likely to attract venture capital and private equity funds compared with economies whose IP regimes lag behind
Availability of skilled researchers	0.82	0.81	0.8	0.84	0.83	Over five times more likely to have highly skilled researchers in a given labor force
Talent competitiveness	NA	0.82	0.82	0.86	0.85	54% more competitive human capital
Quality of local scientific and technical knowledge	NA	0.85	0.83	0.84	0.82	Over five times more knowledge output in terms of scientific and technical journal articles
Growth of knowledge-based economies	0.83	0.83	0.85	0.82	0.85	34% more likely to fully leverage information and communications technology (ICT)
Global networking impact	NA	0.84	0.84	0.82	0.8	47% more likely to support a dynamic ICT sector and to experience the indirect benefits it generates
Outputs of a competitive knowledge-based economy						
Global competitiveness—IMD ranking	NA	NA	NA	NA	0.69	Economies are 25–40% more competitive
Global competitiveness—World Economic Forum ranking	NA	0.86	0.86	0.85	0.84	
Digital competitiveness	NA	NA	NA	NA	0.75	Economies are 41% more digitally competitive

	Strength of correlation					Economies with robust IP protection (scoring above 50% on the Index) on average tend to experience the following benefits compared with economies scoring below 50%
	2018	2019	2021	2022	2023	
Economic complexity	NA	0.82	0.77	0.7	0.69	Significantly more likely to produce and export complex, knowledge-intensive products
Innovation	0.86	0.85	0.85	0.76	0.84	More than double the innovation output as measured by the *Global Innovation Index*
Triadic patenting	0.68	0.65	0.64	0.65	0.64	Over 600 more high-value inventions per million population
Employment in knowledge-intensive sectors	0.67	0.69	0.73	0.75	0.7	Share of workforce employed in knowledge-intensive sectors is 67% higher
Growth of high-tech sectors	0.75	0.79	0.76	0.74	0.78	Produce 94% more knowledge and technology outputs
Biotech innovation	0.78	0.79	0.81	0.82	0.81	More than twice as likely to provide environments conducive to biotech innovation
Biomedical activity	0.72	0.73	0.74	0.74	0.74	Over 10 times more clinical trial activity
Cutting-edge clinical trials	0.73	0.76	0.77	0.78	0.77	Over 17 times more early-phase clinical trials
Development of biotech therapies	0.76	0.77	0.77	0.77	0.76	Over 11 times more clinical research on biologic therapies
Value added and creativity						
Creative outputs	0.84	0.82	0.79	0.8	0.78	82% more likely to benefit from the growth in both volume and value of the dynamic content and media sectors

	Strength of correlation					Economies with robust IP protection (scoring above 50% on the Index) on average tend to experience the following benefits compared with economies scoring below 50%
	2018	2019	2021	2022	2023	
Online creativity	0.84	0.81	0.81	0.81	0.79	Generating over five times more online and mobile content
Added value of licensed software	0.82	0.81	0.77	0.77	0.77	Higher contribution of licensed software to gross domestic product (GDP)
Global reach of local brands	NA	0.86	0.76	0.77	0.76	Almost 40% higher levels of international trademark applications
Access to licensed music outlets	0.79	0.75	0.75	0.74	0.75	Almost double the access to new music through legitimate and secure platforms
VOD penetration	0.66	0.66	0.65	0.65	0.66	Generates more than twice as many video-on-demand and streaming services
Consumption of audiovisual content	0.72	0.72	0.69	0.69	0.7	Generates almost double the number of theatrical screenings of feature films

Methodology

The Pearson correlation coefficient is the statistical analysis used to test the relationship between the Index's scores and other economic variables in this *Annex*. Simply put, the Pearson correlation coefficient is a widely used statistical method of establishing whether two variables are related to each other. 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.

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

- 0.00 to 0.19: very weak
- 0.20 to 0.39: weak
- 0.40 to 0.59: moderate
- 0.60 to 0.79: strong
- 0.80 to 1.0: very strong

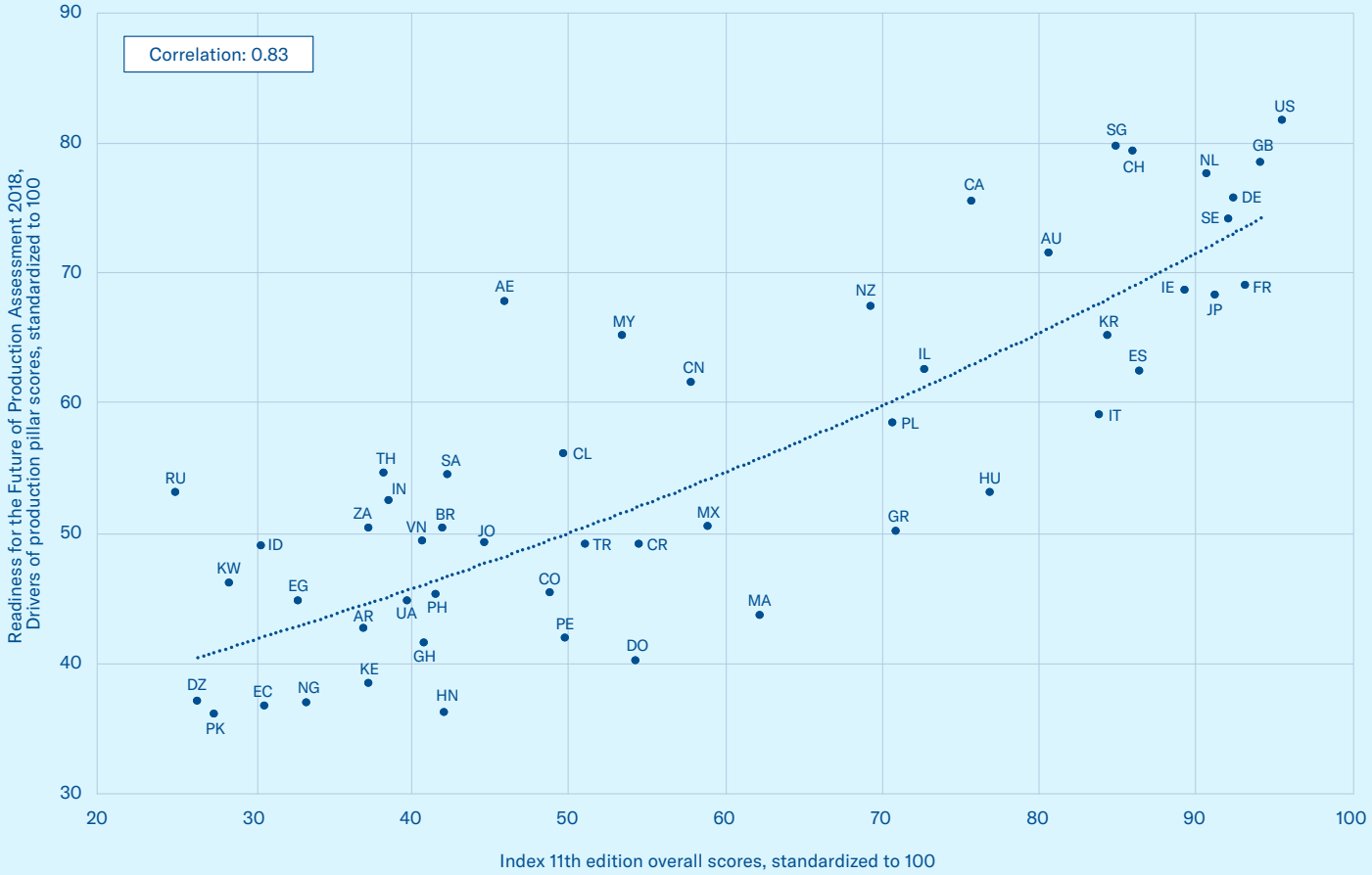
Each individual test of the correlation between two variables was performed under a confidence level of 0.95, which means that if this procedure were repeated on multiple samples, the calculated confidence interval (i.e., a range estimation that is calculated from the observation and therefore would 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 implies that a linear relationship exists between the two variables, the nature of which depends on the variables.

Readiness for the Fourth Industrial Revolution

Economies with Robust IP Environments Are Significantly Better Positioned to Capitalize on the Fourth Industrial Revolution

Figure 1: Association Between The Index Scores And The Readiness For The Future Of Production Assessment, Drivers Of Production Pillar Scores[1]



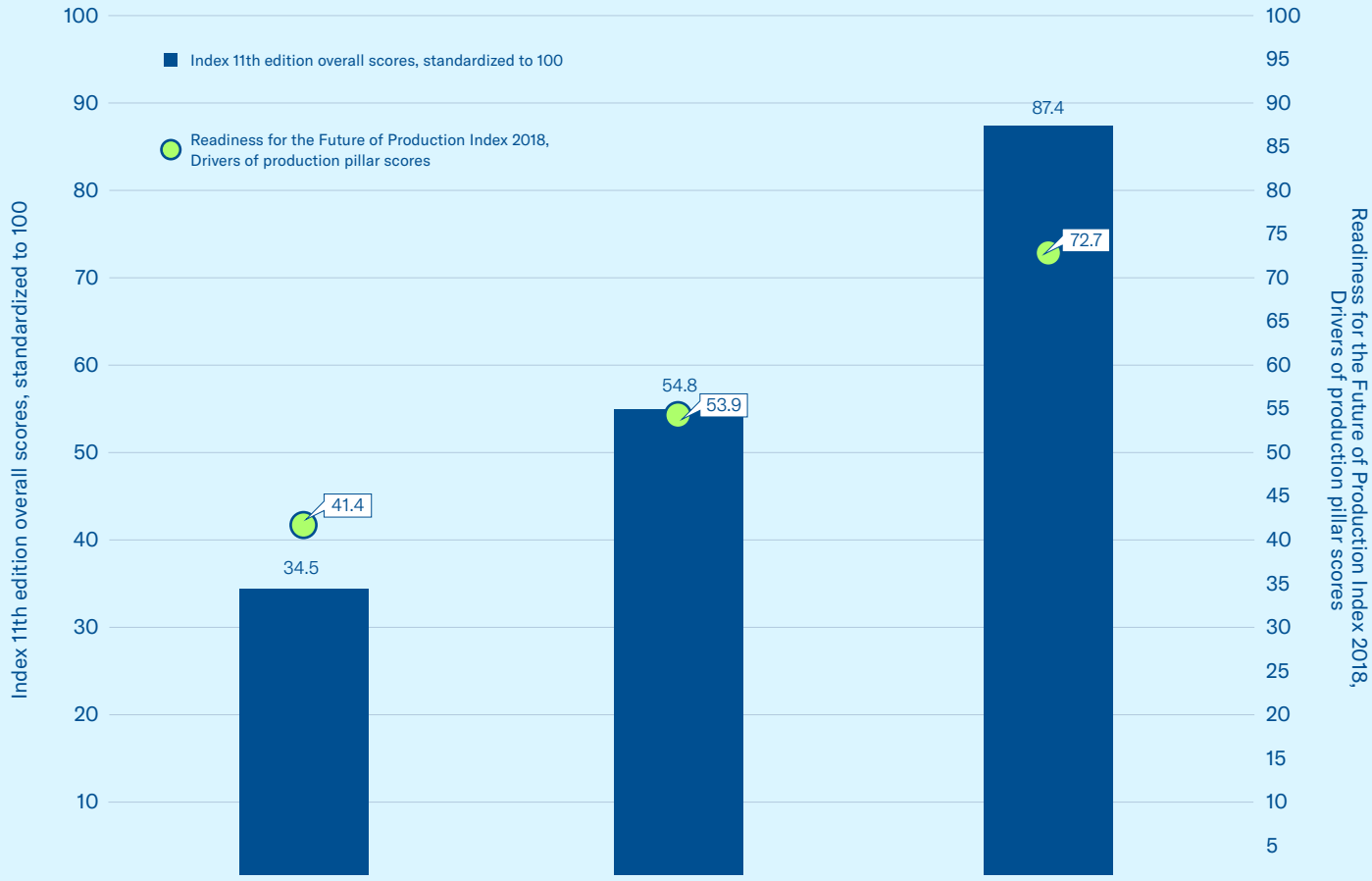
Data not available for Brunei, Taiwan, and Venezuela.

- The Readiness for the Future of Production Assessment's Drivers of Production pillar scores gauge performance in key sectors and themes that enable economies to capitalize on emerging technologies to compete in future production systems. Those Readiness Assessment scores display a strong association—a correlation of 0.83—with the Index scores.

- This relationship adds to the strength of the overall findings of the *Statistical Annex* to date, namely, that robust IP protection is a critical component of the 21st-century knowledge-based economy.

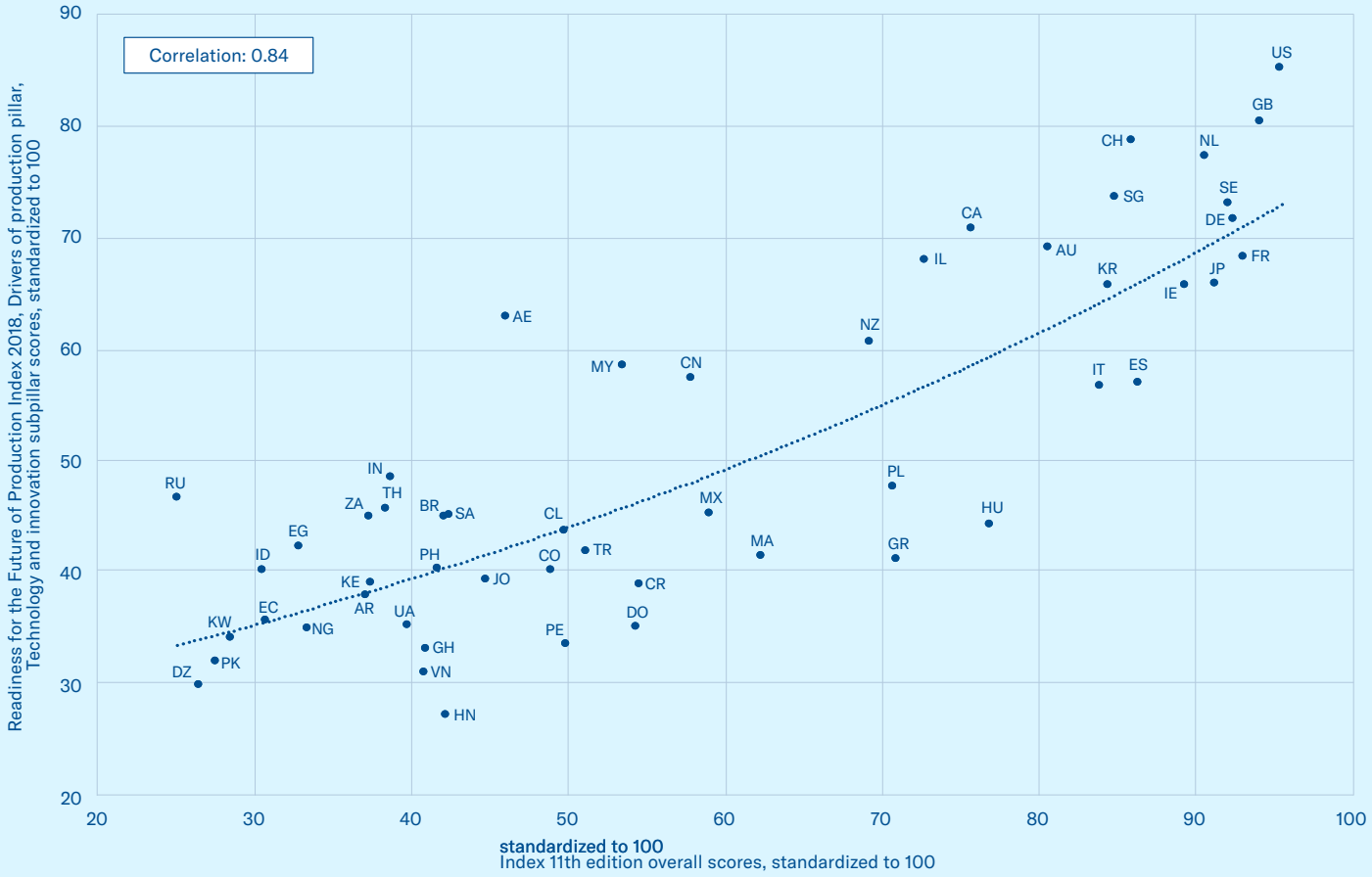
- In fact, a positive stepwise improvement can be seen across both measures. Economies with robust IP environments are 50% more likely to adapt to the Fourth Industrial Revolution and to secure new growth opportunities.

Figure 2: Association Between The Index Scores And The Readiness For The Future Of Production Assessment 2018, Driver Of Production Pillar Scores: Division By Thirds In Index Scores, Average Scores Per Third



A Strong IP Framework Equals Greater Capacity for Innovation and Technological Absorptive Capacity

Figure 3: Association Between The Index Scores And The Readiness For The Future Of Production Assessment, Drivers Of Production Pillar, Technology & Innovation Subpillar Scores[2]

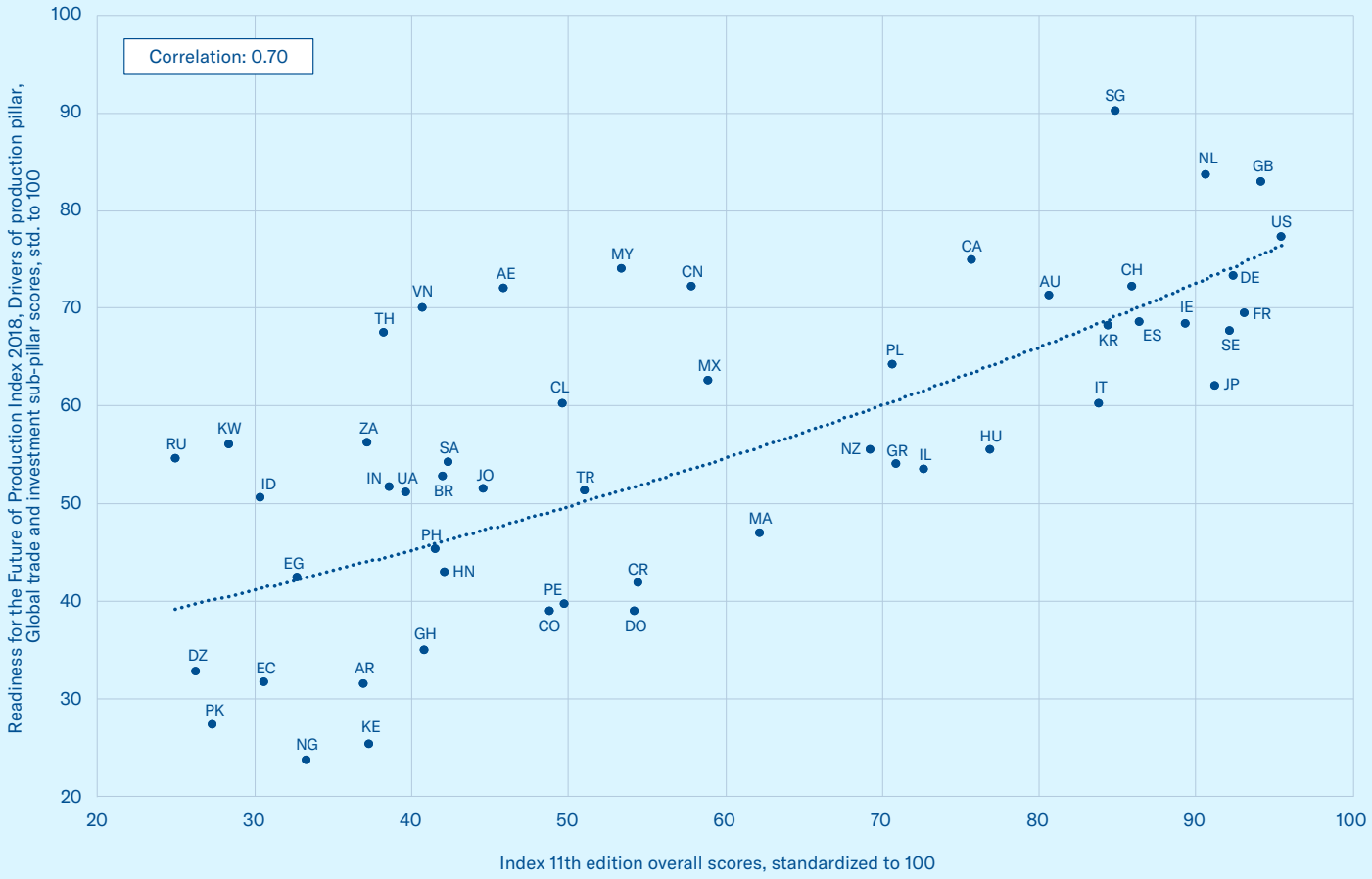


Data not available for Brunei, Taiwan, and Venezuela.

- The Readiness for the Future of Production Assessment's Technology & Innovation subpillar measures the extent to which an economic production system is advanced, digitally secure, globally connected, and interoperable, which is critical for economies to foster and commercialize new and innovative technologies.
- The Index exhibits a very strong correlation of 0.84 to the Technology & Innovation subpillar scores. In fact, economies with strong IP systems are 54% more likely to be able to transform their economies using sophisticated, state-of-the-art technologies compared with economies whose IP systems require improvement.

Favorable IP Regimes Promote Trade Openness and Attractiveness to Foreign Investments

Figure 4: Association Between The Index Scores And The Readiness For The Future Of Production Assessment, Global Trade & Investment Subpillar Scores[3]



Data not available for Brunei, Taiwan, and Venezuela.

