



The Global Catastrophic Risk Index

Putting Risk on the Agenda

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Executive Summary

Catastrophes take many forms: from economic downturns to political strife, social unrest, and environmental disaster. The impact of crises such as these can be multiplied by both governments' failure to recognize them quickly, let alone preemptively, and their inability to respond effectively. These crises can be further compounded by economic vulnerability – itself heightened by the COVID-19 pandemic – and social instability stemming from poverty, poor governance, corruption and conflict. Moreover, in the highly integrated world of today, significant shocks to the system are unlikely to be contained within their country of origin. Instead, they will propagate among regional neighbors and trading partners with the potential to create complex, widespread emergencies. It is thus critical for policymakers and citizens alike to understand the interactive and reinforcing nature of the risks facing their countries and regions in order to avoid the governance and societal failures that could prove disastrous for the global population.

The Global Catastrophic Risk Index has been constructed to capitalize on the proven advantages of composite indices as guides to decision-making, providing a synthesized index at the country level for global catastrophic risks. Each of the 118 countries covered by the GCRI is evaluated across more than 85 indicators comprised of both vulnerability and resilience factors. The GCRI presents data from a variety of international organizations – including the World Bank, the United Nations and its various agencies, and the International Monetary Fund – to provide a broad-based understanding of global risk factors. The data is organized in seven key risk categories or “Pillars”: Economic Stability, Quality of Governance, Education and Skills, Gender Equality, Business Environment Resilience, Environmental Vulnerabilities, and a grouping of Exogenous Vulnerabilities that, although not falling neatly into the preceding categories, are nonetheless crucial.

This first publication of the Global Catastrophic Risk Index sheds light on the complex risks facing countries globally. The findings are unique as they demonstrate not only that no country is free of risk, but also that policymakers globally have often failed to take collective action against systemic and environmental risks. There is the obvious correlation between the general level of development and vulnerability to catastrophic risks, with poor countries with weak or failing governments and low investment in human capital clearly much more at risk. More surprising is the much smaller difference with respect to environmental risks, showing that these largely planetary risks threaten countries more equally and must be addressed globally. The results of this year's Global Catastrophic Risk Index show that the most-at-risk countries in the world are Sudan, Afghanistan, Yemen, Lebanon and Mali. At the other end, the least-at-risk countries are Denmark, Sweden, Ireland, Finland and Luxembourg, an outcome that will likely not be particularly surprising to readers.

Future editions of the index will attempt to broaden country coverage as far as data availability allows, particularly to include small island developing states known to be particularly vulnerable. There is still considerable potential to enhance and update data, and include new indicators deemed to have meaningful descriptive power.

Introduction

The publication of the Intergovernmental Panel on Climate Change’s Sixth Assessment Report details the destructive power and increasing frequency of climate catastrophes globally. Daily headlines make evident that environmental crises do not discriminate between countries and that no countries are impervious to their threat (see Figure 1). However they manifest, crises are only compounded by economic vulnerability (which has itself been exacerbated by the COVID-19 pandemic) and social instability stemming from poverty, poor governance, corruption and conflict. It is thus critical for authorities to recognize that risks today come in complex forms, interacting and reinforcing each other, and carry the possibility of major governance and societal failures resulting in severe consequences for the global population.

A comprehensive overview of the potential catastrophic risks facing states today is overdue. Such a publication has been needed to identify stress points for which preventive measures can be implemented (where possible) and contingency plans actioned (where necessary) to anticipate and minimize the consequences of such risks. A product of complex and sometimes opaque factors, risk can be viewed more simplistically as a function of vulnerability and resilience. A catastrophe comes from more than a triggering event and its impact can be multiplied by both a failure to recognize the issue quickly, let alone preemptively, and an inability to respond effectively. Because of this, it is critical that policymakers and citizens alike understand the complex risks facing their countries and regions, and where they stand in relation to their allies, neighbors, and trading partners.

The Global Catastrophic Risk Index (GCRI) has been constructed to capitalize on the proven advantages of composite indices as guides to decision-making, providing a synthesized index at the country level for global catastrophic risks (GCRs). It is a first step towards developing a common metric, harmonizing the global discourse, and focusing public attention on GCR mitigation and adaptation. Based on extensive data collection and scaling, the GCRI presents a comprehensive yet coherent answer to two complex questions: *What countries are facing the greatest catastrophic risks? and What are those risks?*

Composite indicators such as the GCRI have the power to influence policy by quantifying benchmarks and measuring states’ relationship to them, thus providing incentives to affect policy. By synthesizing quantitative figures, surveys, and other established indices, the GCRI provides value and insight beyond the sum of its parts. The index’s simple scoring system offers accessible and intuitive insights to individuals needing to understand the extent to which certain states face myriad internal and external risks, and the interactions between those risks.

The index covers the 118 largest economies in the world (measured by GDP). Together, these countries account for 99% of global GDP and 97% of the world's population. Each country is evaluated across more than 85 indicators comprised of both internal vulnerability and resilience factors (see Figure 2). The GCRI presents data from a variety of international organizations – including the World Bank, the United Nations together with its various agencies, and the International Monetary Fund – to provide a broad-based understanding of global risk factors. The data focuses on seven key risk categories: economics, governance, education and skills, gender inequality, business environment resilience, the environment, and a grouping of exogenous risk factors that, although not falling neatly into the preceding categories, are nonetheless crucial.