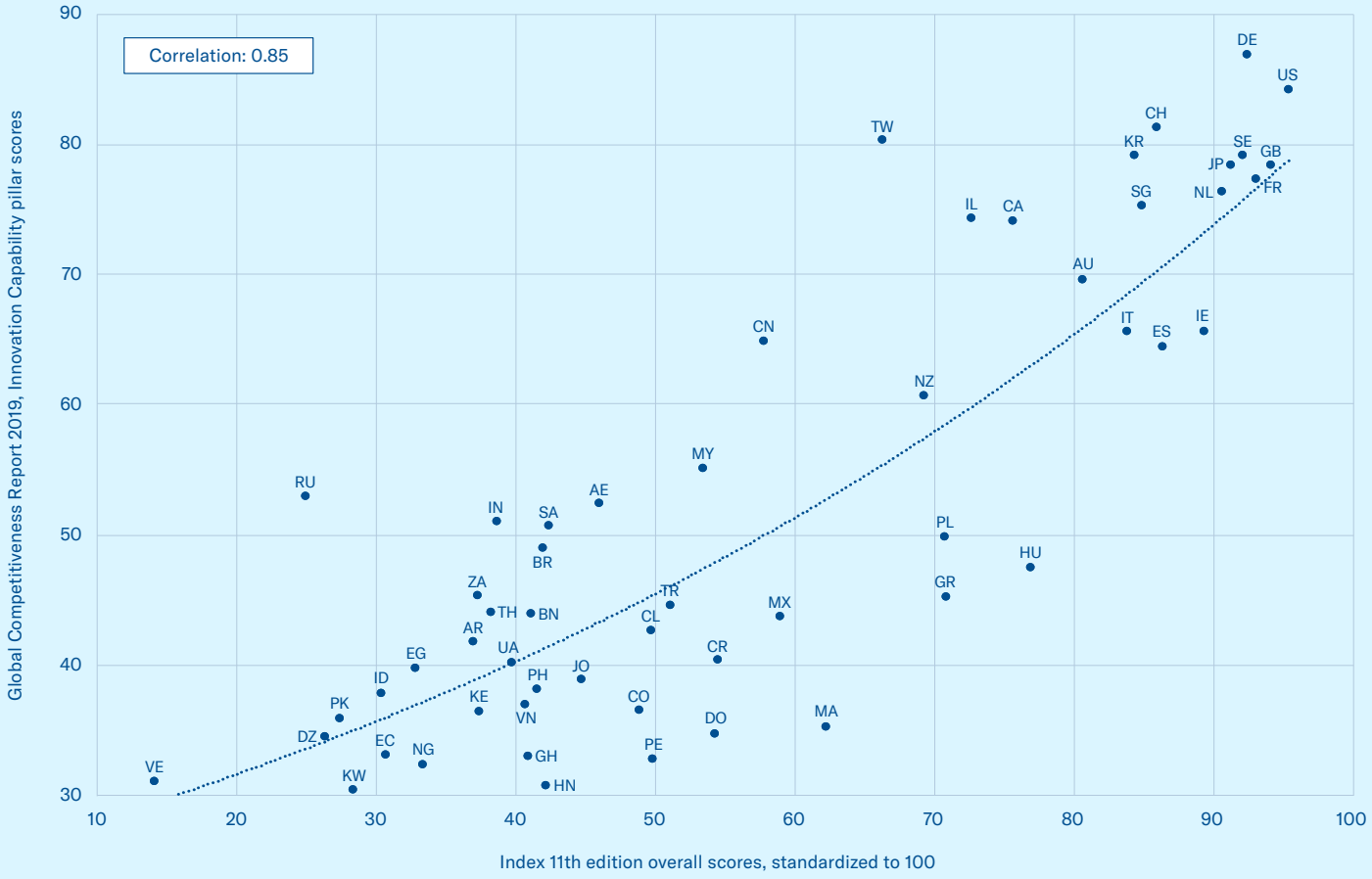
- The Readiness for the Future of Production Assessment's Global Trade & Investment subpillar measures economies' levels of openness to international trade and the availability of capital directed to production-related development. There is a strong relationship (at a correlation strength of 0.70) to the Index scores, which suggests that the strength of a national IP environment contributes to economies' ability to bolster knowledge and skill attainment, increase technology transfer, and boost productivity and competitiveness.

- Economies with fair to strong IP environments are 40% more open for business and attractive to foreign investments in their production systems compared with weaker economies.

Resources to Innovate

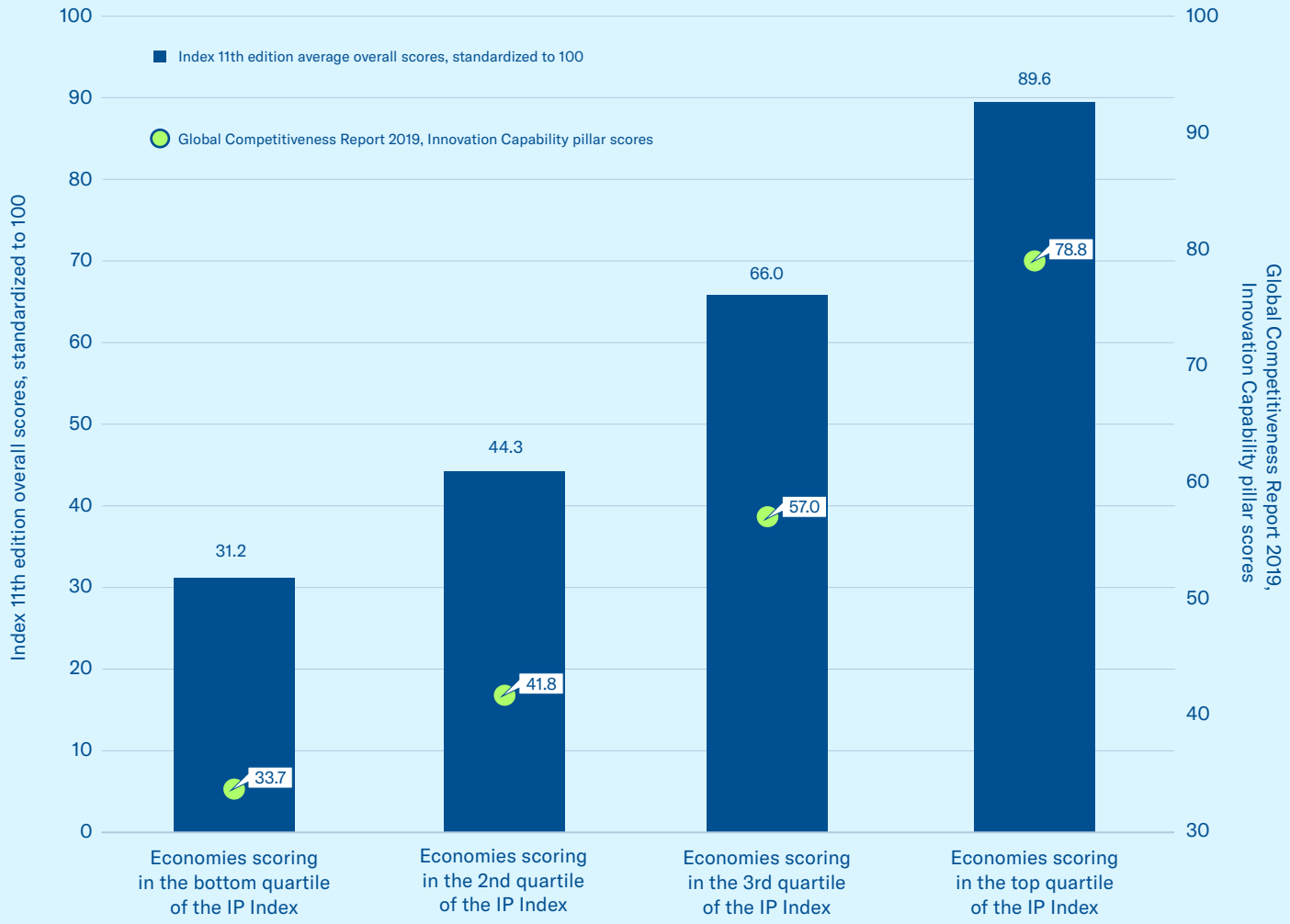
Robust IP Protection Is a Key Component in Developing a Strong Innovation Capability

Figure 5: Association Between The Index Scores And The *Global Competitiveness Report 2019*, Innovation Capability Pillar Scores[4]



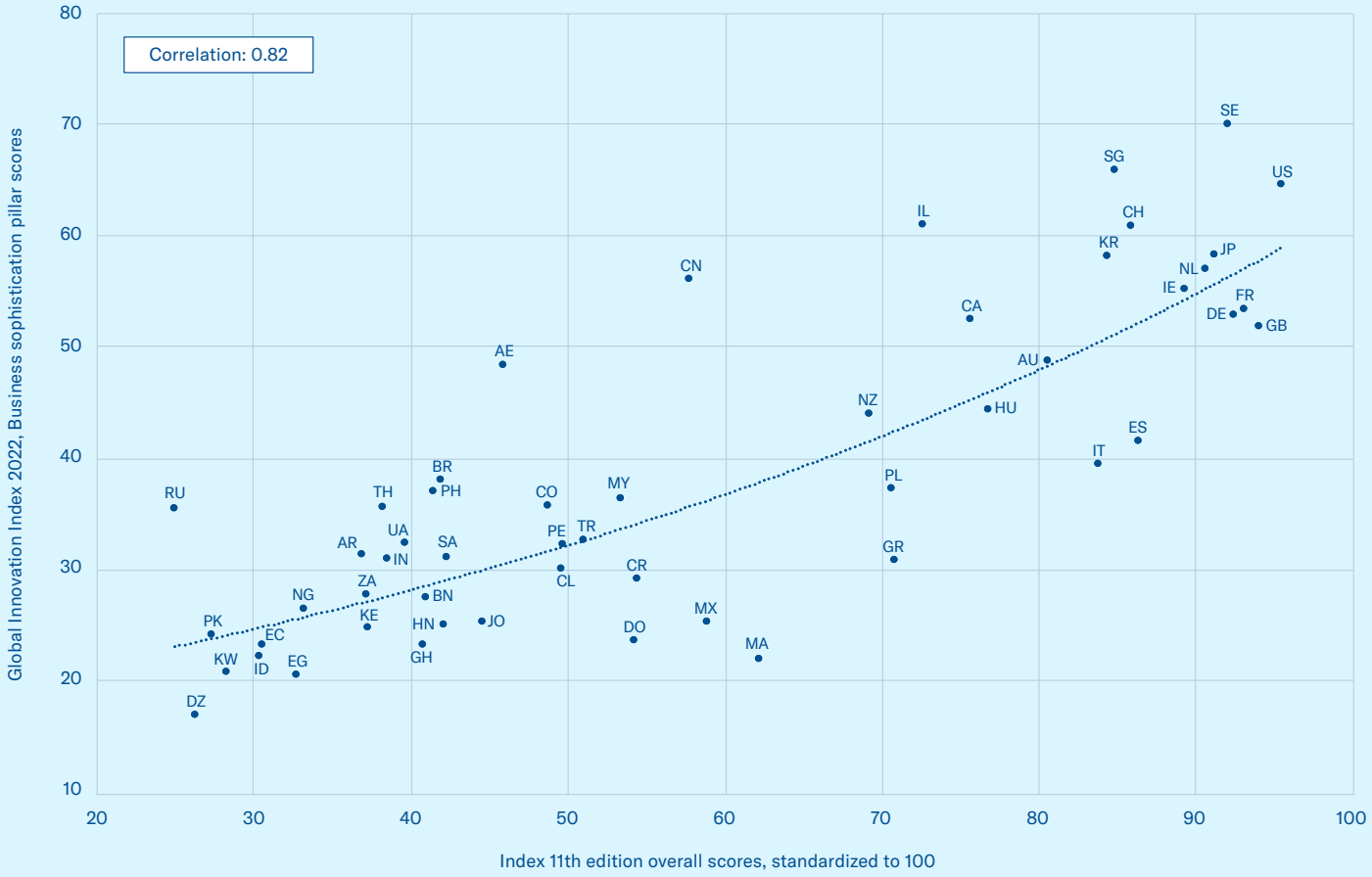
- A very strong relationship (a correlation of 0.85) was found between the Index scores and the *Global Competitiveness Report's* Innovation Capability pillar scores.
- Economies with fair to strong IP regimes are on average 78% more likely to maintain an environment capable of producing innovative outputs compared with weaker economies.
- The link between the two variables is strong when looking at group averages by quartiles of Index scores. Economies scoring in the third and fourth quartiles of the Index are much more capable of innovating and benefiting from local innovation activities compared with economies scoring in the second and first quartiles of the Index.

Figure 6: Association Between The Index Scores And The *Global Competitiveness Report 2019*, Innovation Capability Pillar Scores: Division By Quartiles In Index Scores, Average Scores Per Quartile



Supportive IP Regimes Are Essential for Creating Environments Conducive to Innovation

Figure 7: Association Between The Index Scores And The *Global Innovation Index* 2022, Business Sophistication Pillar Scores[5]

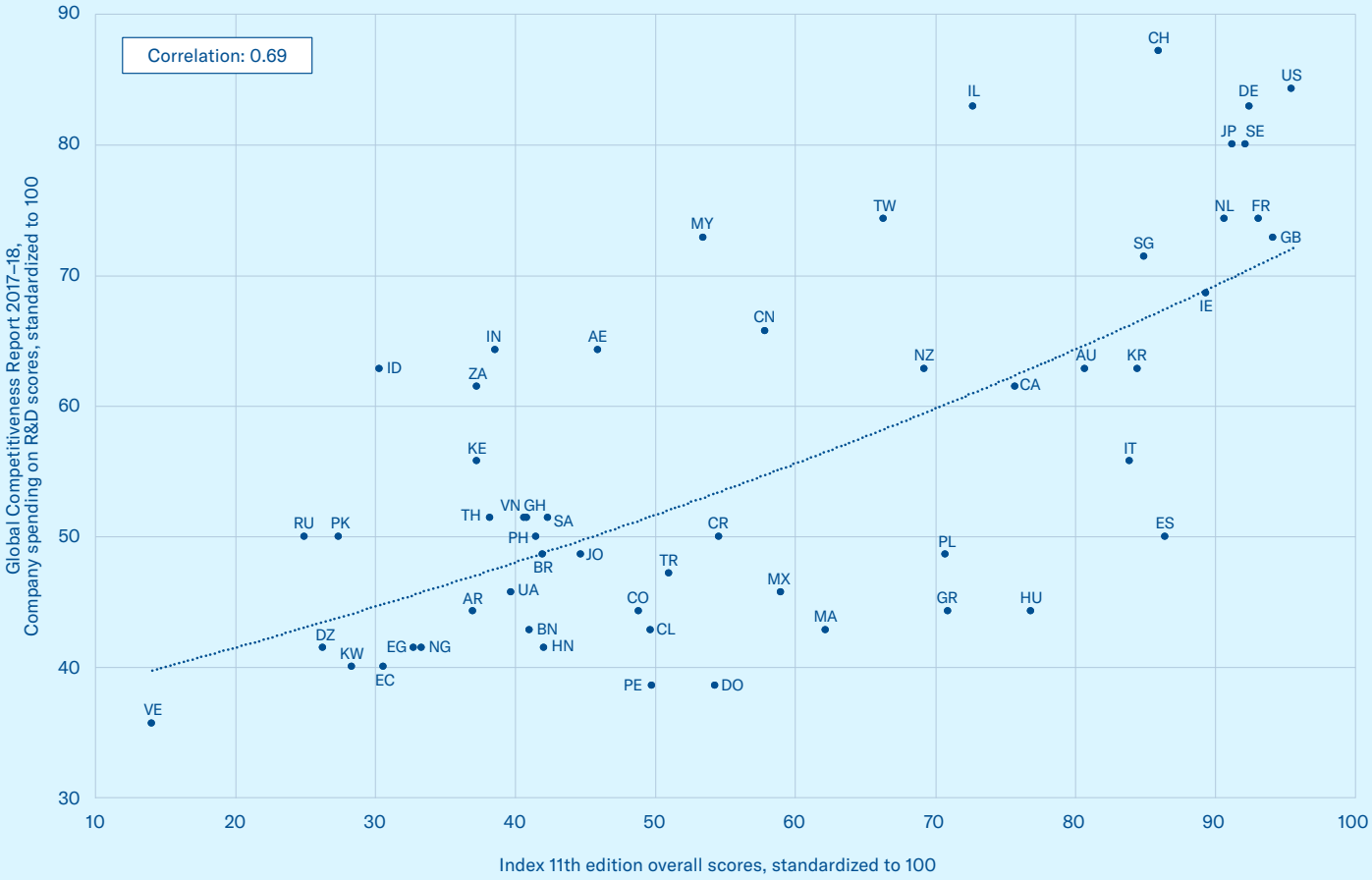


Data not available for Taiwan and Venezuela.

- The *Global Innovation Index's* Business Sophistication pillar measures the availability of competent talent, levels of innovation linkages and infrastructure, and levels of foreign direct investment (FDI) and reliance on high-tech imports. There is a very strong correlation of 0.82 to the Index scores.
- As a result, economies with strong IP protection are 62% more likely to experience the benefits of an innovation-driven economy, ranging from more highly skilled and highly paid workers to increased R&D activity.

Companies Are More Likely to Spend on R&D in Favorable IP Environments

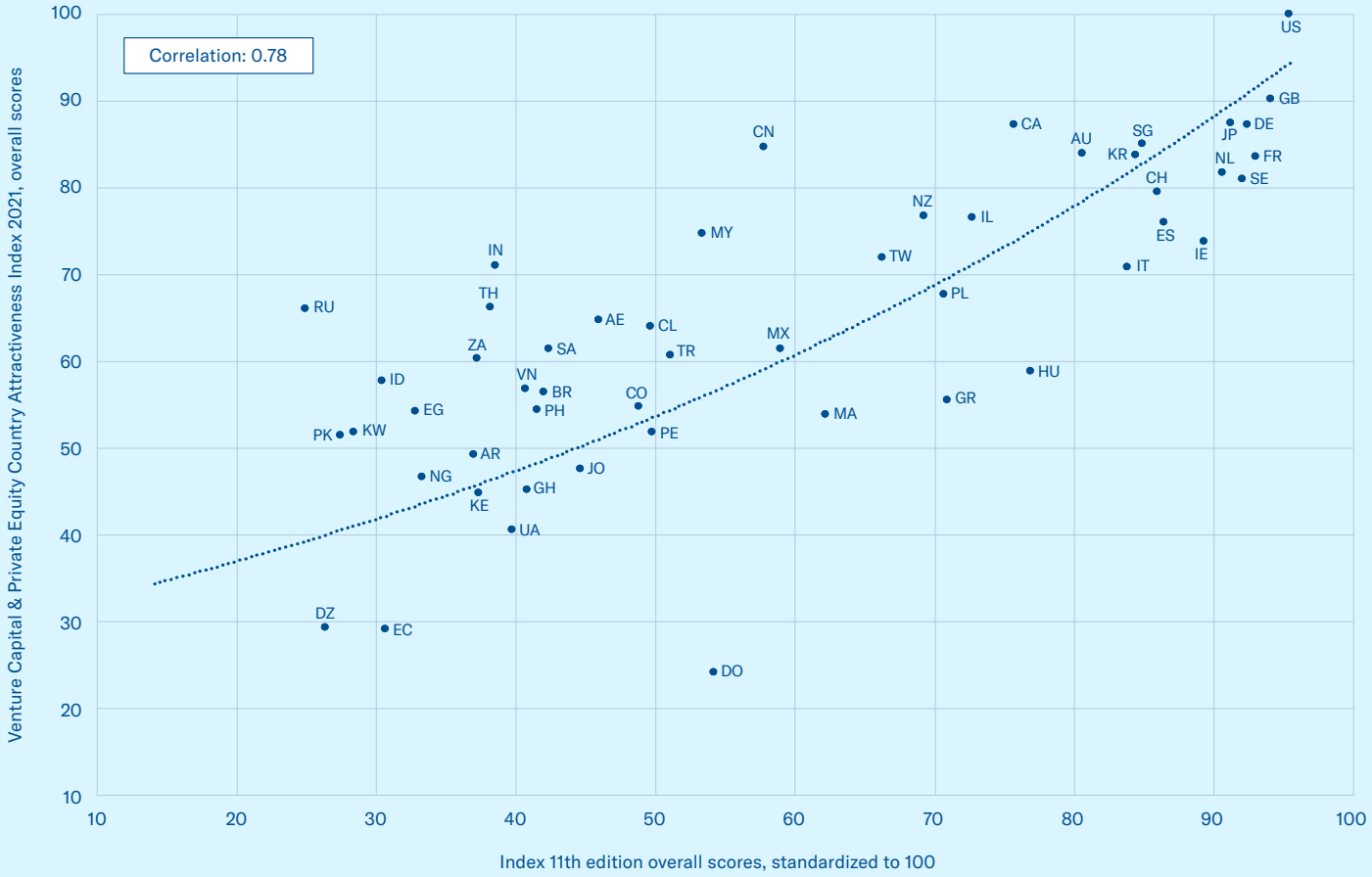
Figure 8: Association Between Index Scores And The *Global Competitiveness Report 2017–18*, Company Spending On R&D Scores[6]



- A strong correlation of 0.69 exists between the Index scores and private sector propensity to spend on R&D.
- Economies with robust IP environments, scoring over 50% on the Index, are 32% more likely to see private sector investment in R&D activities compared with companies in economies with less supportive IP environments.

Economies with Robust IP Regimes Are More Attractive to Investors

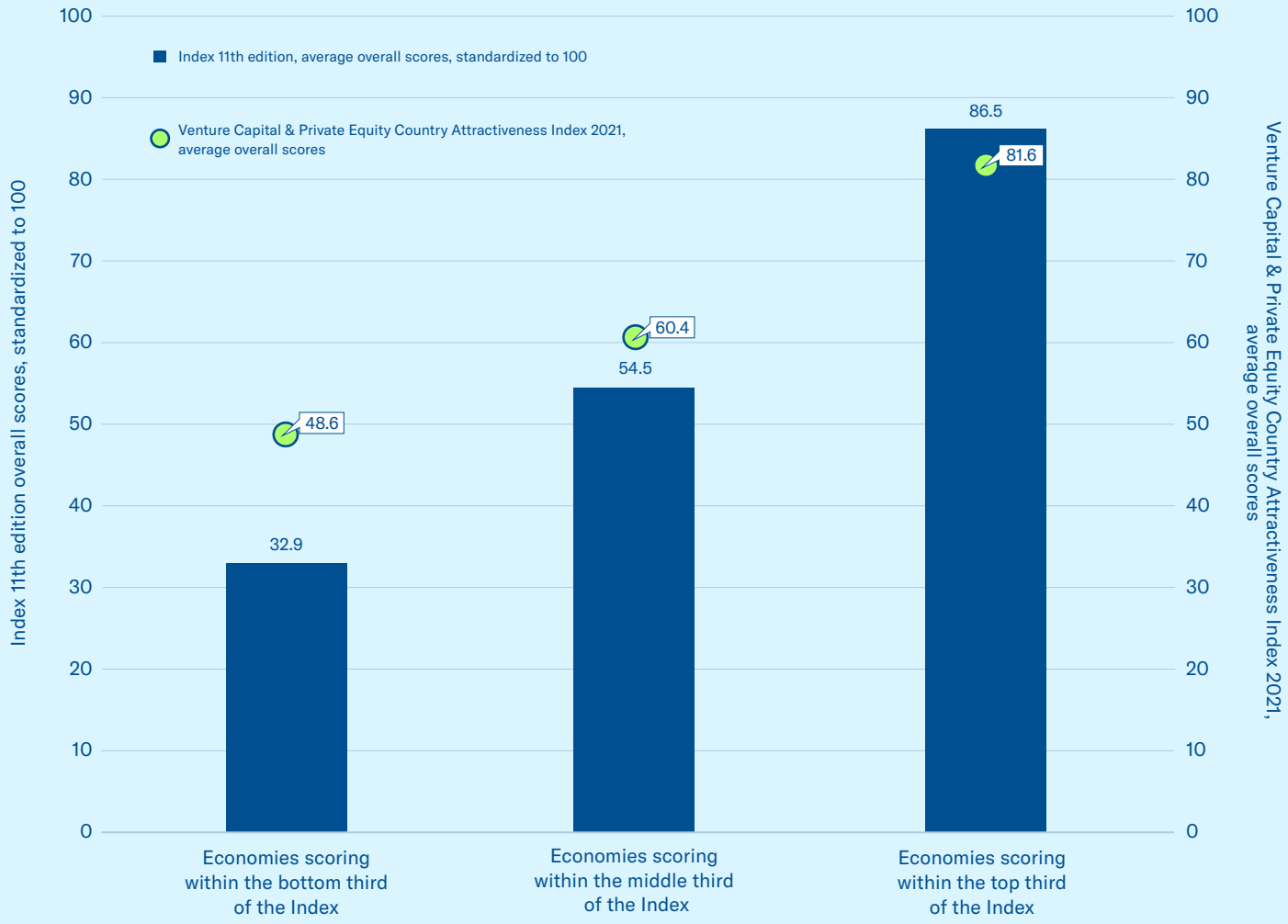
Figure 9: Association Between The Index Scores And The *Venture Capital & Private Equity Country Attractiveness Index* 2021 Scores[7]



Data not available for Brunei, Costa Rica, and Honduras.

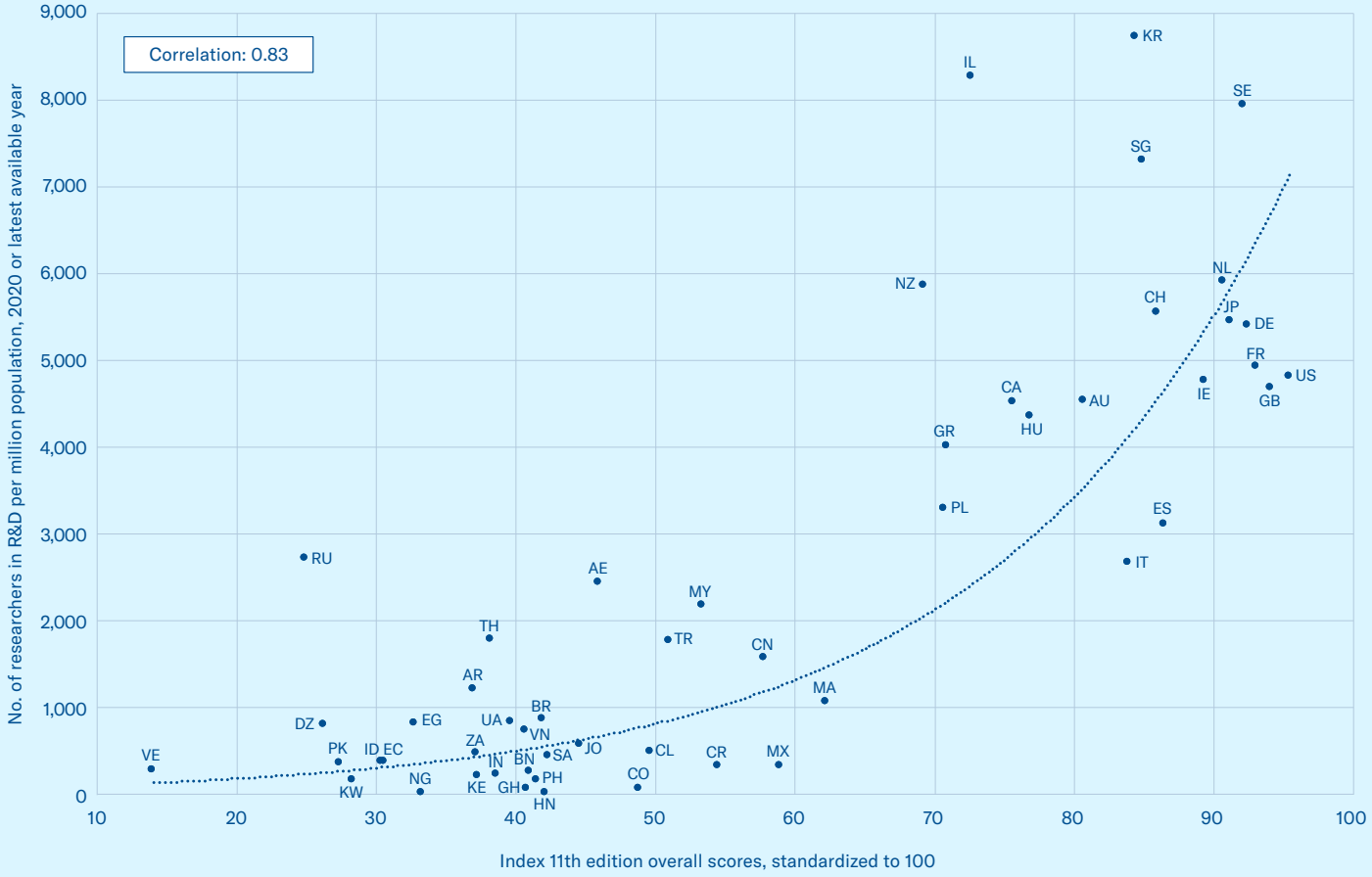
- There is a strong correlation of 0.78 to the IESE and EMLYON Business Schools' Venture Capital & Private Equity Attractiveness Index scores.
- Innovators and companies in economies with higher Index scores and stronger national IP environments are 46% more likely to attract venture capital and private equity funds compared with economies whose IP regimes lag behind.

Figure 10: Association Between The Index Scores And The *Venture Capital & Private Equity Country Attractiveness Index* Scores: Division By Thirds In Index Scores, Average Scores Per Third



Strong IP Environments Encourage the Development of Human Capital

Figure 11: Association Between Index Scores And The Number Of Researchers In R&D Per Million Population[8]

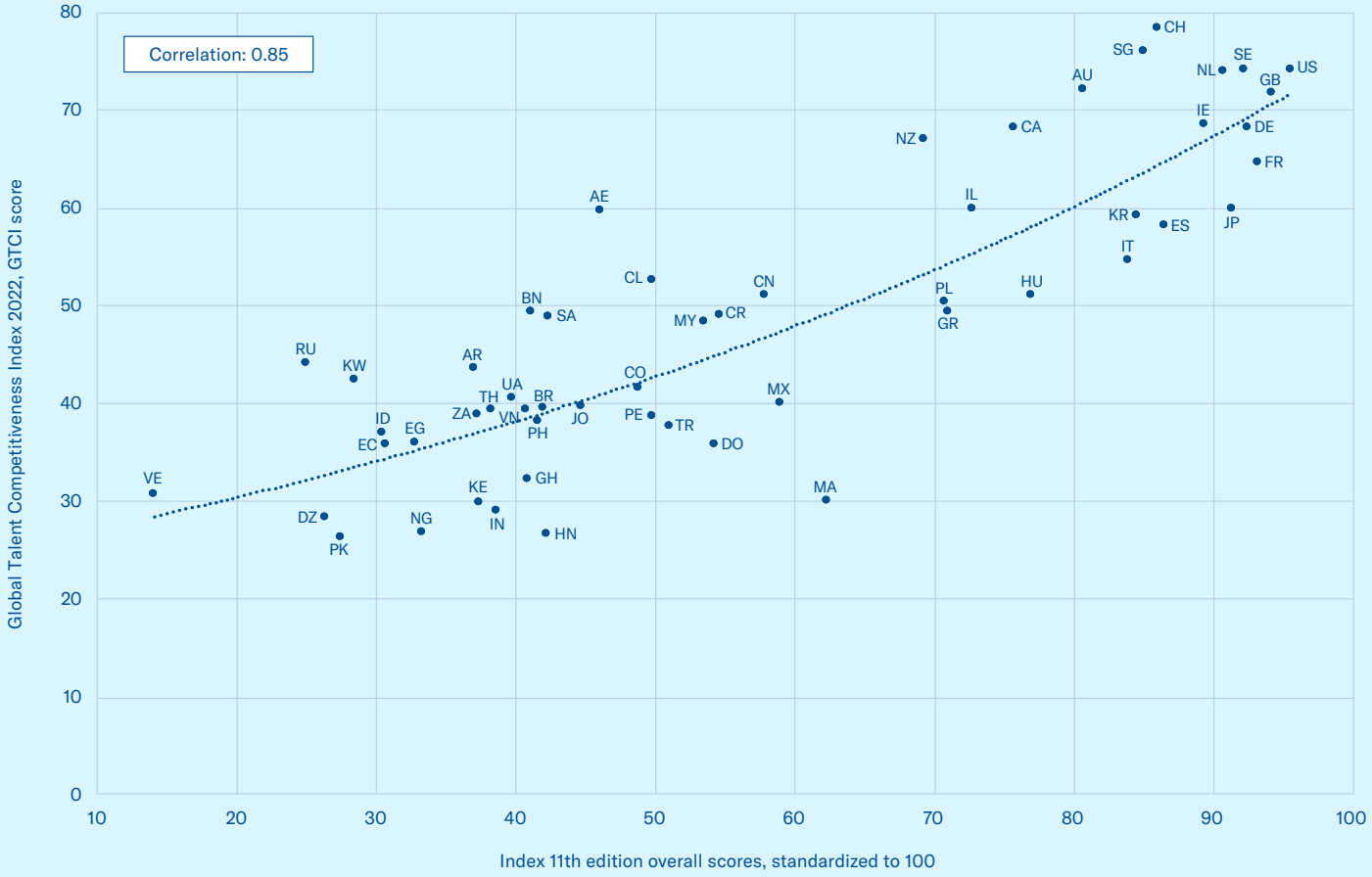


Data not available for Dominican Republic, Peru, and Taiwan.

- The relationship between the Index scores and levels of human capital has remained very strong (a correlation strength of over 0.80) over the past six editions of the *Annex*.
- Economies with favorable IP regimes are over five times more likely to have highly skilled researchers in a given labor force.

Favorable IP Environments Are Better Positioned for Competing in the Global Innovation Arena

Figure 12: Association Between The Index Scores And The *Global Talent Competitiveness Index* 2022[9]



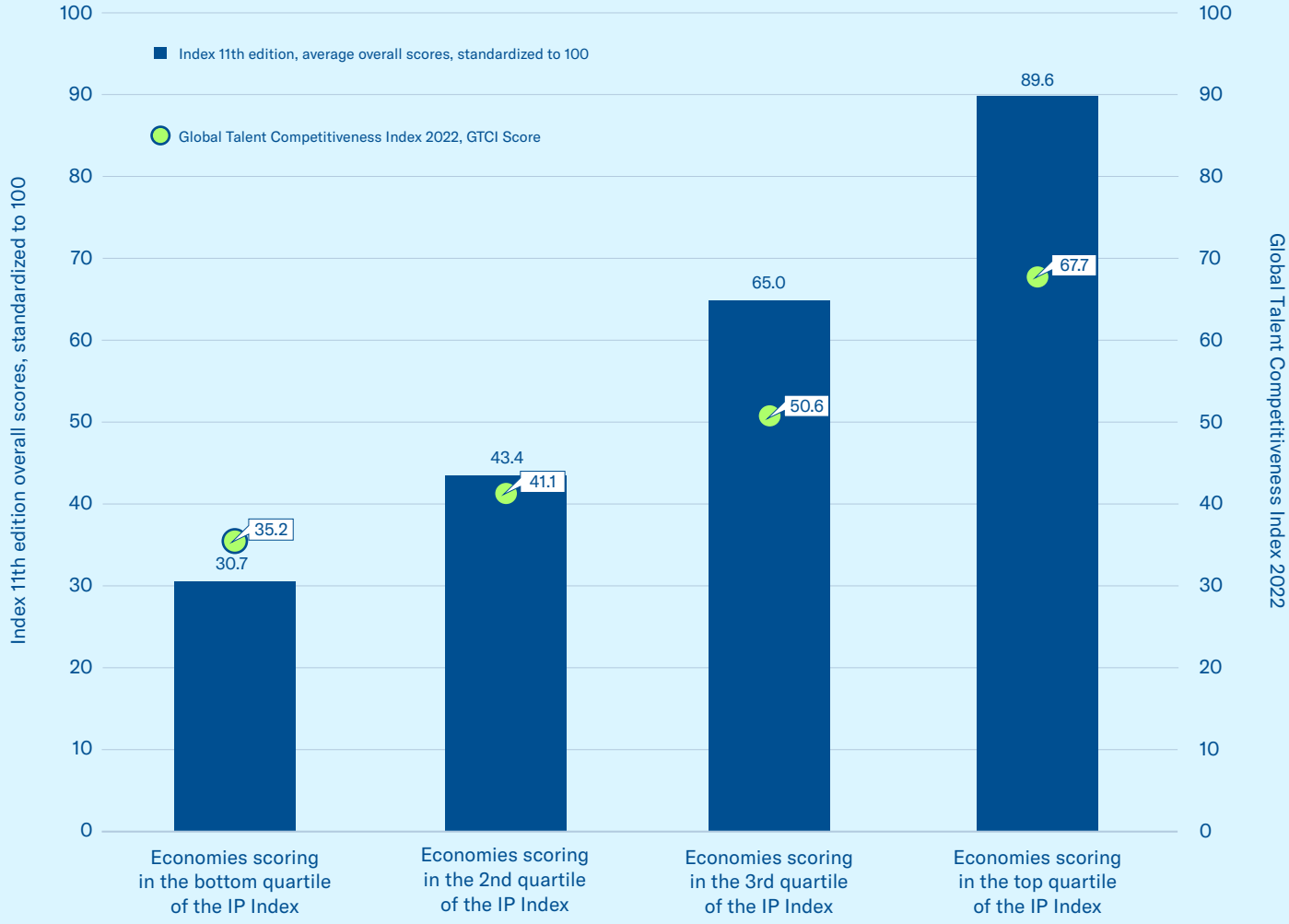
Data not available for Taiwan.

- IP protection displays a very strong relationship—at a correlation strength of 0.85—with economies' performance on the *Global Talent Competitiveness Index*. The latter benchmarks economies' ability to develop, attract, and empower human capital and measures both inputs (such as enabling landscape, market openness, quality of learning, and sustainability) and outputs (such as mid- and high-level skills and overall talent impact).

- Economies with higher Index scores are 54% more competitive on the *Global Talent Competitiveness Index* than are weaker economies.

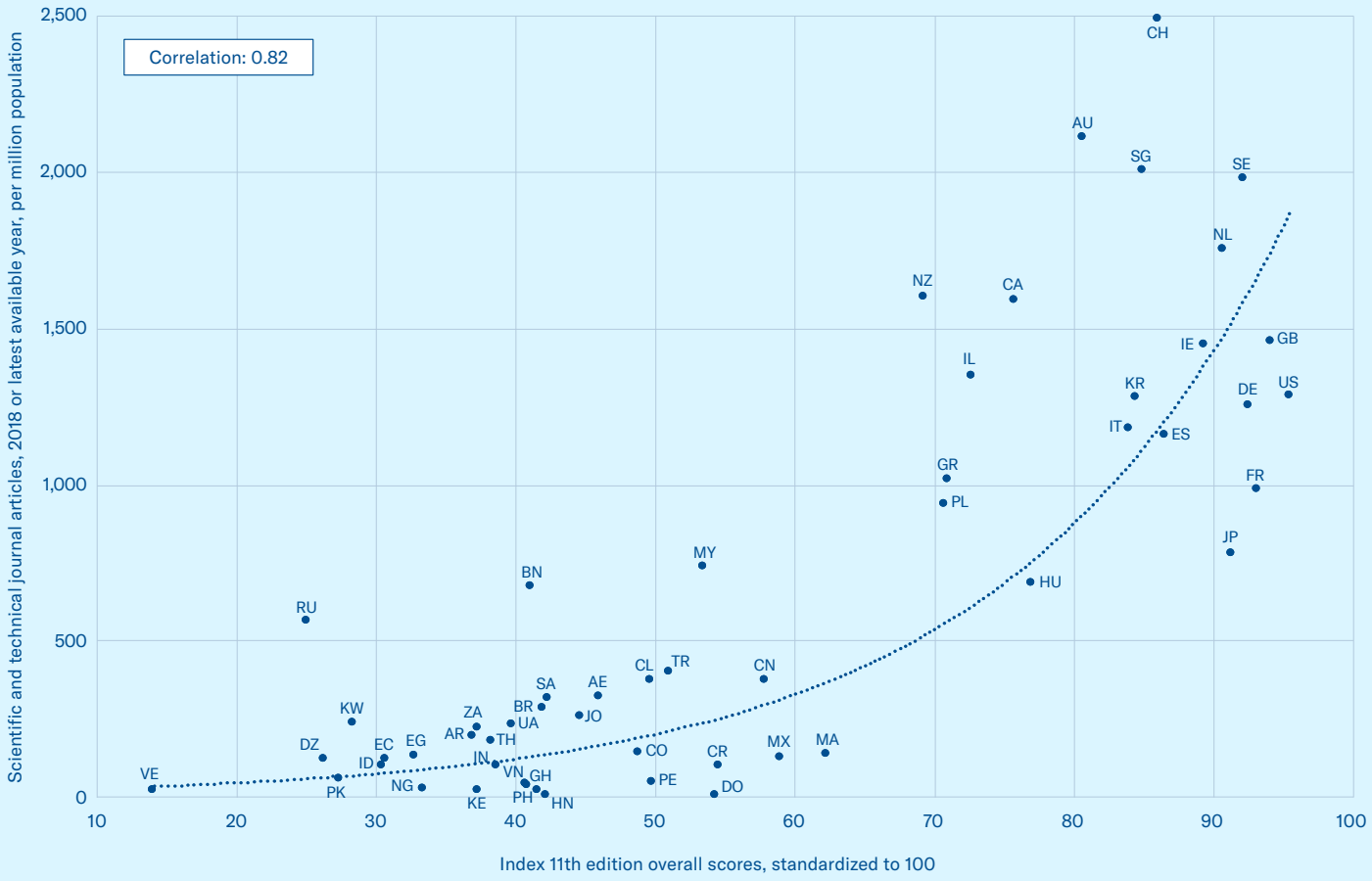
- When dividing the Index scores into quartiles, a corresponding stepwise increase is revealed in economies' talent competitiveness, which suggests that the overall strength of economies' IP protection goes hand in hand with the development of a strong and competitive workforce.

Figure 13: Association Between The Index Scores And The *Global Talent Competitiveness Index* 2022 Rankings: Division By Quartiles In Index Scores, Average Scores Per Quartile



Supportive IP Frameworks and Science and Technology Knowledge Production

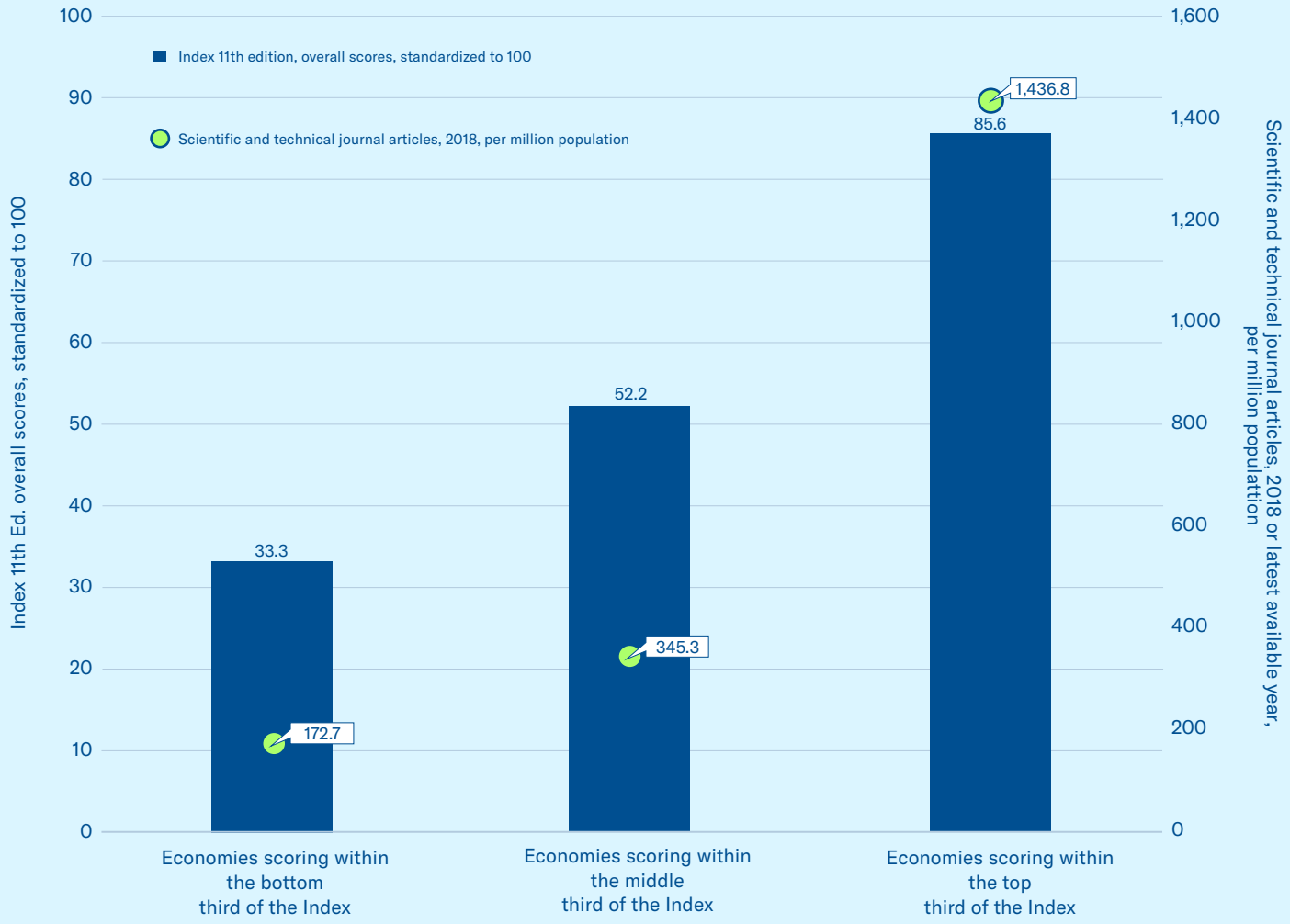
Figure 14: Association Between The Index Scores And The Number Of Scientific And Technical Journal Articles Per Million Population[10]



Data not available for Taiwan.

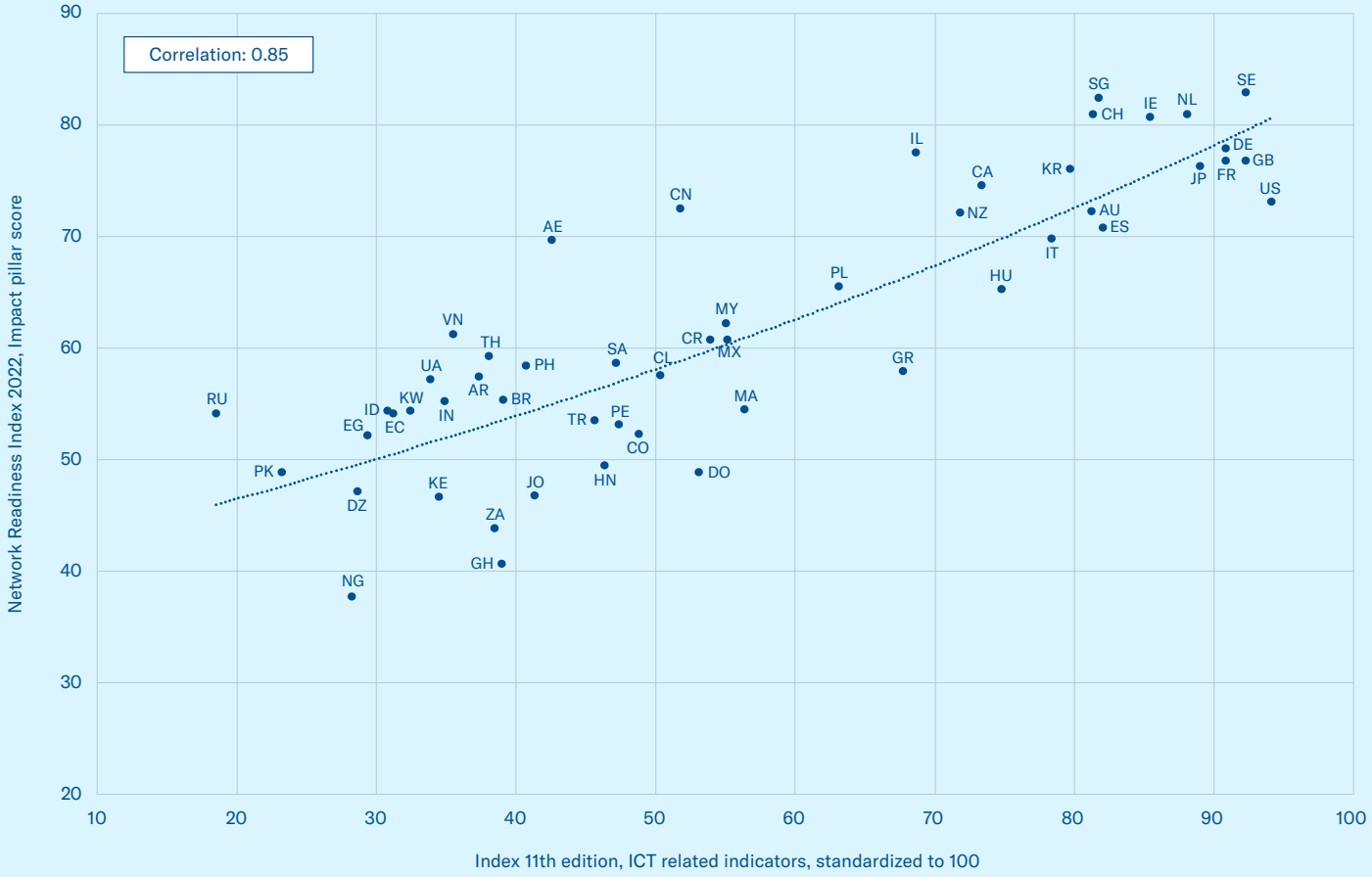
- The population-adjusted rate of scientific and technical journal articles—a robust measure for the quality and productivity for the human capital in the fields of life sciences, technology, and engineering—displays a very strong correlation (0.82) with the Index overall scores.
- Economies with robust IP systems, as measured by the Index, have over five times more knowledge output in terms of scientific and technical journal articles.

Figure 15: Association Between The Index Scores And The Number Of Scientific And Technical Journal Articles Per Million Population: Division By Thirds In Index Scores, Average Scores Per Third



IP Protection Contributes to the Growth of the ICT Sector and Knowledge-Based Economies

Figure 16: Association Between The Index's Ict-Related Indicator Scores And The *Network Readiness Index 2022*, Impact Pillar Scores[11]

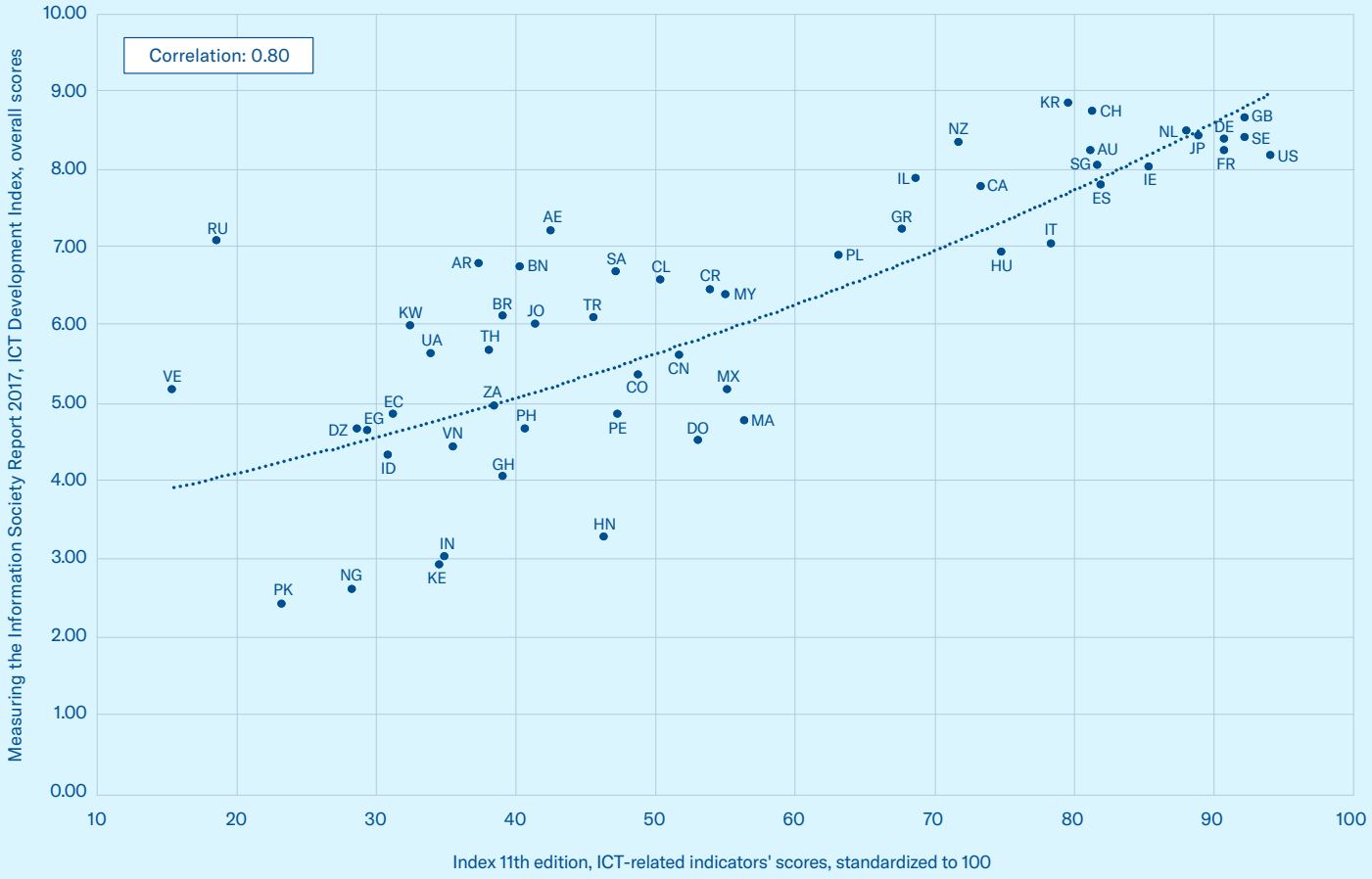


Data not available for Brunei, Taiwan, and Venezuela.

- A very strong correlation (0.85) exists between the Index's ICT-related indicators and the extent to which an economy leverages ICT and benefits from its economic and societal impact, as measured by the Network Readiness Index.
- Economies with stronger Index scores are 34% more likely to fully leverage ICTs for increased productivity and technology development.

IP Protection Contributes to the Growth of the ICT Sector and Knowledge-Based Economies

Figure 17: Association Between The Index Ict-Related Indicator Scores And The *Measuring The Information Society Report*, 2017 Ict Development Index[12]



Data not available for Taiwan.

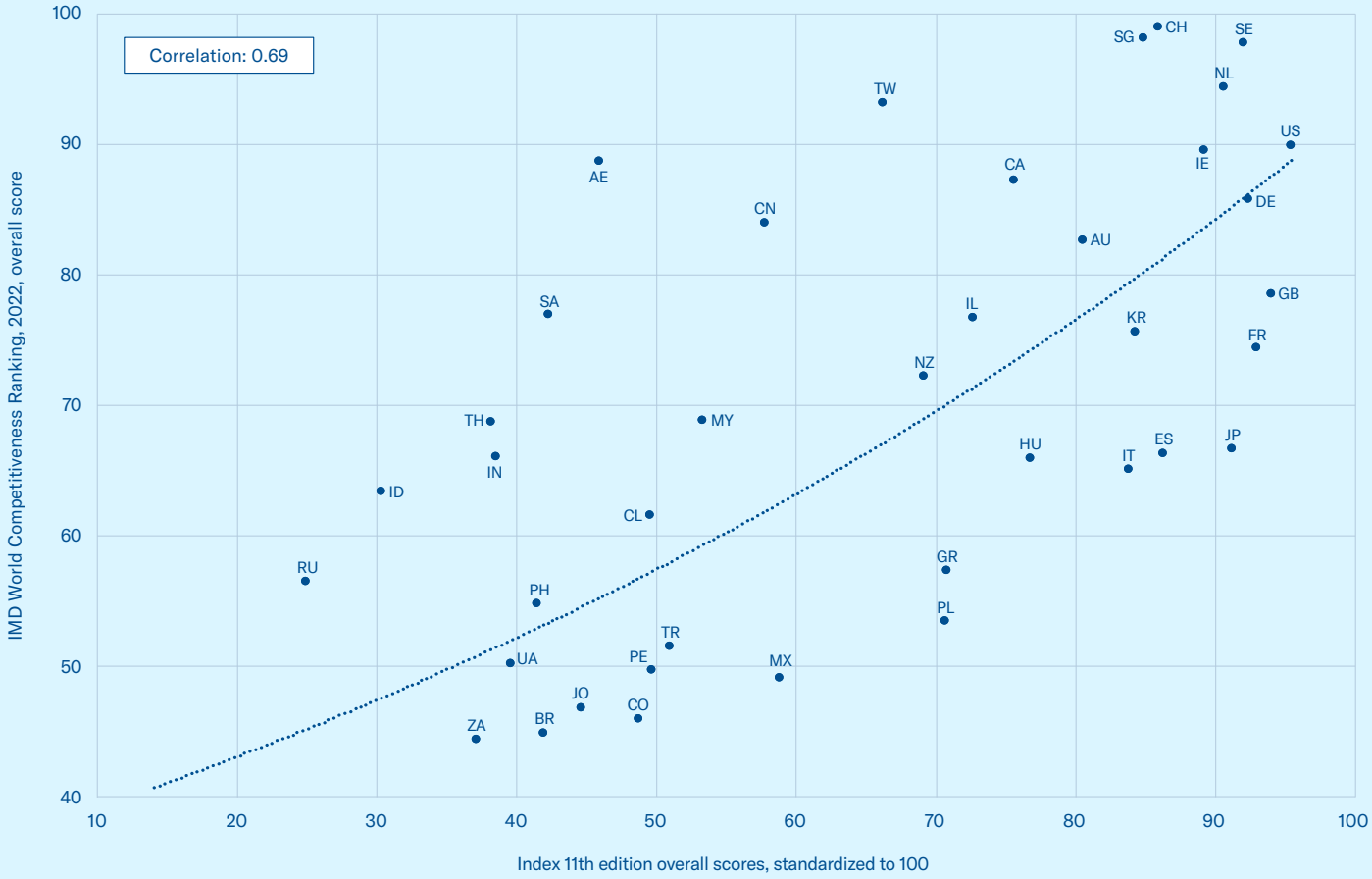
- The Index's ICT-related indicators' scores display a very strong correlation of 0.80 with the ICT Development Index.

- Economies with favorable IP environments are 47% more likely to support a dynamic ICT sector and experience the socioeconomic benefits this generates.

Outputs of a Competitive Knowledge-Based Economy

Economies with Favorable IP Environments Are More Globally Competitive

Figure 18: Association Between The Index Scores And The *2022 IMD World Competitiveness Ranking* Overall Scores[13]



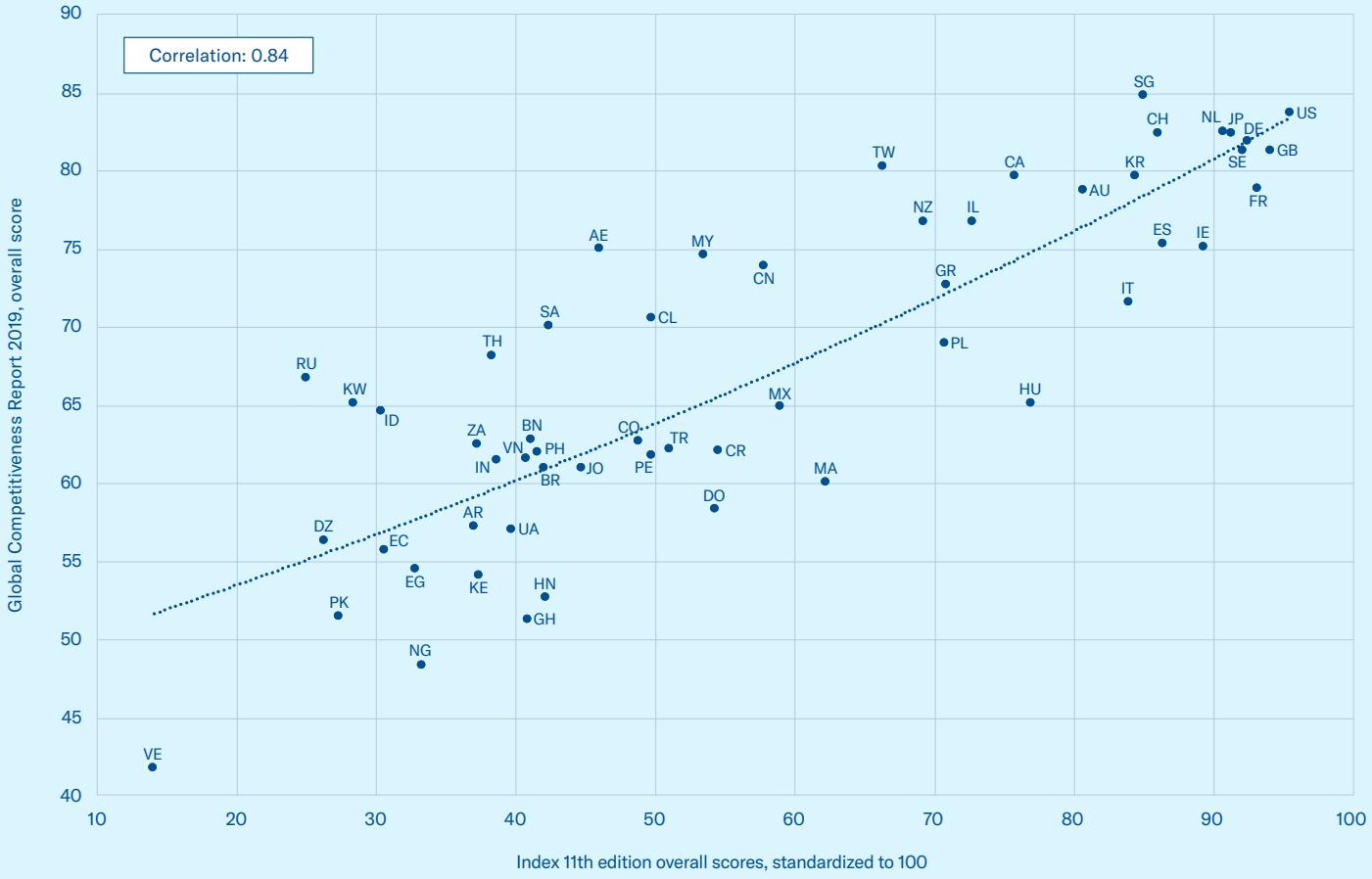
Data not available for Algeria, Brunei, Costa Rica, Dominican Republic, Ecuador, Egypt,

Ghana, Honduras, Kenya, Kuwait, Morocco, Nigeria, Pakistan, and Vietnam.

- The IMD World Competitiveness Ranking shows a strong relationship (at a correlation strength of 0.69) with an economy's Index scores.
- On average, economies with stronger Index scores are 40% more competitive than economies scoring below 50%.

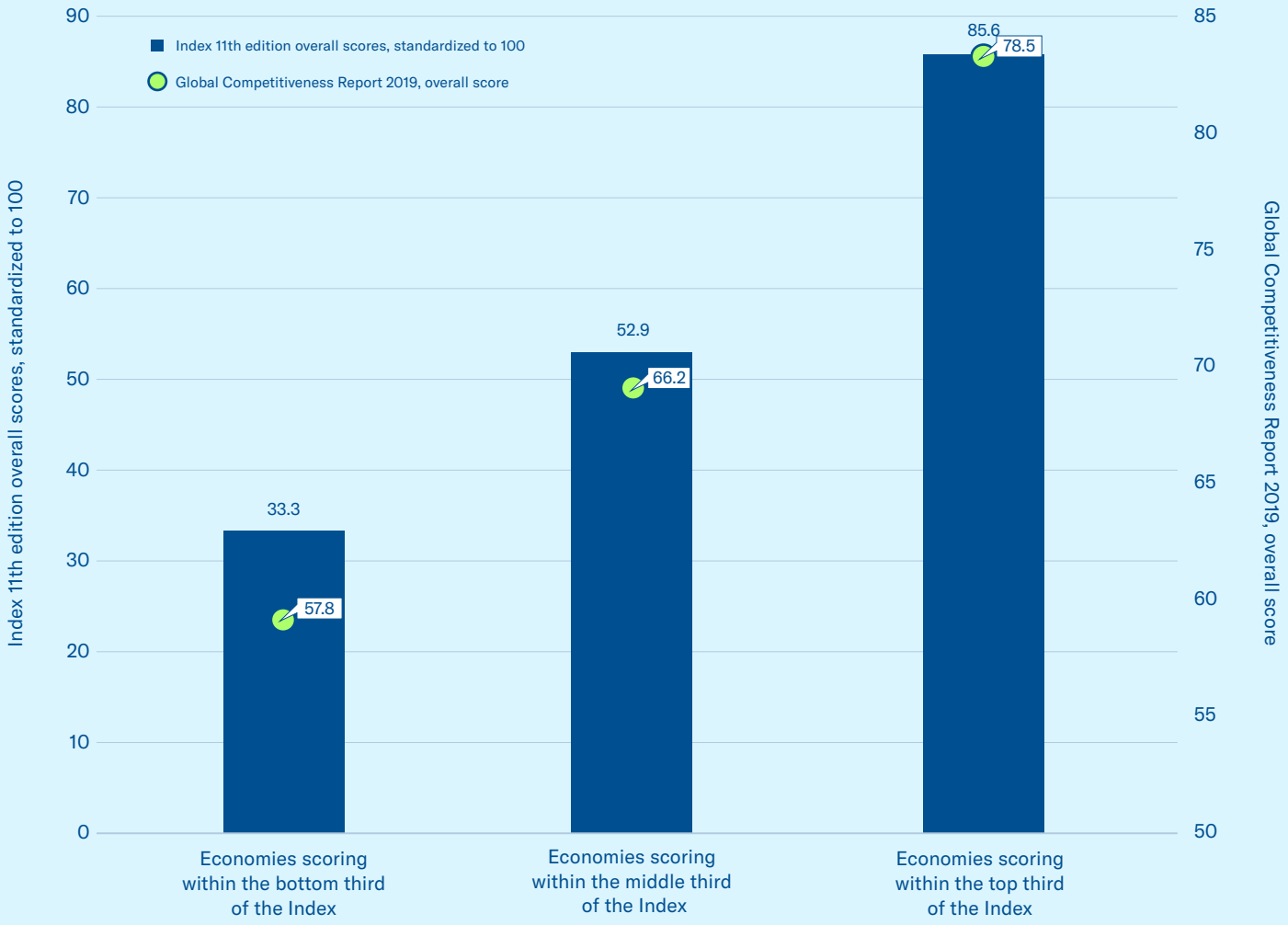
Economies with Favorable IP Environments Are More Globally Competitive

Figure 19: Association Between The Index Scores And The *Global Competitiveness Report 2019* Overall Scores[14]



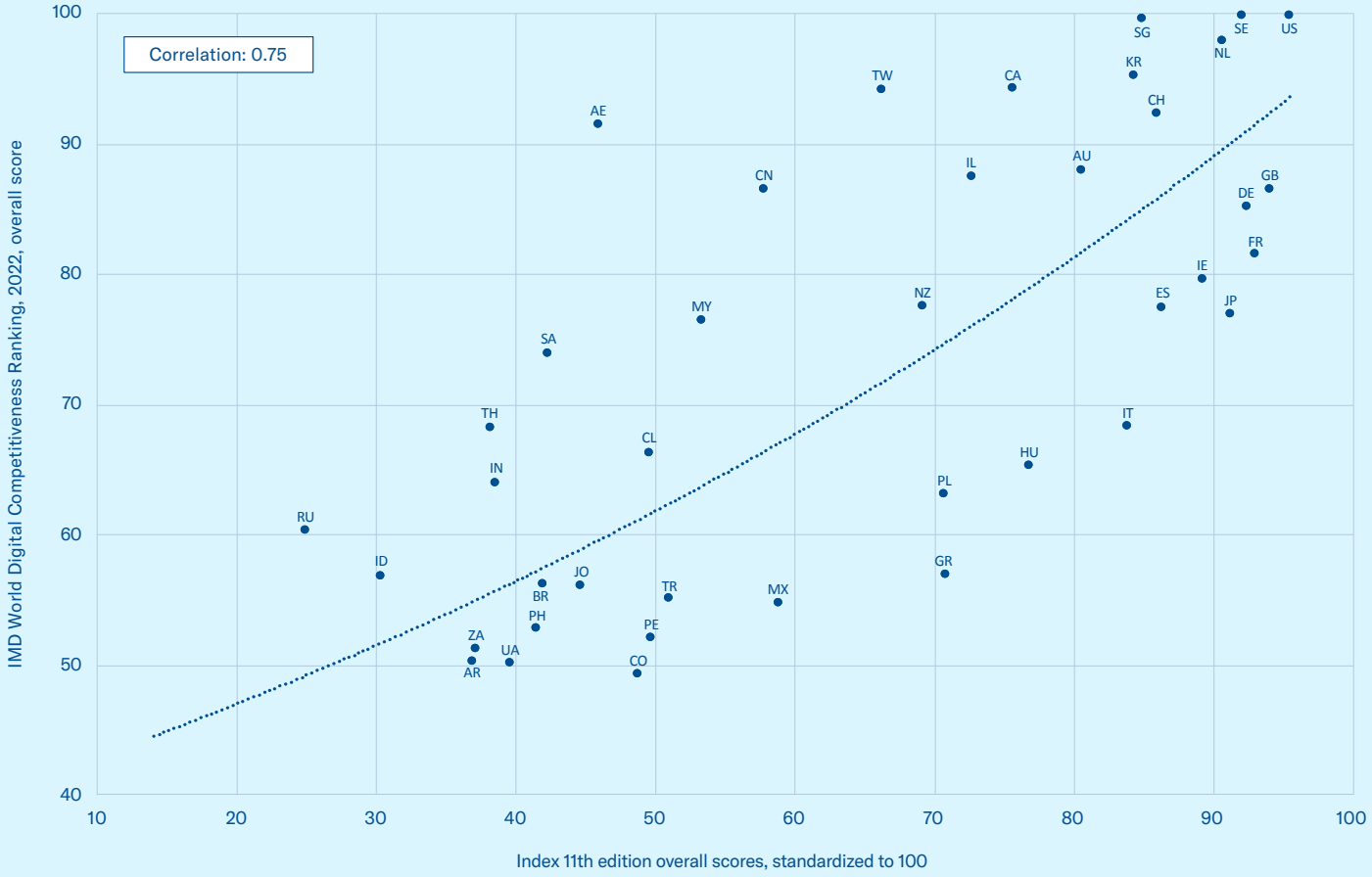
- The Global Competitiveness Index is a comprehensive benchmark of the set of institutions, policies, and factors that determine economies' productivity and competitiveness. There is a very strong relationship (at a correlation strength of 0.84) with the Index scores.
- On average, economies with stronger Index scores are 25% more competitive than economies scoring below 50%.
- When dividing the Index scores into thirds, a corresponding stepwise increase is revealed in economies' competitiveness, which suggests that the overall strength of economies' IP protection goes hand in hand with overall levels of international economic competitiveness.

Figure 20: Association Between The Index Scores And The *Global Competitiveness Report 2019* Overall Scores: Division By Thirds In Index Scores, Average Scores Per Third



Economies with Favorable IP Environments Are More Digitally Competitive

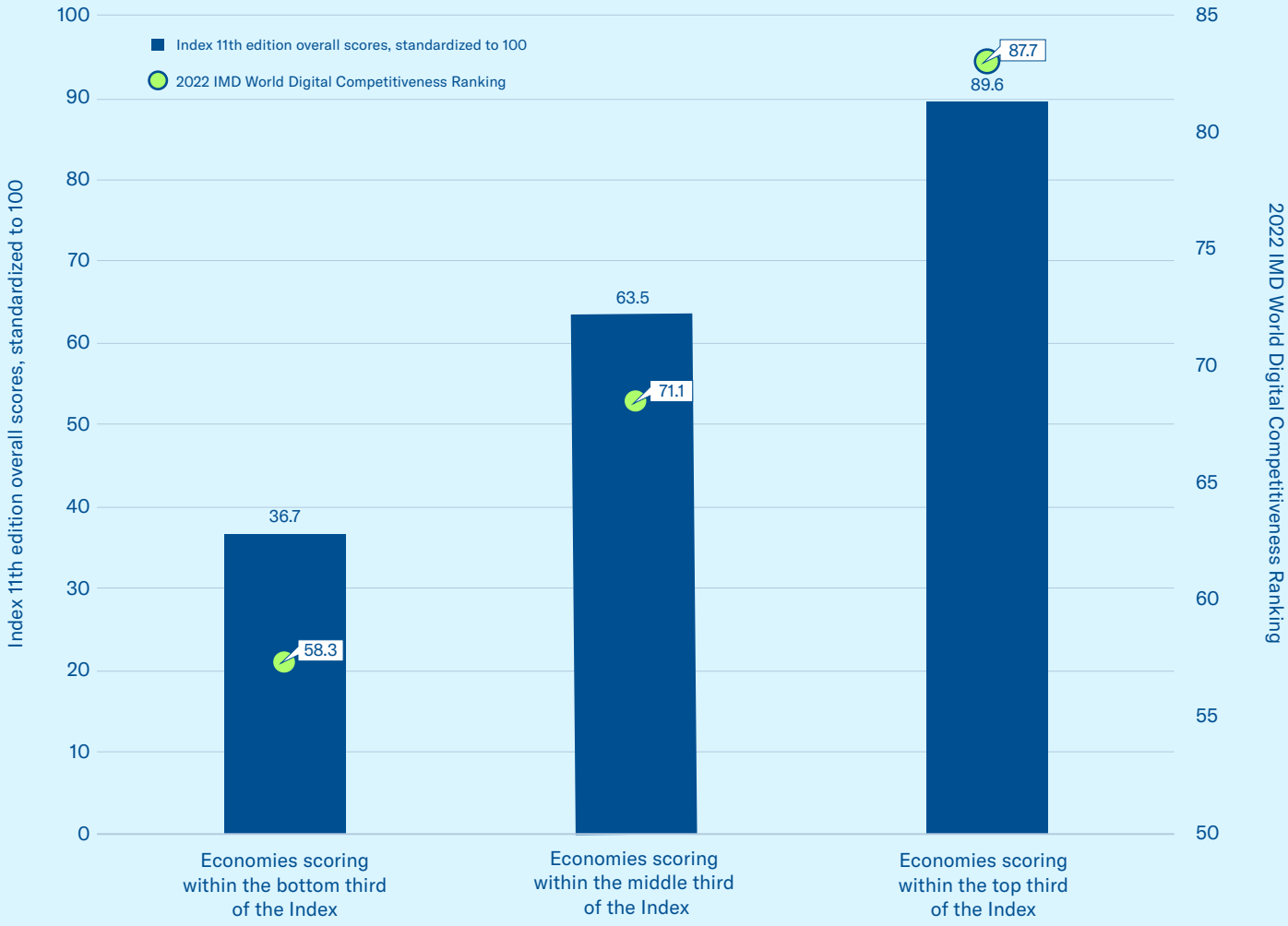
Figure 21: Association Between The Index Scores And The *2022 IMD World Digital Competitiveness Ranking* Overall Scores[15]



Data not available for Algeria, Brunei, Costa Rica, Dominican Republic, Ecuador, Egypt, Ghana, Honduras, Kenya, Kuwait, Morocco, Nigeria, Pakistan, and Vietnam.

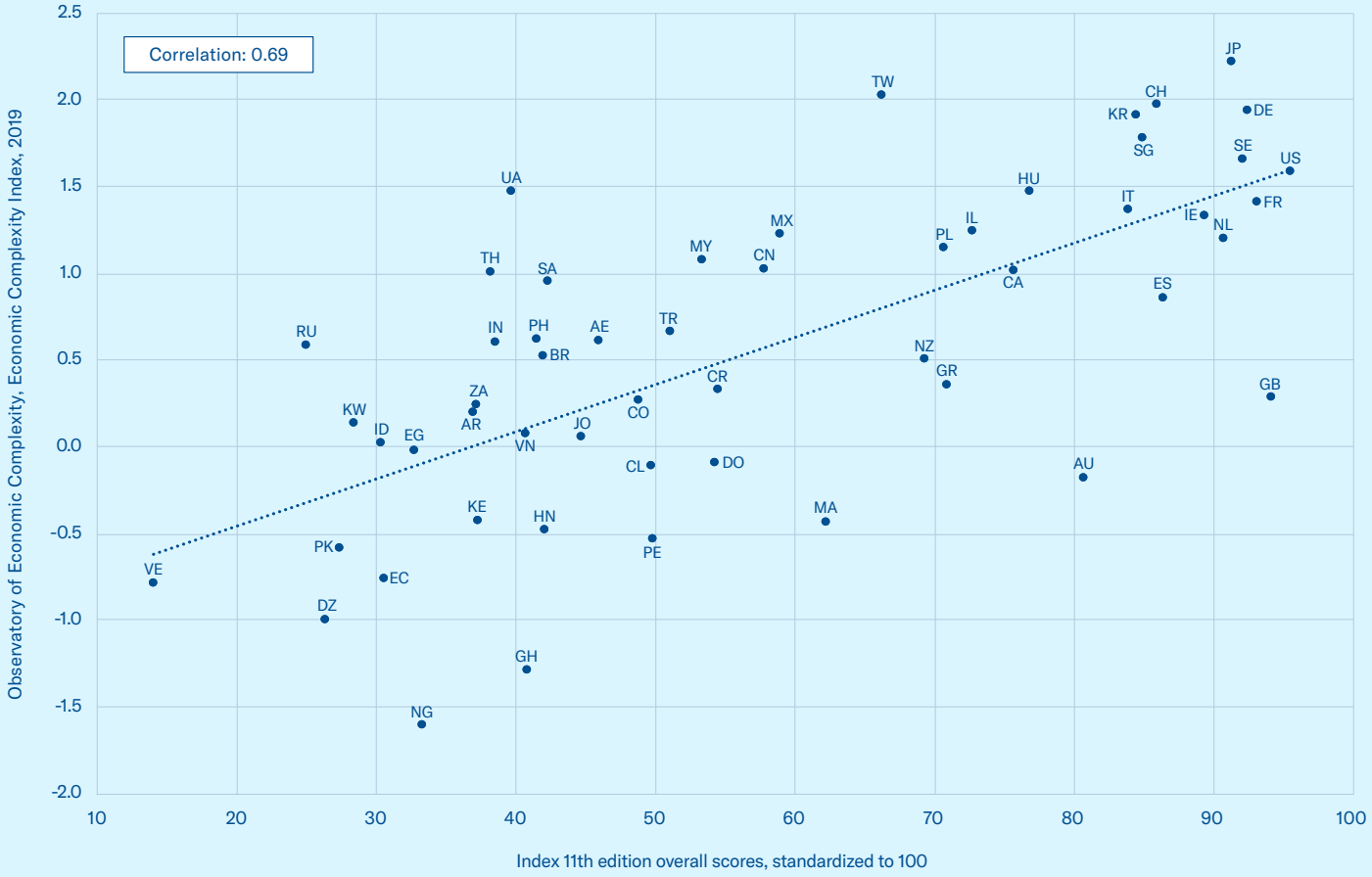
- The IMD World Digital Competitiveness Ranking "analyzes and ranks the extent to which countries adopt and explore digital technologies leading to transformation in government practices, business models and society in general."[16]
- There is a strong relationship between digital competitiveness (at a correlation strength of 0.75) and an economy's overall Index scores.
- On average, economies with stronger Index scores are 41% more digitally competitive than economies scoring below 50%.
- When dividing the Index scores into thirds, a corresponding stepwise increase is revealed in economies' competitiveness, which suggests that the overall strength of economies' IP protection goes hand in hand with overall levels of international digital competitiveness.

Figure 22: Association Between The Index Scores And The *2022 IMD World Digital Competitiveness Ranking* Overall Scores: Division By Thirds In Index Scores, Average Scores Per Third



Robust IP Protection and Economic Complexity

Figure 23: Association Between The Index Scores And The Observatory Of Economic Complexity's *Economic Complexity Index*[17]

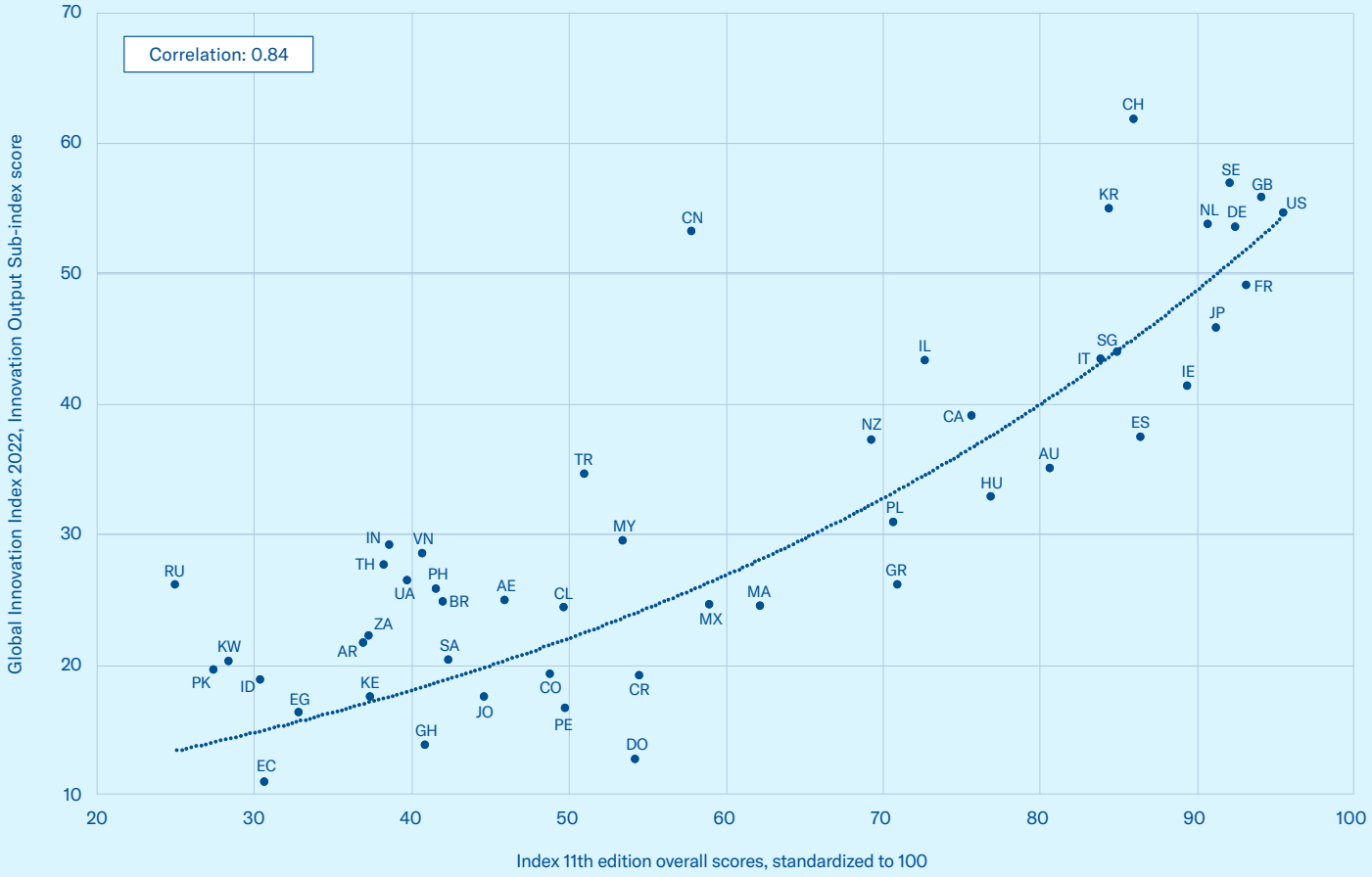


Data not available for Brunei.

- The Observatory for Economic Complexity's *Economic Complexity Index* measures the multiplicity and complexity levels of the knowledge required to produce a given product and the level of its exports. There is a strong correlation of 0.69 with the Index scores.
- Economies scoring above 50% on the Index are significantly more likely to produce and export complex, knowledge-intensive products and to reap the associated social and economic benefits compared with economies scoring below 50%.

Strong IP Environments Have Higher Levels of Innovative Output

Figure 24: Association Between Index Scores And The *Global Innovation Index 2022*, Innovation Output Subindex Scores[18]



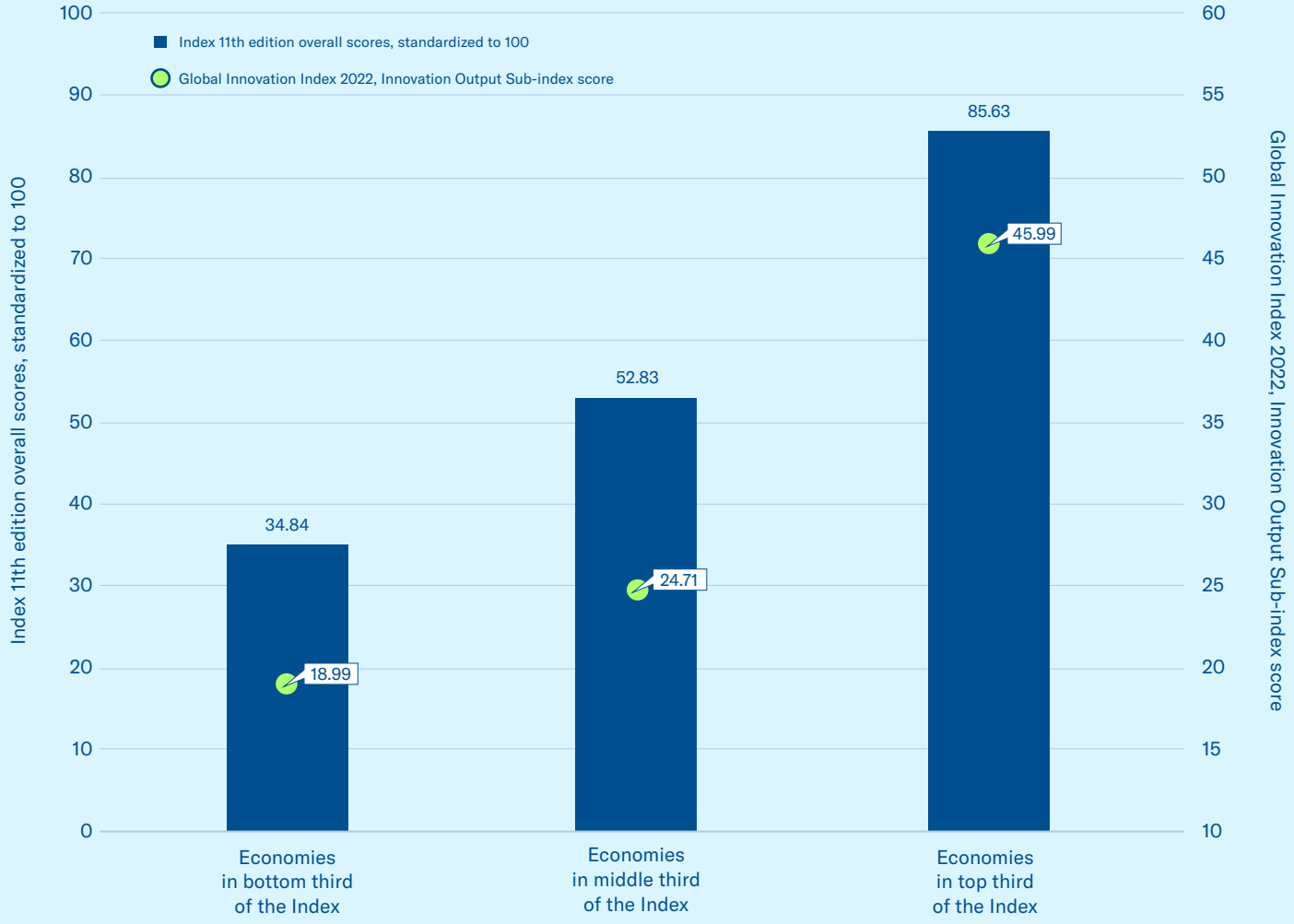
Data not available for Taiwan and Venezuela

- The *Global Innovation Index's* Innovation Output subindex is 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. When compared to the Index, there is a very strong correlation of 0.84 to the Index scores.

- Economies with robust IP regimes experience more than double the innovation output compared with that of economies with weaker national IP environments.

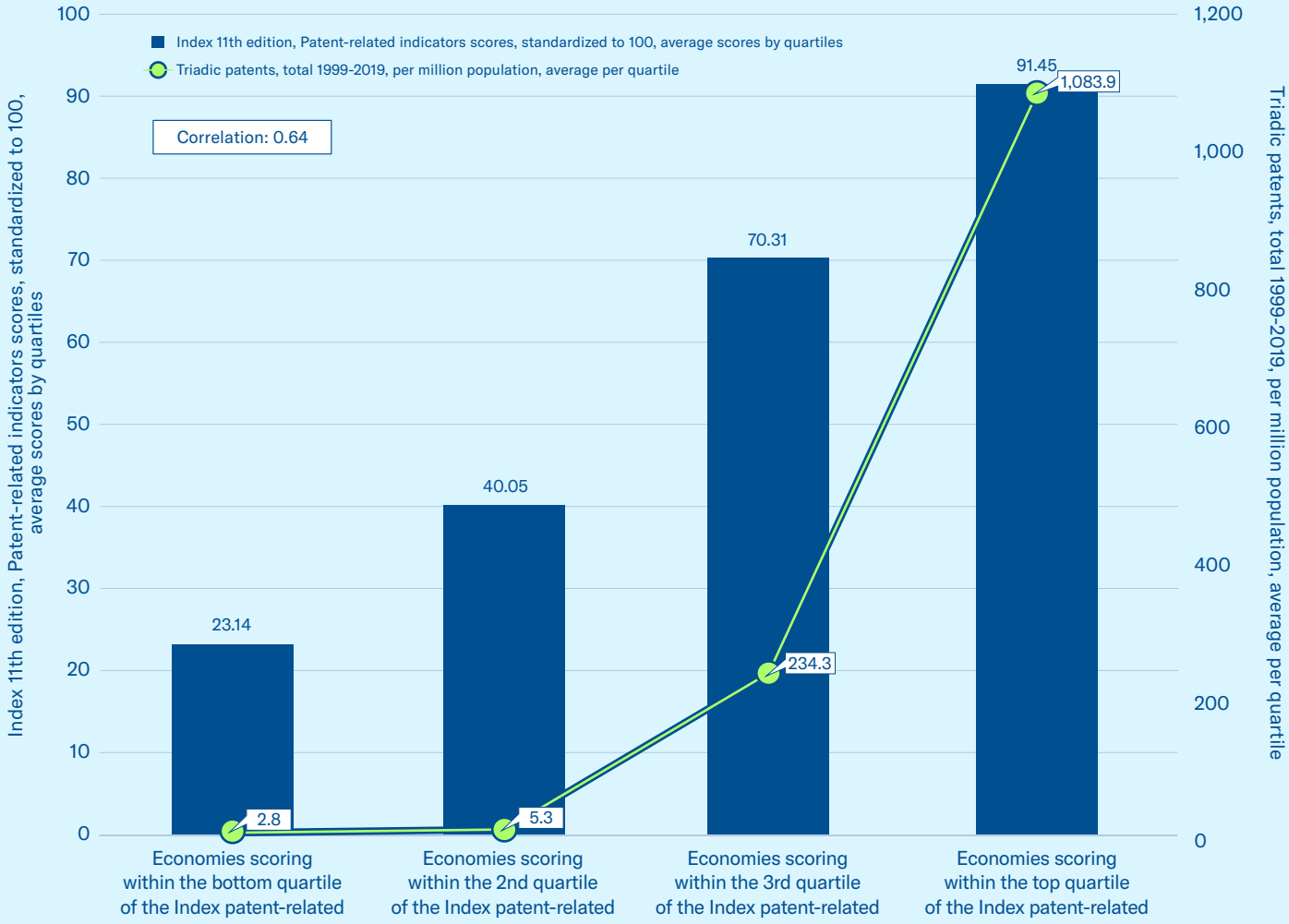
- When dividing the Index scores into thirds, a corresponding stepwise increase is revealed in economies' innovation output, which suggests that the overall strength of economies' IP protection goes hand in hand with overall levels of innovation.

Figure 25: Association Between Index Scores And The *Global Innovation Index* 2022, Innovation Output Subindex Scores: Division By Thirds In Index Scores, Average Scores Per Third



Inventive Intensity Depends on Strong Patent Protection

Figure 26: Association Between Index Patent-Related Indicator Scores And Triadic Patents (Total, 1999–2019) Per Million Population, By Quartiles In Index Scores, Average Per Quartile[19]

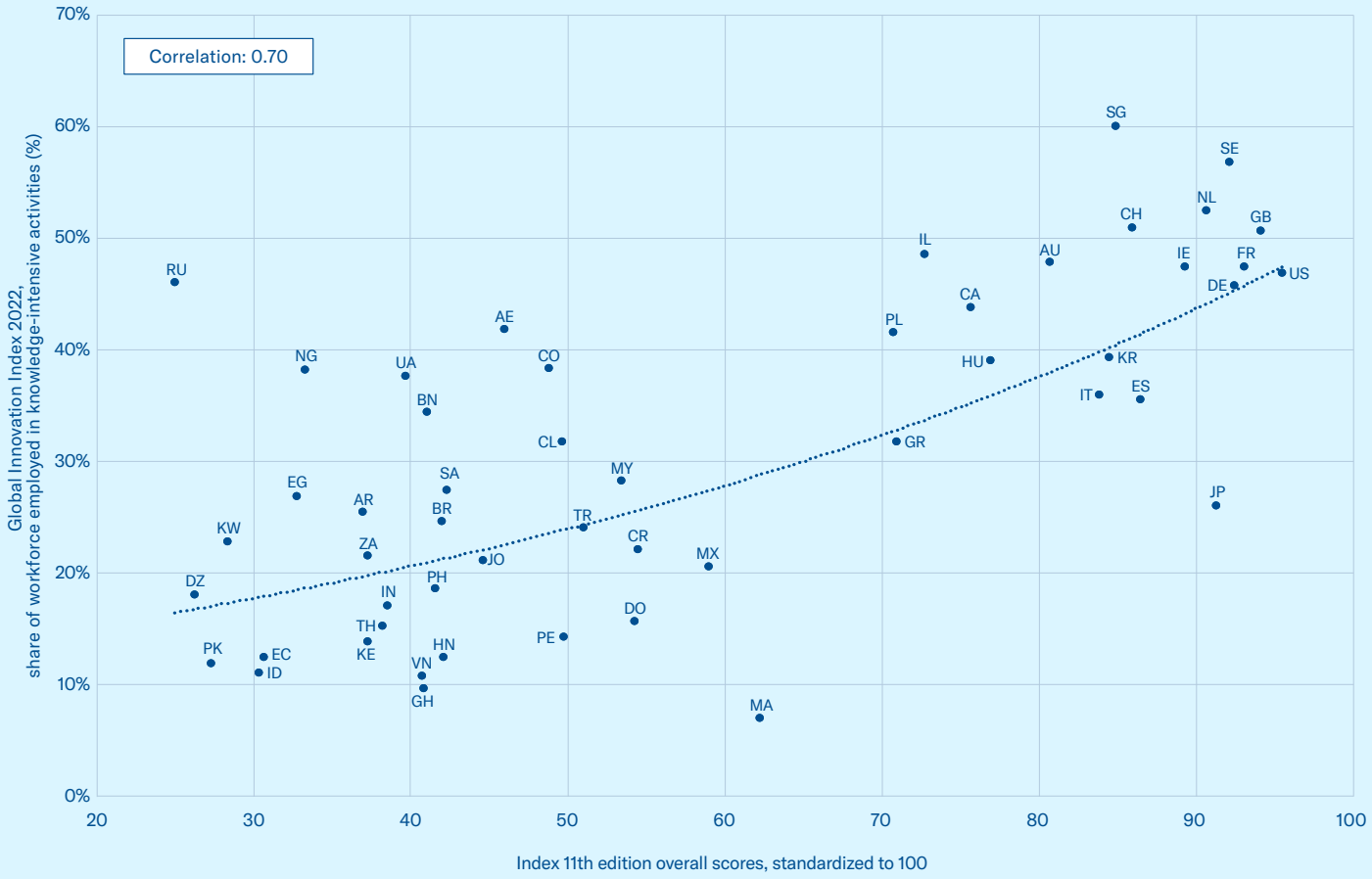


Data Not Available For Brunei, Dominican Republic, Ghana, Honduras, And Vietnam.

- Triadic patenting rates are a measure of patent protection granted by the three biggest patent offices (the U.S. Patent and Trademark Office, European Patent Office, and Japan Patent Office) and serve as a good indicator of the development of high-value innovations with significant commercial potential.
- The Index patent-related indicators' scores display a strong relationship (a correlation of 0.64) with triadic patenting rates standardized for population. Strong IP environments generate more triadic patenting, whereas weaker environments see virtually no triadic patenting.
- Economies with the strongest IP frameworks have over 600 more high-value inventions patented per million population than do economies with weaker IP environments.
- Economies in the lower two quartiles see rates of triadic patenting activity in the low single digits per million population.

A Robust IP Regime Promotes the Growth of Knowledge-Intensive Sectors

Figure 27: Association Between The Index Scores And *Global Innovation Index 2022*, Share Of Workforce Employed In Knowledge-Intensive Services

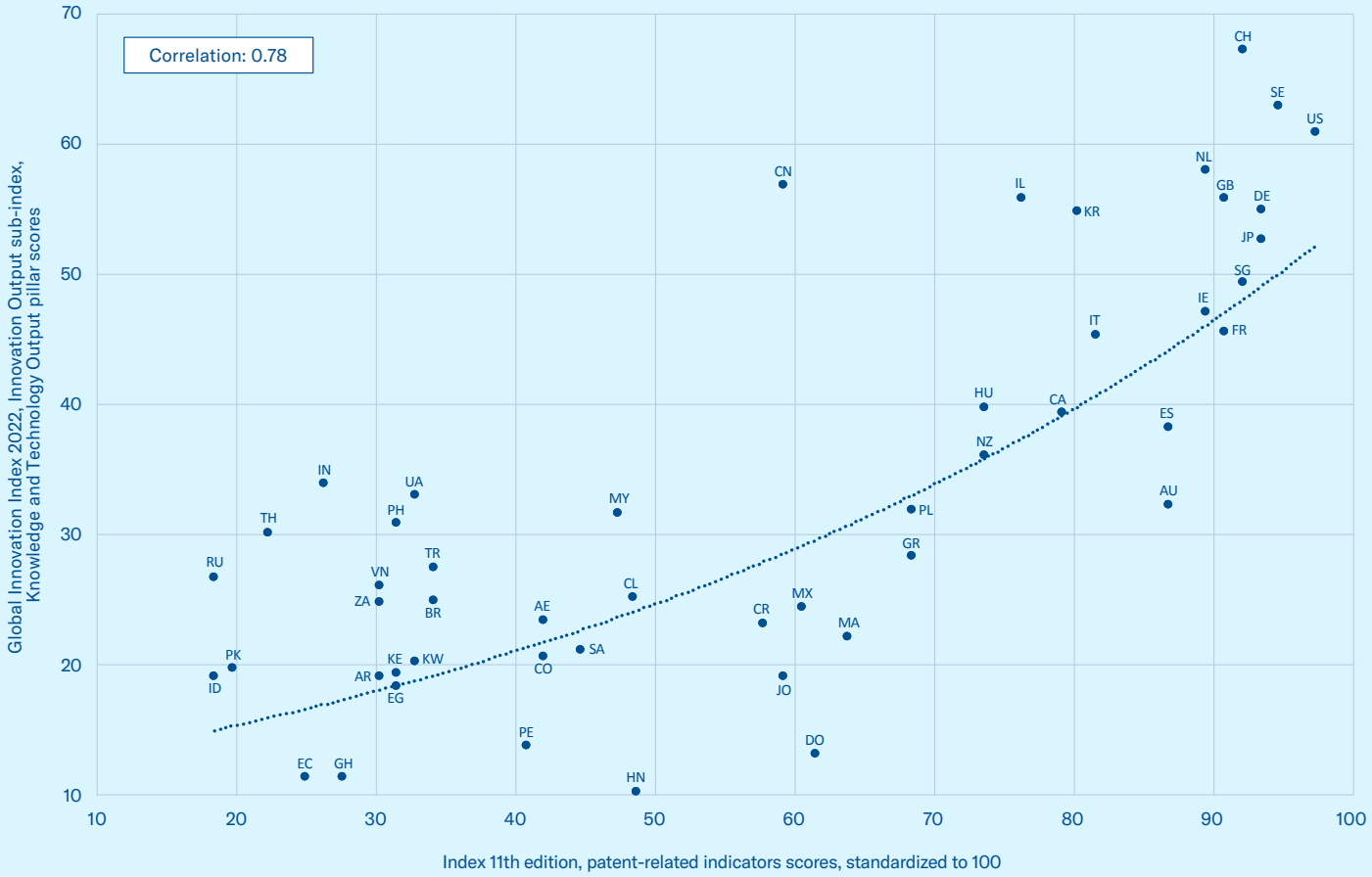


Data not available for China, New Zealand, Taiwan, and Venezuela.

- There is a strong correlation (0.70) between Index scores and the share of the workforce employed in knowledge-intensive activities, as measured by the *Global Innovation Index* 2022.
- The share of the workforce concentrated in knowledge-intensive sectors in economies with robust IP environments is 67% higher compared with economies with weaker national IP environments.

Patent Protection Is Linked to the Growth of High-Tech Sectors

Figure 28: Association Between Index Patent-Related Indicator Scores And The *Global Innovation Index 2022*, Innovation Output Subindex Knowledge And Technology Output Pillar Scores[20]

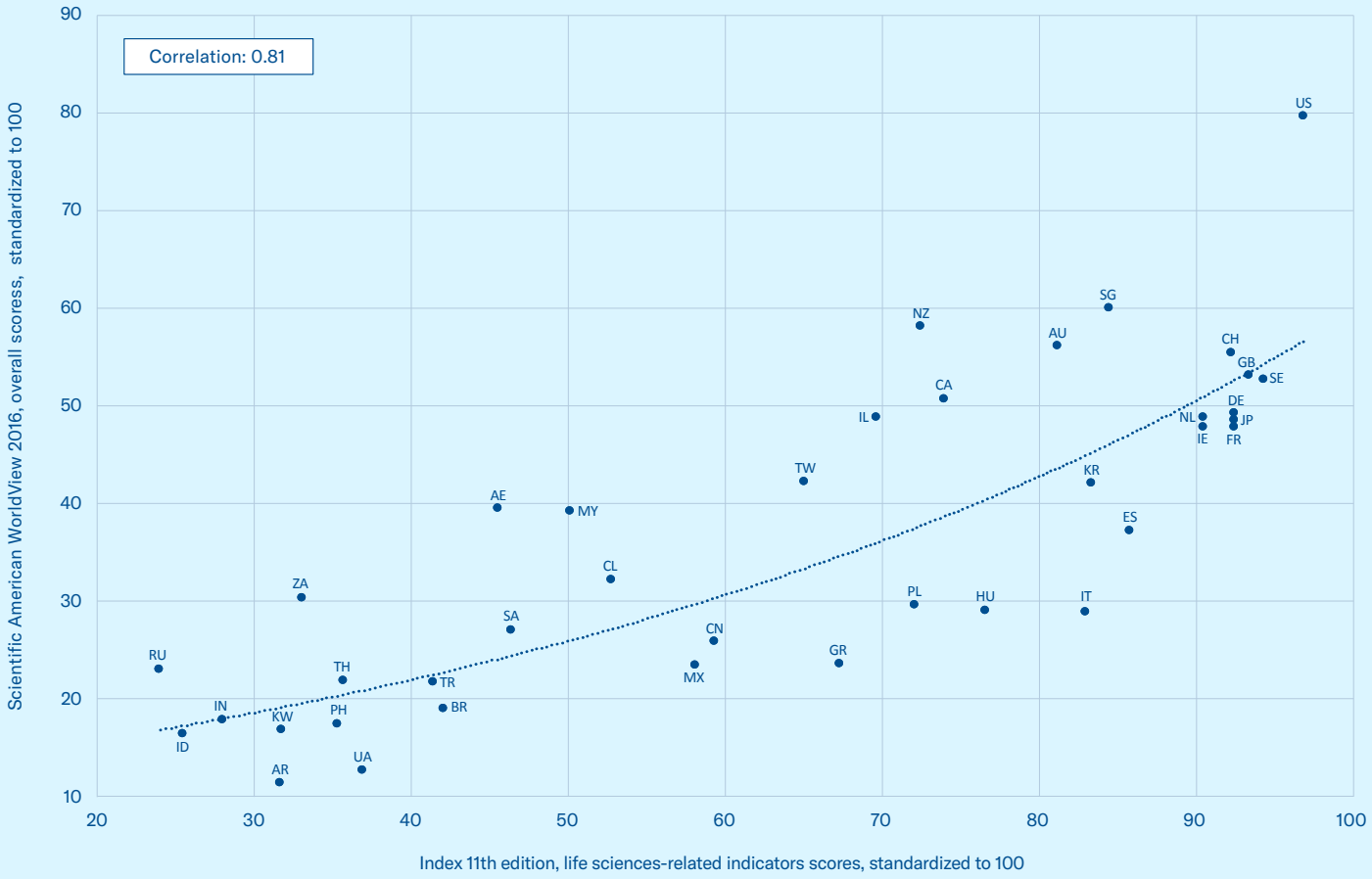


Data not available for Taiwan and Venezuela.

- The Index's patent-related indicators exhibit a strong correlation of 0.78 with knowledge and technology outputs as measured by the *Global Innovation Index's* Innovation Output Subindex.
- Economies with strong patent environments, scoring 50% or above on the Index, produce 94% more knowledge and technology outputs compared with economies whose patent environments trail behind.

Biotechnological Innovation Depends on Protecting IP

Figure 29: Association Between The Index's Life Sciences–Related Indicator Scores And The *Scientific American Worldview* Scores[21]

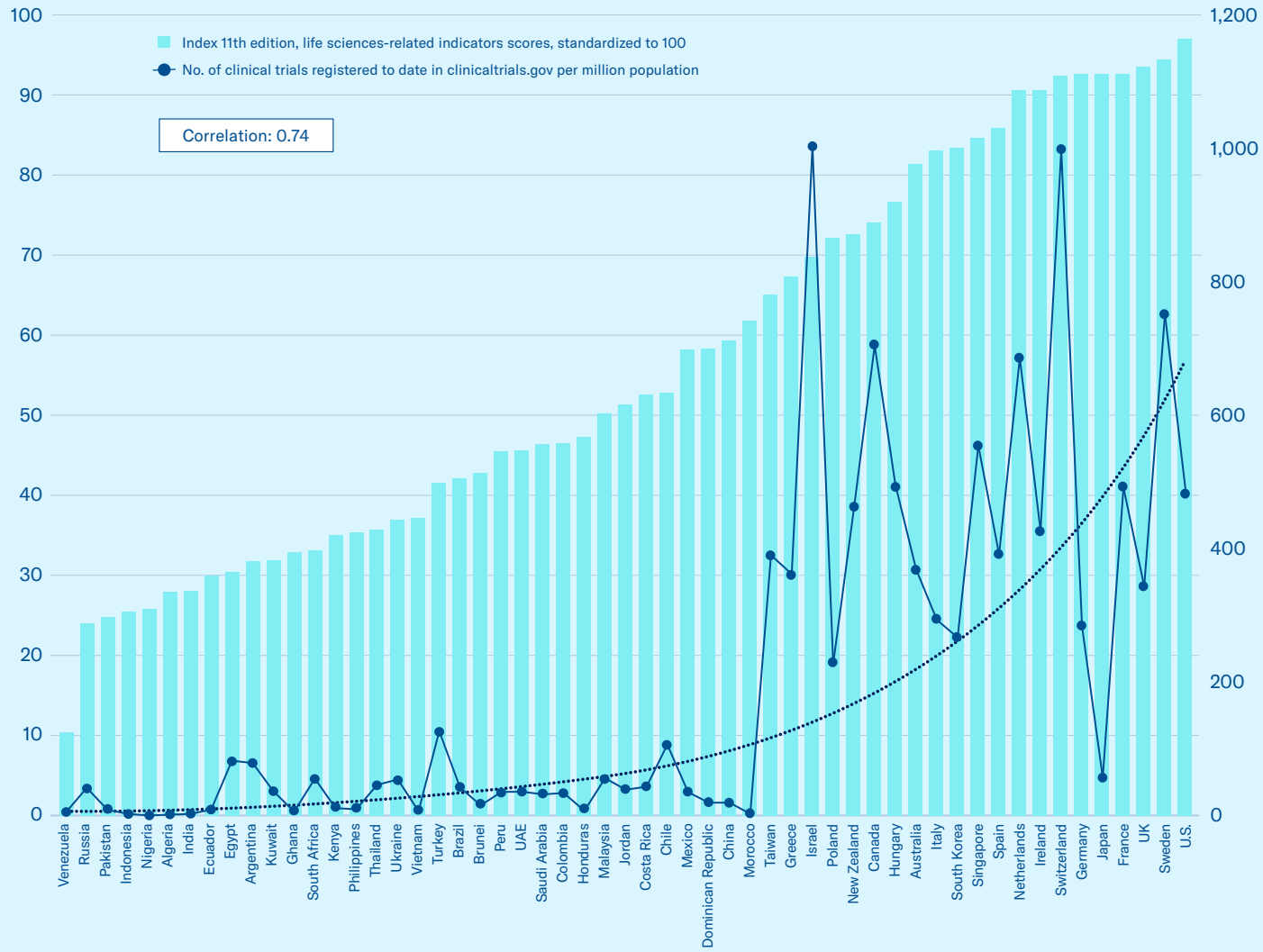


Data not available for Algeria, Brunei, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, Ghana, Honduras, Jordan, Kenya, Nigeria, Pakistan, Peru, Venezuela, and Vietnam.

- Protecting IP rights related to the life sciences (such as patents, regulatory data protection, and patent term restoration) has a clear and direct correlation with an environment in which biotechnology innovation can thrive.
- The Index scores on life sciences–related indicators correlate very strongly—at 0.81—with the *Scientific American WorldView* overall scores (as a measure of biotech innovation).
- Economies that score 50% or more on the Index are more than twice as likely to provide environments conducive to biotech innovation than economies with weaker national IP environments.

IP Rights Lead to Biomedical Foreign Direct Investment (FDI)

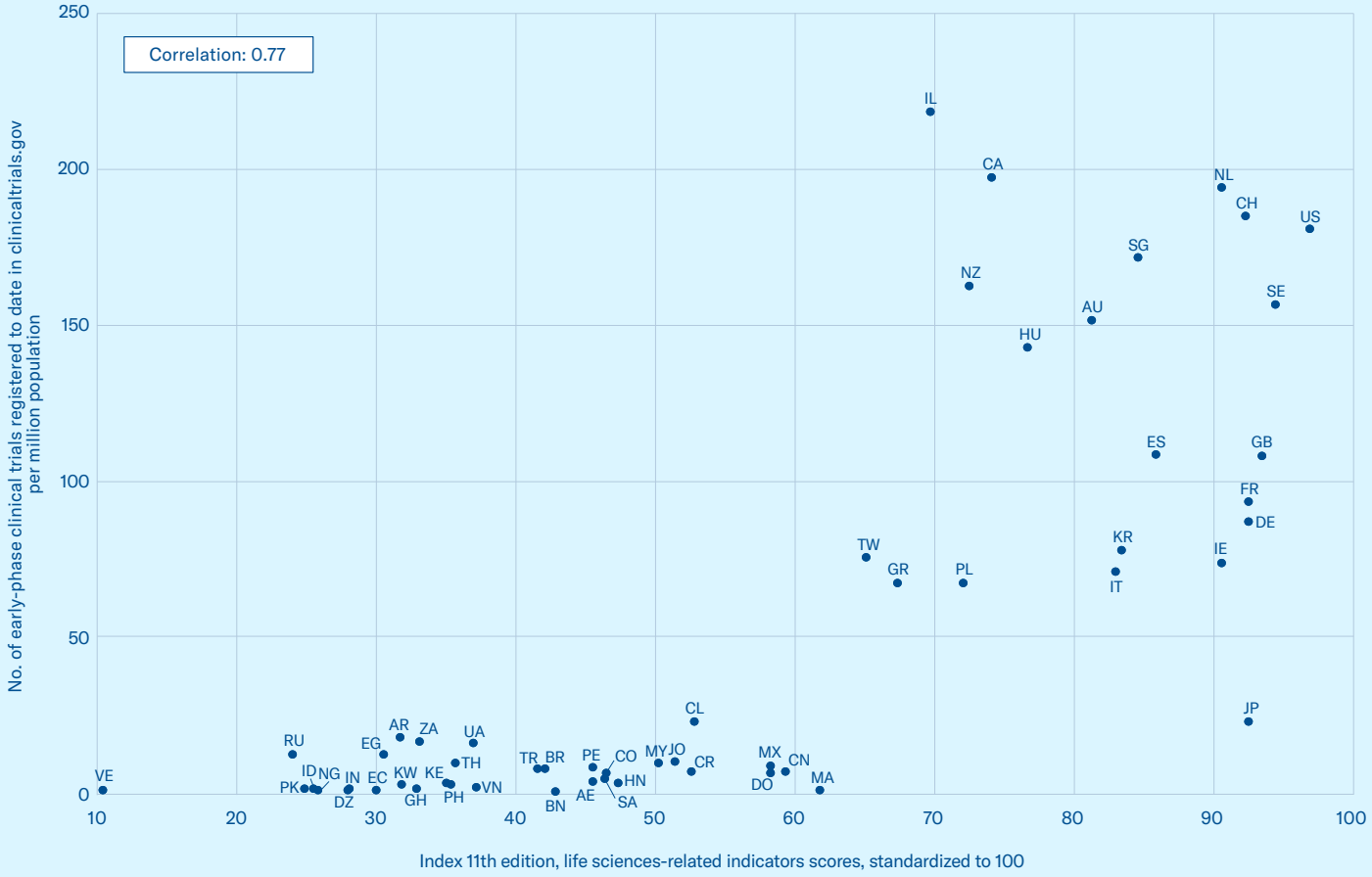
Figure 30: Association Between Index Life Sciences–Related Indicator Scores And The Number Of Clinical Trials Per Million Population[22]



- Economies' clinical trial intensity, serving as a proxy for life sciences FDI, displays a strong association—a correlation of 0.74—with biopharmaceutical IP rights, as measured by the Index's scores on life sciences–related indicators.
- Economies that score 50% or more on the Index's life sciences–related indicator host over 10 times more clinical trials than low-scoring economies.

IP Protection Is Critical to Greater Investment in Cutting-Edge Clinical Research

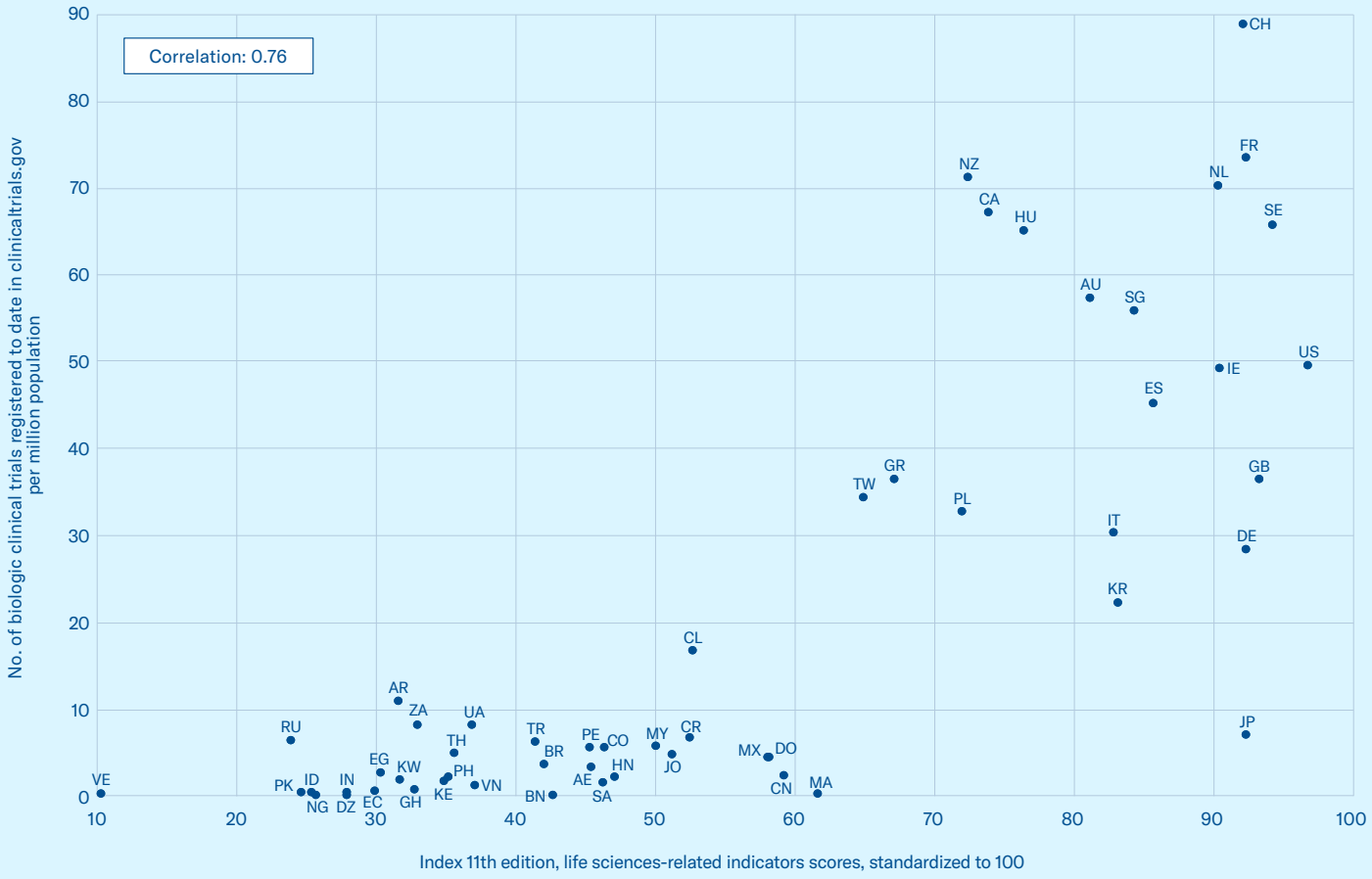
Figure 31: Association Between Index Life Sciences–Related Indicator Scores And The Number Of Early-Phase (I+Ii) Clinical Trials Per Million Population[23]



- The Index scores for life sciences–related indicators exhibit a strong correlation of 0.77 with rates of early-stage (phase I and II) clinical trial activity.
- Economies that maintain robust IP environments tend to see over 17 times more early-phase clinical trials on average compared with economies whose life sciences–related IP environments trail behind.

Development of Biologic Therapies Is Closely Linked to IP Protection

Figure 32: Association Between Index Life Sciences–Related Indicator Scores And The Number Of Biologic Clinical Trials Per Million Population[24]



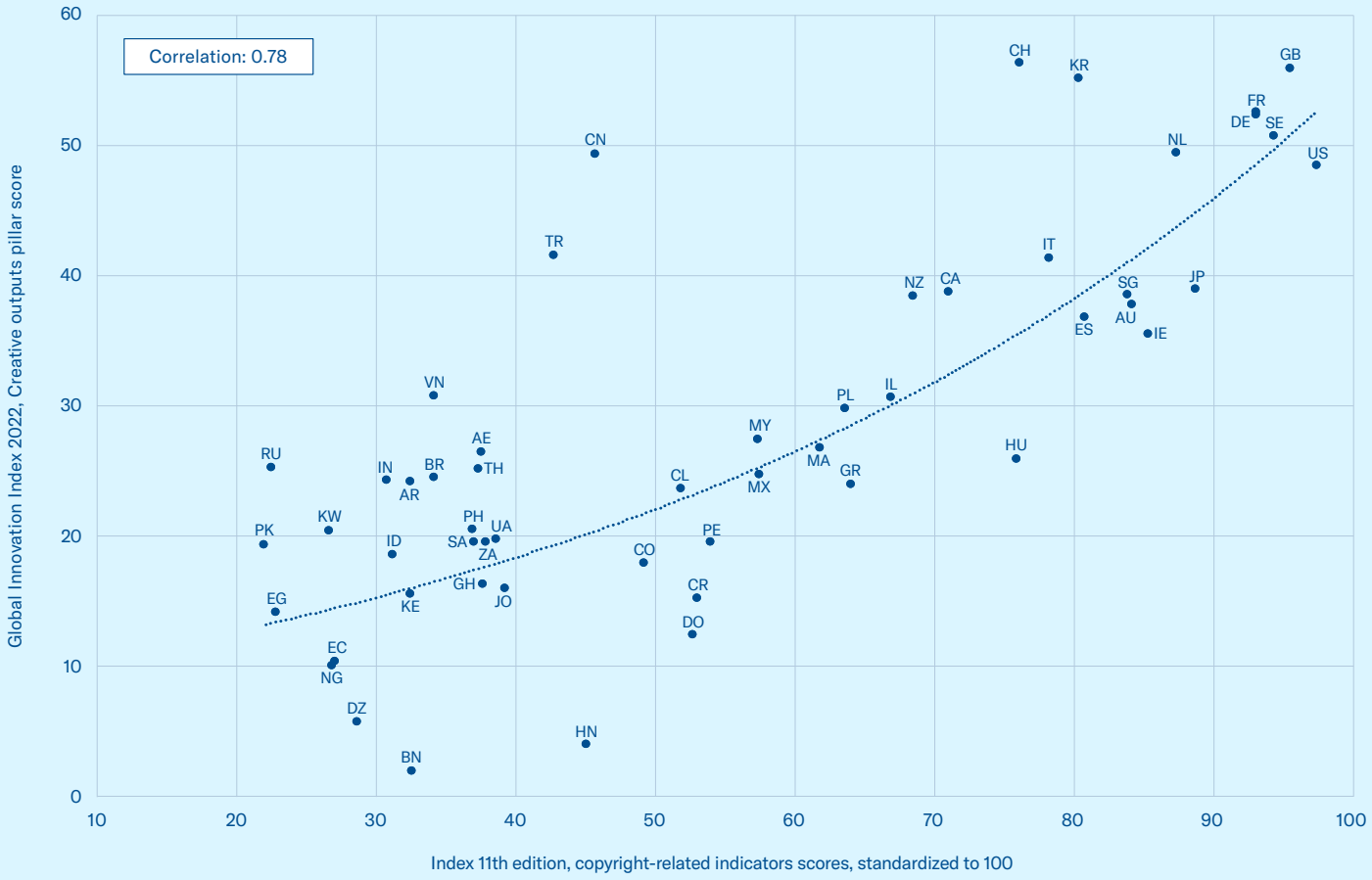
- Biologic medicines—gene-, cellular-, or protein-based therapies produced from living organisms—are at the forefront of medical research. The trials involved in developing these biologics are highly complex and require high levels of skill and technical infrastructure; this is the high end of the value chain in clinical research.
- A strong correlation of 0.76 exists between the population-adjusted number of clinical trials on biologic drugs and the Index scores for life sciences–related indicators.

- Economies with strong to robust IP frameworks for the life sciences host over 11 times more clinical trials on innovative biologic drugs compared with economies with a weaker environment.

Value Added and Creativity

Robust Copyright Protection Encourages Creative Activity

Figure 33: Association Between Index Copyright-Related Indicator Scores And The *Global Innovation Index 2022*, Innovation Output Subindex, Creative Output Pillar Scores[25]

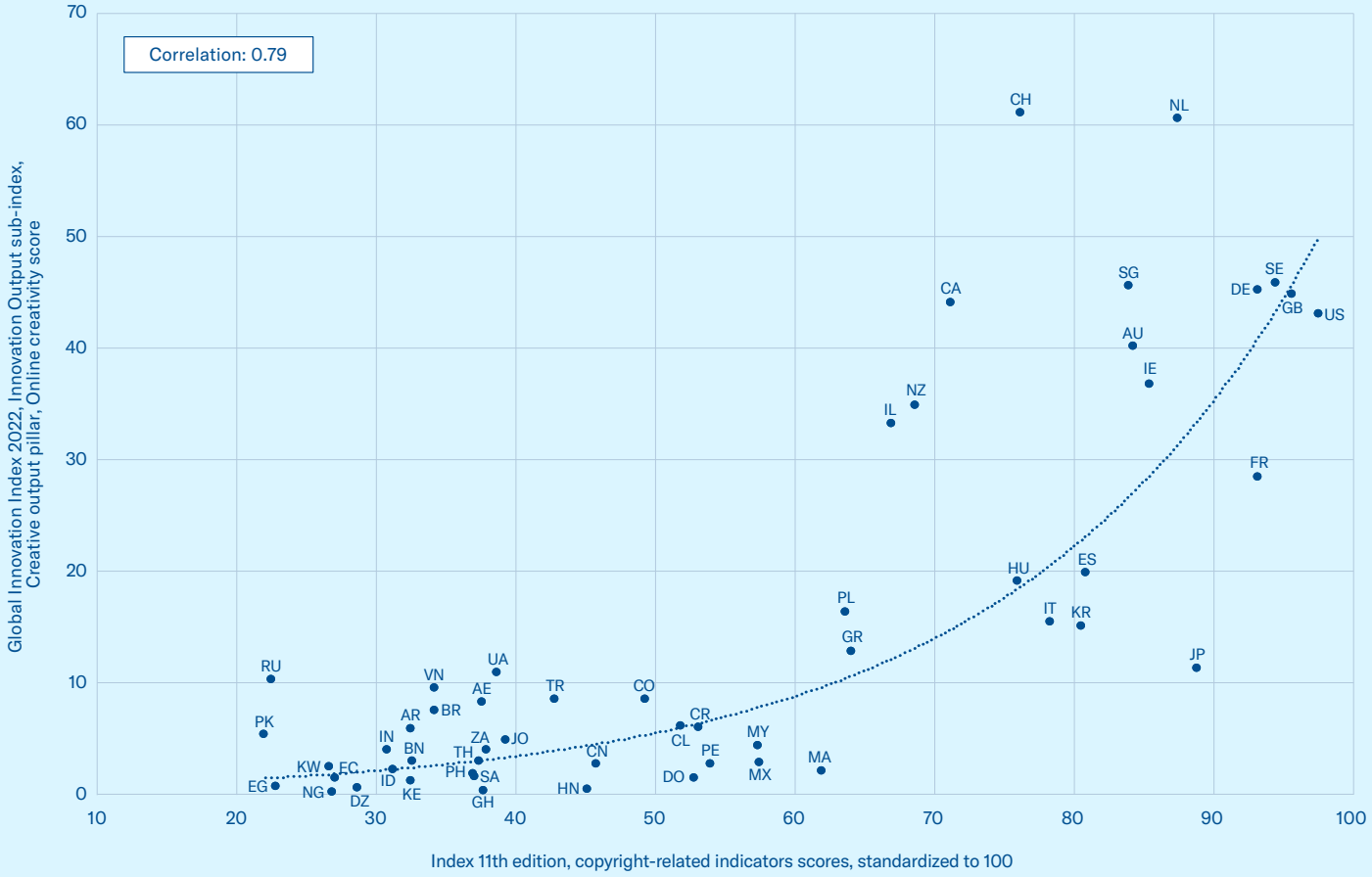


Data not available for Taiwan and Venezuela.

- Copyright protection, measured by the Index's copyrights-related indicators, displays a strong correlation of 0.78 to the creative outputs pillar in the *Global Innovation Index*.
- Economies scoring above 50% on the Index's copyright-related indicators are 82% more likely to benefit from the growth in both volume and value of the dynamic content and media sectors than economies with weaker national IP environments.

Robust Copyright Protection Encourages Online Creativity

Figure 34: Association Between Index Copyright-Related Indicator Scores And The *Global Innovation Index 2022*, Innovation Output Subindex, Creative Output Pillar, Online Creativity Scores[26]

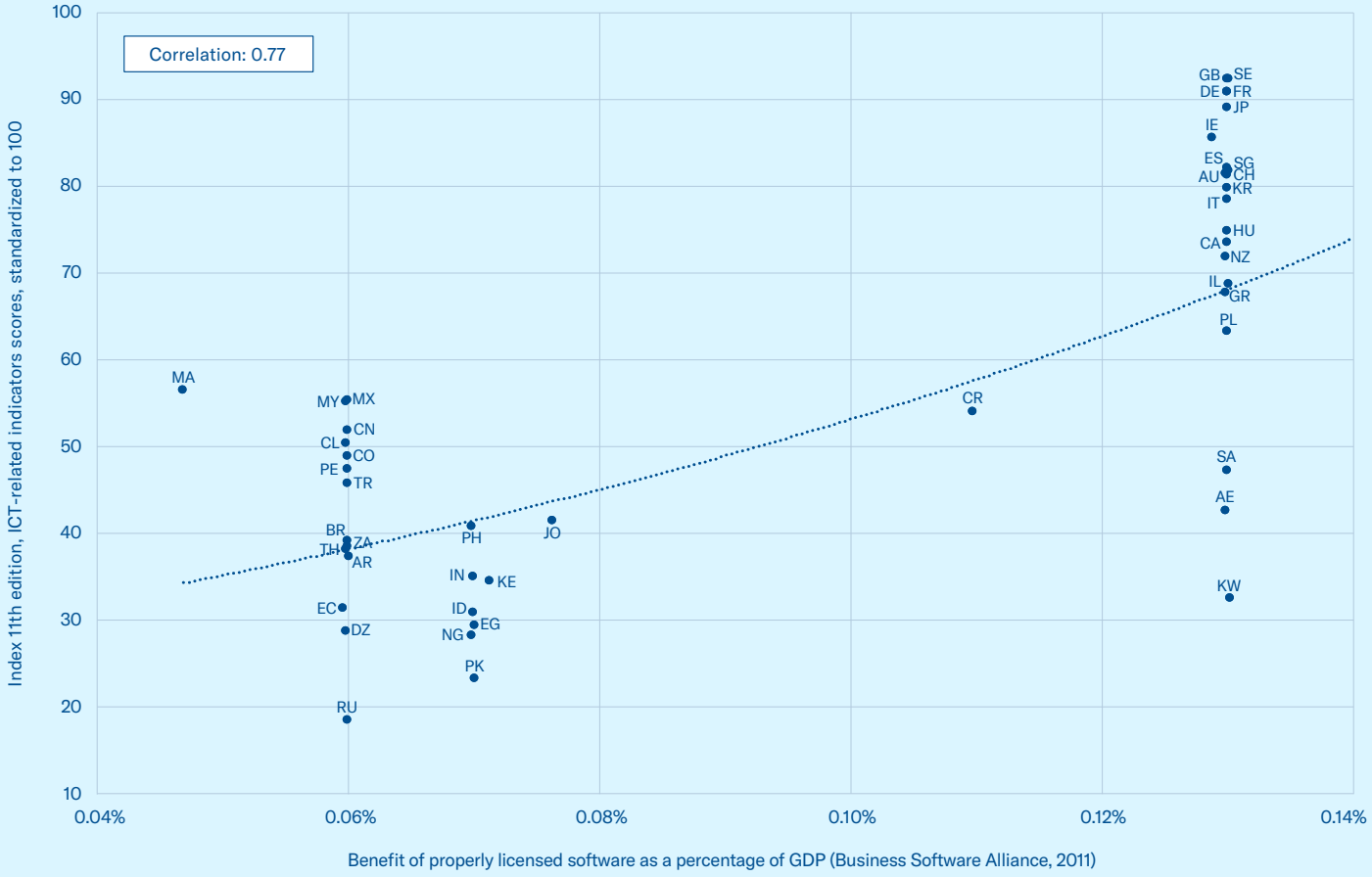


Data not available for Taiwan and Venezuela.

- The Index's copyright-related indicators' scores display a strong relationship (at a correlation strength of 0.79) with online creativity as measured by the *Global Innovation Index*.
- Economies that provide and enforce strong copyright protection, including for digital and online works, generate over five times more online and mobile content, such as websites, applications, and audiovisual media.

IP Rights Equal Greater Added Value of Properly Licensed Software

Figure 35: Association Between The Index Scores On Ict-Related Indicators And The Gross Domestic Product Benefit From A 1% Increase In Software Use[27]



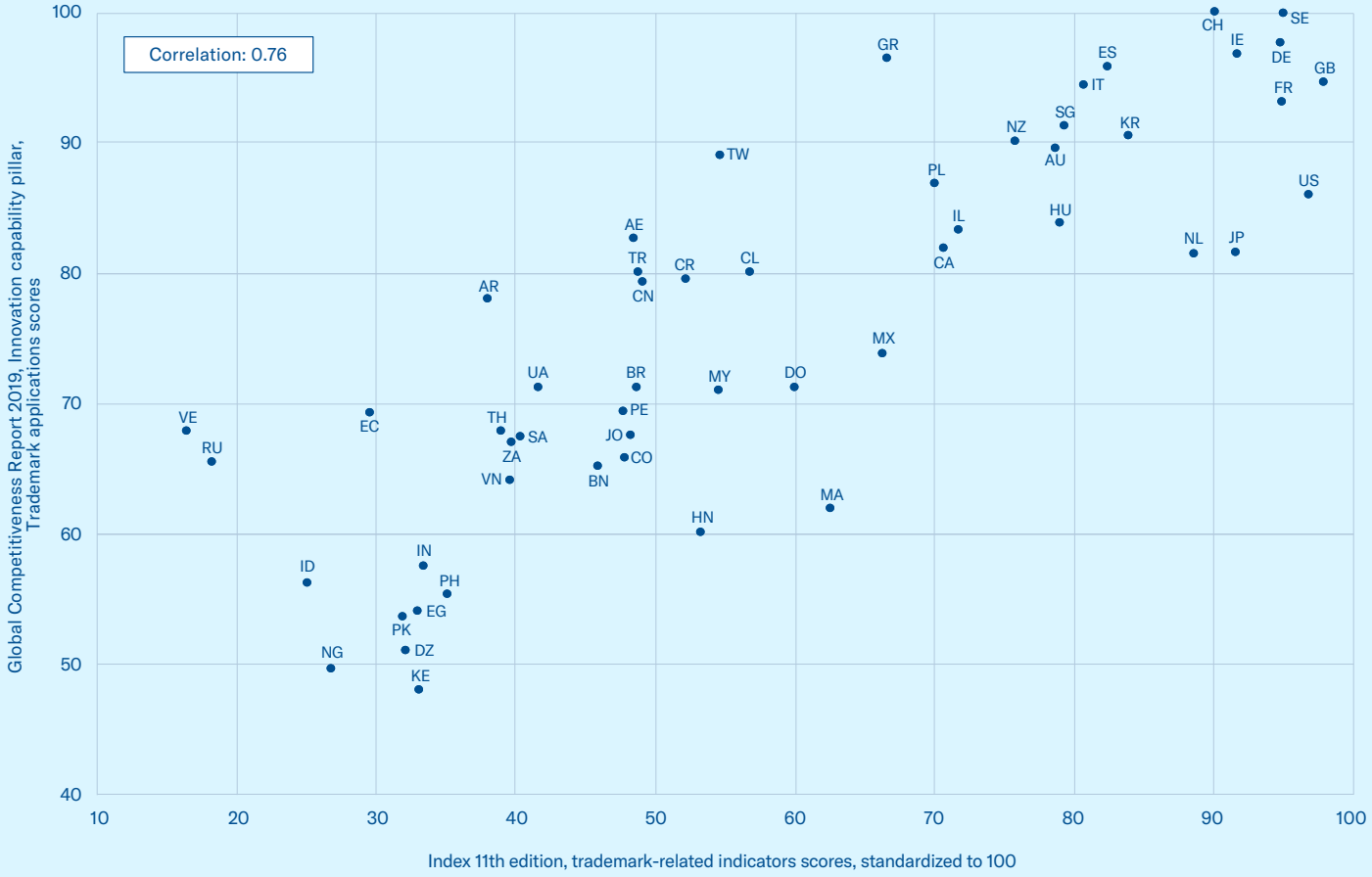
Data not applicable for Brunei, Dominican Republic, Ghana, Honduras, and Taiwan.

- The Index's ICT-related indicator scores are strongly related to the benefits of properly licensed software as a percentage of gross domestic product as measured by BSA | The Software Alliance and INSEAD, with a correlation strength of 0.77.

- Economies that provide strong ICT-related protection have a higher contribution of licensed software to gross domestic product.

Strong IP Environments Promote International Brand Use

Figure 36: Association Between The Index Trademark-Related Indicators' Scores And The *Global Competitiveness Report 2019*, Innovation Capabilities Pillar, Trademark Applications Scores[28]



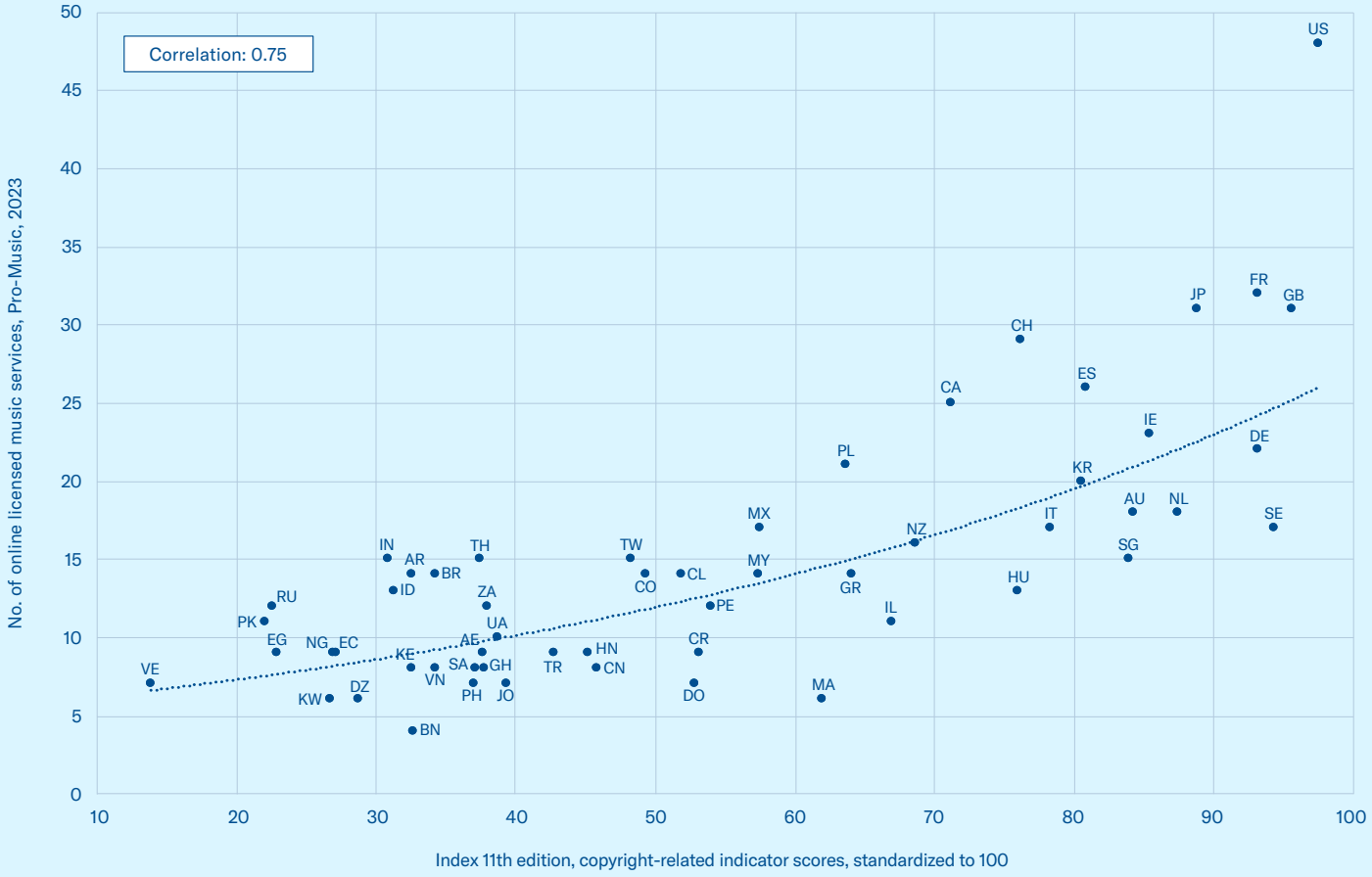
- Obtaining international trademark protection and enforcing it across multiple jurisdictions require significant financial resources. A high rate of international trademark applications provides a good indication of the quality and value of companies and products within a given economy. In other words, high rates of international trademark applications suggest high rates of international competitiveness linked with a given economy.

- The Global Competitiveness Index's Trademark Applications indicator, which offers a population-adjusted, standardized measure of international trademark applications, exhibits a strong relationship (at a correlation strength of 0.76) with the Index's trademark-related indicator scores.

- Economies with effective IP systems have almost 40% higher levels of international trademark applications than those whose IP regimes lag behind.

Strong Copyright Protection Encourages Increased Availability of Legitimate Online Music Outlets

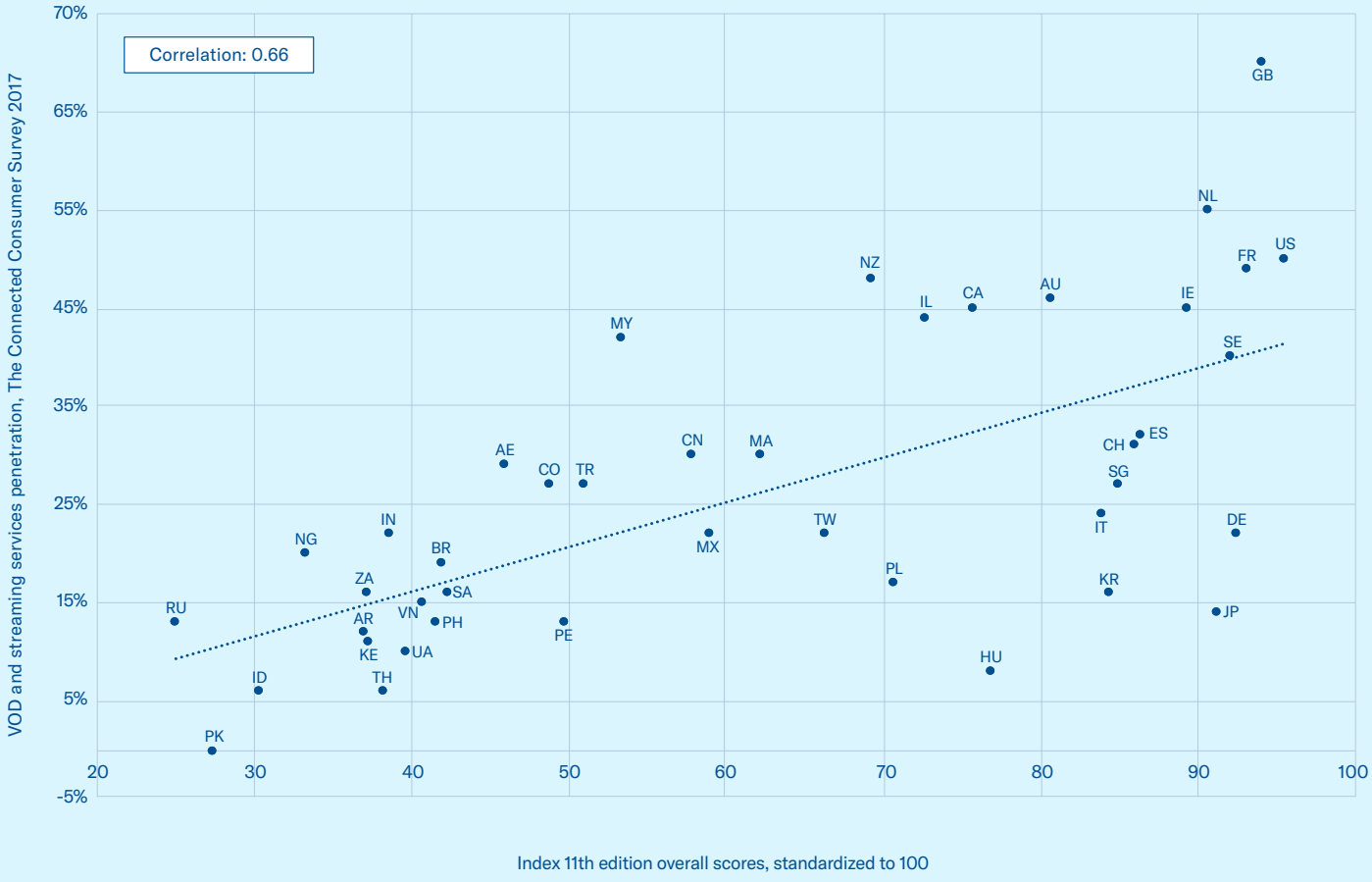
Figure 37: Association Between The Index Copyright–Related Indicator Scores And Volume Of Licensed Online Music Services[29]



- A strong correlation of 0.75 exists between the Index's copyright-related indicators' scores and the number of online licensed music services as measured by Pro-Music.org.
- Economies that maintain robust copyright environments enjoy almost double the access to new music through legitimate and secure platforms.

Mature IP Environments Have Wider and More Convenient Access to Video Content

Figure 38: Association Between Index Scores And Video-On-Demand (Vod) And Streaming Services Penetration[30]



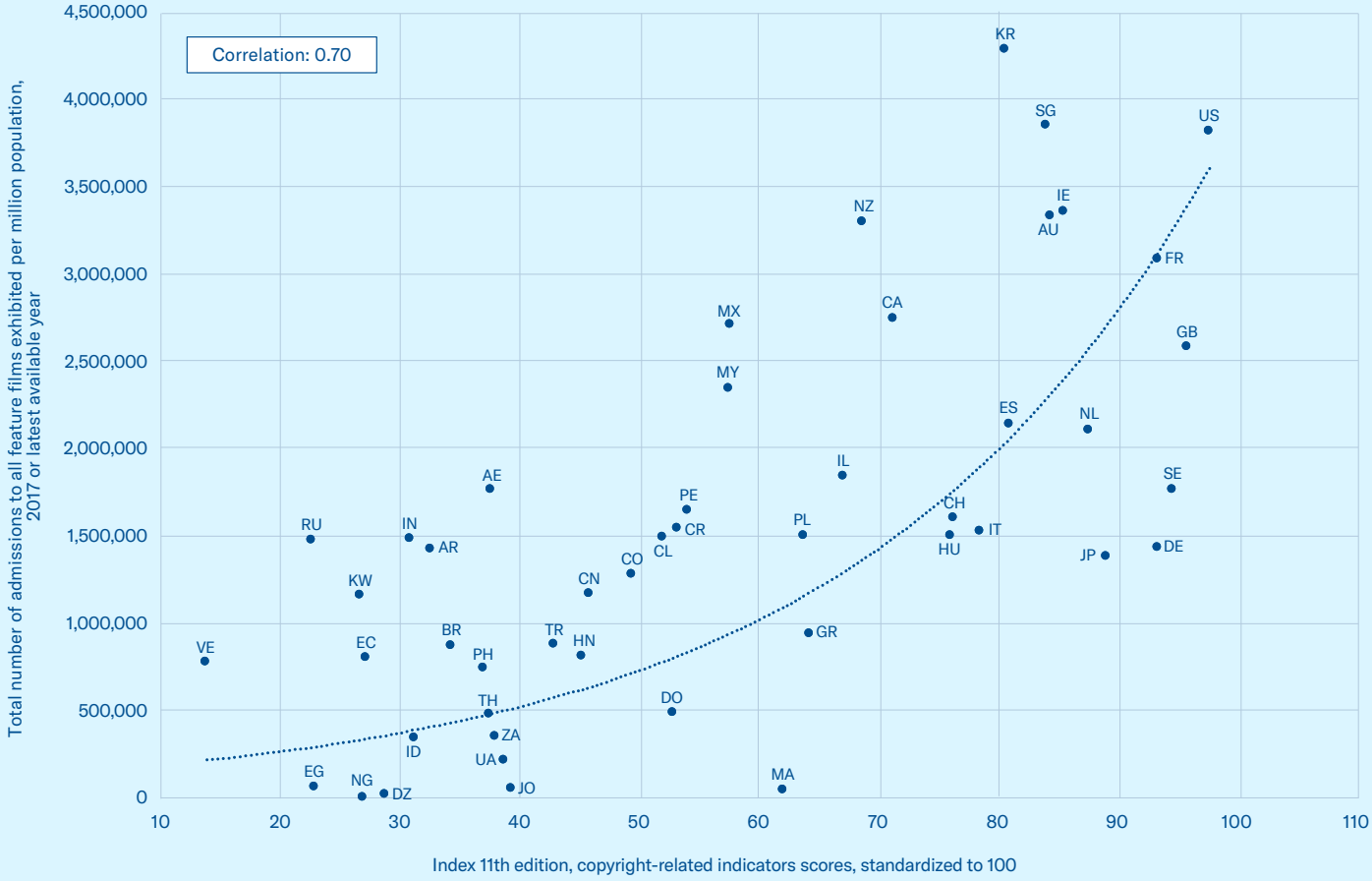
Data not available for Algeria, Brunei, Chile, Costa Rica, Dominican Republic, Egypt, Ecuador, Ghana, Greece, Honduras, Jordan, Kuwait, and Venezuela.

- The overall Index scores present a strong association between rates of video on demand (VOD) and television streaming services penetration, as measured by the Connected Consumer Survey with a correlation of 0.66.
- Consumers in economies with strong IP protection can access more than double the

number of VOD and streaming services.

IP Protection Supports Wider Access to Audiovisual Content

Figure 39: Association Between Index Copyright–Related Indicator Scores And The Number Of Admissions To All Feature Films Exhibited Per Million Population[31]



Data not available for Brunei, Kenya, Pakistan, Saudi Arabia, Taiwan, and Vietnam.

- Index scores on content-related indicators are strongly correlated with the quantity of theater admissions for feature films with a correlation of 0.70.

- Economies with strong copyright protection see almost double the number of theatrical screenings of feature films.

Endnotes

1. The Driver of Production pillar within the Readiness for the Future of Production Index consists of 59 indicators within 11 subpillars nested under six key drivers: Technology & Innovation, Human Capital, Global Trade & Investment, Institutional Framework, Sustainable Resources and Demand Environment. See World Economic Forum, *Readiness for the Future of Production Report 2018*, pp. 5–9.

2. The Technology & Innovation subpillar within the Readiness for the Future of Production Index measures economies' capacity for innovation and utilization of new technologies in the value chains by gauging ICT availability and usage, digital security levels, R&D spending and innovative outputs, and availability of venture capital and FDI in innovation. See World Economic Forum, *Readiness for the Future of Production Report 2018*, p. 21.

3. The Global Trade & Investment subpillar within the Readiness for the Future of Production Index measures economies' trade balance and infrastructure, logistic performance, availability of financial resources for the private sector, and volume of investments. See World Economic Forum, *Readiness for the Future of Production Report 2018*, pp. 46–47.

4. The Innovation Capability pillar in the World Economic Forum's *Global Competitiveness Report 2019* measures a wide array of indicators that influence economies' ability to generate innovative outputs, including R&D spending, multistakeholder collaboration in research, dispersion of specialized clusters, inventive activity, and buyer sophistication. See World Economic Forum, *The Global Competitiveness Report 2019*.

5. The *Global Innovation Index's* Business Sophistication pillar is composed of three subpillars: Knowledge workers, which measures both inputs and outputs for human capital in the public and private sector; Innovation linkages, which measures the levels of collaborative R&D activities; and Knowledge absorption, which measures innovation capacity and attractiveness to foreign direct investments. See Cornell University, INSEAD, and WIPO (2021): *The Global Innovation Index 2021,* Ithaca, Fontainebleau, and Geneva.

6. The company R&D spending score is based on responses to the question "In your country, to what extent do companies spend on research and development?" where 1 = do not spend on R&D and 7 = spend heavily on R&D (standardized to 100), in the World Economic Forum's *Global Competitiveness Report 2017–18*. Because this variable is no longer measured in the latest edition of the *Global Competitiveness Report* series, this edition of the *Annex* continues to use the data from the 2017–18 edition.

7. The IESE and EMYLON Business Schools' *Venture Capital and Private Equity Country Attractiveness Index* measures economies' attractiveness to venture capital and private equity funding by examining a range of factors, including the capital market, taxation environment, investor protection, entrepreneurial culture, and deal opportunities. See A. Groh, H. Liechtenstein, K. Lieser, and M. Biesinger (2021), *The Venture Capital and Private Equity Country Attractiveness Index: 2018 Annual* (IESE Business School and EMYLON Business School). Spell out IESE and EMYLON?

8. World Bank databank, Researchers in R&D (per million people).

9. The *Global Talent Competitiveness Index* by INSEAD is an international benchmark of 134 economies based on the policies and practices that enable an economy to develop, attract, and empower human capital, measuring both inputs, such as enabling landscape, market openness, quality of learning, and sustainability, and outputs, such as mid- and high-level skills and overall talent impact. See B. Lanvin, and F. Monteiro (Eds.), *The Global Talent Competitiveness Index 2022*, INSEAD.

10. Scientific and technical journal articles refer to the number of scientific and engineering articles published in the fields of physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences in 2018 or the latest available year, adjusted per million population. Source: World Bank, World Bank databank.

11. 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: S. Dutta and B. Lanvin (2022), *The Network Readiness Index 2022*, Portulans Institute. ICT-related indicators consist of indicators under the Patent, Copyright, Trademarks, and Trade Secrets categories, as well as relevant indicators in the Enforcement and International Treaties categories.

12. The ICT Development Index measures the level of ICT development across 176 economies by examining the availability of ICT infrastructure and access, level of ICT usage, and the capability to use ICTs effectively, derived from relevant skills. Economies are benchmarked based on their ICT frameworks' readiness, usage, and impact on the economy. Source: International Telecommunications Union. ICT-related indicators consist of indicators under the Patent, Copyright, Trademarks, and Trade Secrets categories, as well as relevant indicators in the Enforcement and International Treaties categories.

13. International Institute for Management Development (IMD) (2022), *IMD World Competitiveness Booklet 2022*, Lausanne, Switzerland.

14. World Economic Forum (2019).

15. International Institute for Management Development (IMD) (2022), *IMD World Digital Competitiveness Ranking 2022*, Lausanne, Switzerland.

16. 16 . Ibid. p. 30.

17. The *Economic Complexity Index* measures the multiplicity and complexity levels of the knowledge required to produce a given product and the level of its exports. A higher economic complexity coefficient entails higher capabilities to produce knowledge-intensive products and higher levels of productive outputs.

18. Innovative output is measured by the *Global Innovation Index* Innovation Output subindex score. The 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, licensing fees, and FDI outflows.

19. Triadic patenting (patents filed with the three major patent offices in the world—the U.S. Patent and Trademark Office, European Patent Office, and Japan Patent Office) is generally considered to be the best indicator of a patent's perceived overall value and quality. The patent application is filed in those three separate locations, and filing costs are high. In this edition of the *Statistical Annex*, the triadic patent rates are calculated as the sum of triadic patents over a 20-year period from 1999 to 2019, adjusted per million population to get a standardized rate of triadic patenting intensity. Source: OECDStat, Patents by technology, Triadic patent families, Total patents, Inventor country of residence, Priority date, 1999 to 2019 inclusive; World Bank (population). Patent-related indicators consist of indicators that fall under the Patent category of the Index, as well as those indicators in the Trade Secrets, Commercialization of IP Assets, Enforcement, and International Treaties categories that are relevant to patents.

20. Knowledge creation, impact, and diffusion are 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.

21. 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. Source: *Scientific American WorldView* (2016). Life sciences–related indicators consist of indicators that fall under the Patent category Trademarks and the Trade Secrets, Market Access, Commercialization of IP Assets, Enforcement, Systematic Efficiency, and International Treaties categories that are relevant to life sciences.

22. Clinical trial activity is measured as the gross number of clinical trials to date per economy, as registered in the clinicaltrials.gov database housed by the National Institutes of Health in the United States, standardized per million population. Population data are extracted from the World Bank. Life sciences–related indicators consist of indicators 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.

23. Ibid. 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 clinicaltrials.gov database, standardized per million population.

24. Ibid. Clinical trial activity on biologics is measured as the gross number of biologics clinical trials to date per economy, as registered in clinicaltrials.gov database, standardized per million population.

25. 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. Copyright-related indicators consist of indicators under the Copyright category of the GIPC Index, as well as those indicators in the Commercialization of IP Assets, Enforcement, and International Treaties categories that are relevant to copyrights.

26. 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.

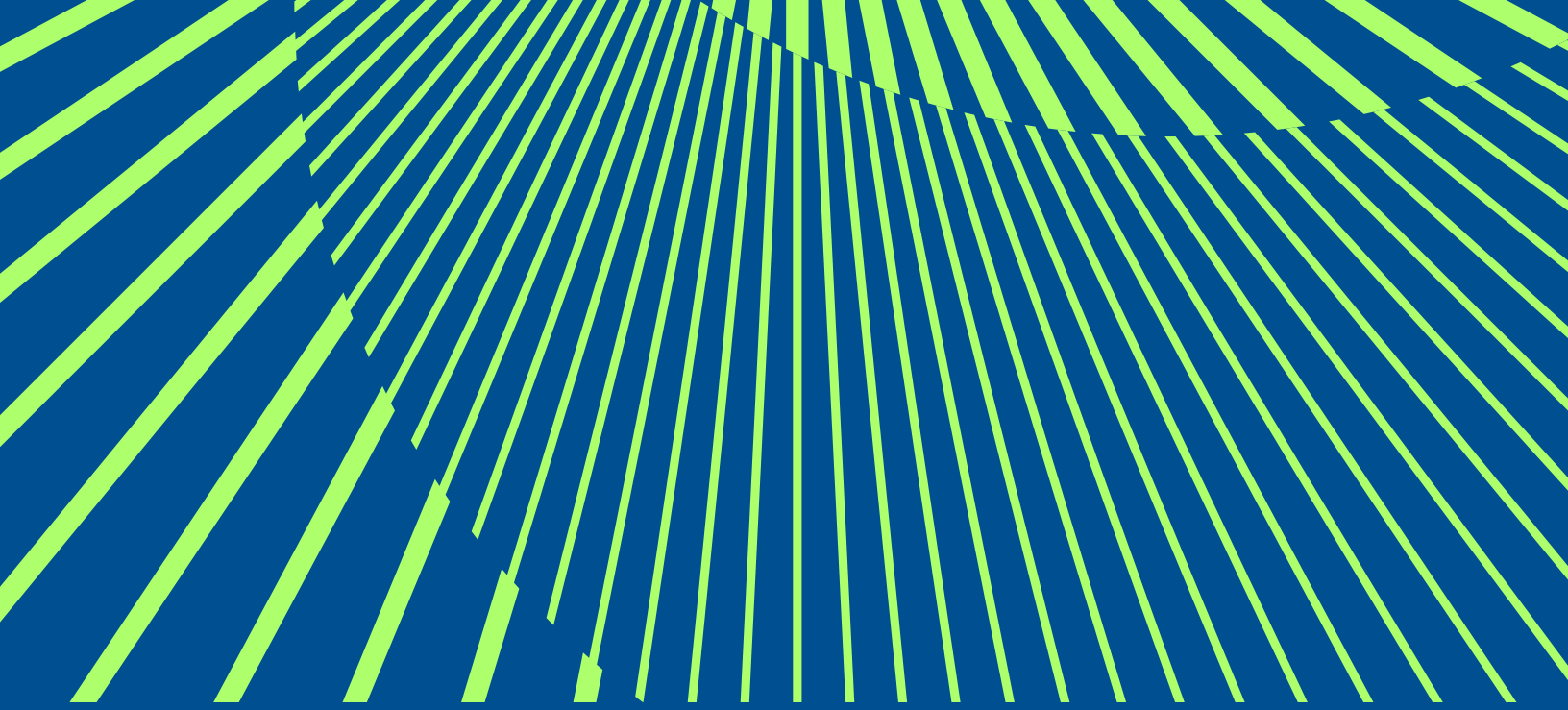
27. BSA/INSEAD (2013), *Competitive Advantage: The Economic Impact of Properly Licensed Software*.

28. The Global Competitiveness Index's Trademark Applications indicators measure the number of international trademark applications by country of origin, adjusted per million population and standardized by log transformation to a score of 0–100. See World Economic Forum (2019). The Index's trademark-related indicators consist of indicators under the Trademark category as well as indicators in the Commercialization of IP Assets, Enforcement, and International Treaties categories that are relevant to trademarks.

29. The 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 that is compiled by the International Federation of the Phonographic Industry. Source: Pro-Music.org (2022).

30. Video on demand 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 2017. Source: Google Consumer Barometer (2017).

31. UNESCO Institute for Statistics, online database, total number of admissions to all feature films exhibited per million population, 2017 or latest available year. IP Index Copyright-related indicators consist of indicators that fall under the Copyright category, as well as relevant indicators in the Trade Secrets, Commercialization of IP Assets, Enforcement, and International Treaties categories.



U.S. Chamber of Commerce
Global Innovation
Policy Center