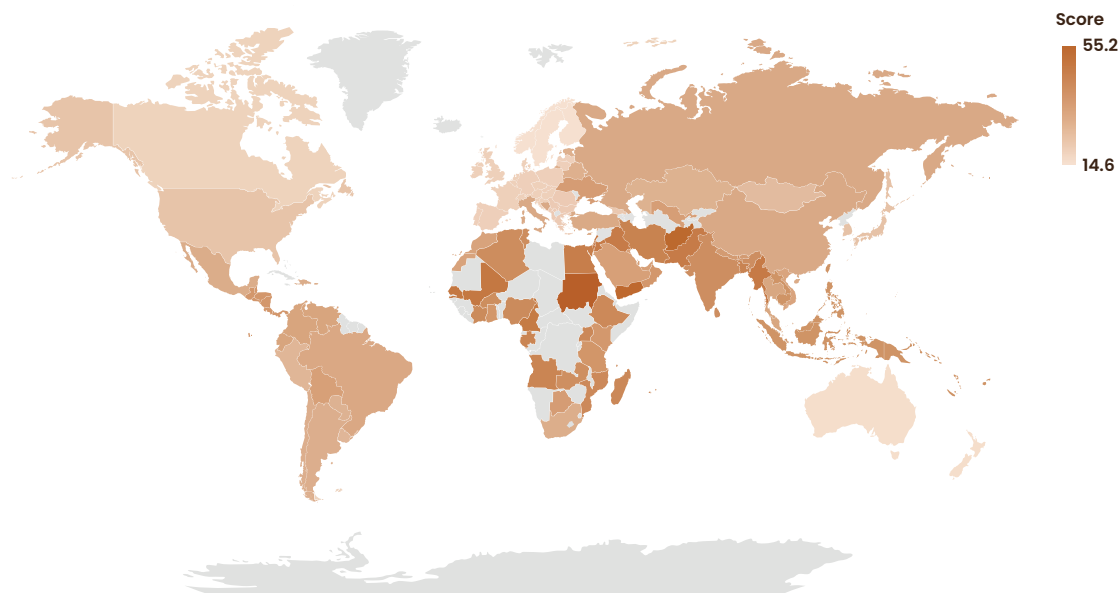
A catastrophe comes from more than a triggering event and its impact can be multiplied by both a failure to recognize the issue quickly, let alone preemptively, and an inability to respond effectively.

The scores for each indicator illuminate the extent to which countries are exposed – whether through poor policy, bad geography, or bad luck – to risks that could result in catastrophe. Vulnerability to catastrophic risks needs to be addressed at two levels. There are those risks that can be addressed largely within a country by measures within its own control or management, where an index can promote internal policies and actions. Other risks external to and exceeding any individual country's = control must be countered collectively at the regional or planetary level with some form of global governance. In the latter cases, national actions will usually be limited to measures reducing vulnerability and increasing resilience.

It should be emphasized that, in the highly integrated world of today, any significant shock to the system will not be limited to the initial cause, but will propagate through the system creating a complex emergency with many negative consequences: one crisis will probably trigger others. Therefore, it may be necessary to consider the risk scores of neighbors, trading partners, and allies to further untangle the complex web of risk facing states in the world today.

As subsequent versions of this report are published biennially, readers will be able to track countries' progress over time. The increasing interconnectedness of global economies, oscillation of the quality of democracies, and acceleration of climate change promises only one certainty: that the landscape of global catastrophic risk will be in constant flux.

Figure 1 | The Geography of Global Catastrophic Risk



Index Structure - Vulnerability and Resilience Factors

The paragraphs that follow present an overview of those factors, policies and institutions which contribute to making a country more or less resilient and vulnerable to shocks, whether domestic or exogenous. An attempt has been made to be comprehensive in coverage, subject to data limitations and the requirement that such data be available for the 118 countries covered in the index.¹

¹ The current reality in terms of global datasets that try to capture various risk factors is that there is a wealth of data on macroeconomic and economic development indicators, reflecting the important investments in data collection made in this area by the international financial institutions. However, there is considerably less data on environmental factors and other vulnerabilities which are inherently more difficult to measure, particularly in the context of middle and low-income countries. Indeed, the weaknesses in data collection across the world have been made evident in the challenges faced in the monitoring of progress made with respect to the implementation of the Sustainable Development Goals for 2030.

Figure 2 | Structure of the Global Catastrophic Risk Index

Pillar I: Economic Stability

1. Macroeconomic Stability

- a. Budget Deficit
- b. Debt Level
- c. Inflation Rate

2. Structural Resilience

- a. Size of the Underground Economy
- b. Income Inequality
- c. Natural Resource Endowment
- d. Quality of Infrastructure
- e. Integration with Global Markets
- f. Trade Restrictiveness
- g. Openness to Foreign Investment

3. Financial Resilience

- a. Foreign Currency Denominated Loan to Total Loans
- b. Liquid Asset to Short-Term Liabilities
- c. Non-Performing Loans to Total Gross Loans
- d. Regulatory Capital to Risk-Weighted Assets

Pillar II: Quality of Governance

1. Building Blocks of Good Governance

- a. Political Stability and Absence of Violence
- b. Control of Corruption
- c. Voice and Accountability
- d. Rule of Law
- e. Government Effectiveness

2. Regime Fragility

- a. Fractionalization of Elites
- b. Group Grievances

3. Incidence of Corruption

- a. Corruption Perceptions Index
- b. Reliability of Police Service
- c. Judicial Independence
- d. Electoral Participation

4. Information Freedoms

- a. Political Rights
- b. Press Freedom

Pillar III: Education and Skills

1. Quantity of Education

- a. Primary Enrollment
- b. Secondary Enrollment
- c. Tertiary Enrollment

2. Quality of Education

- a. Mean Year of Schooling (Primary and above)
- b. Educational Attainment (Primary)
- c. Educational Attainment (Upper Secondary)
- d. Educational Attainment (Bachelor)

3. Job Training

- a. Adult Education and Job Training
- b. Brain Drain

Pillar IV: Gender Inequality

1. Gender Inequality

- a. Legal Restriction
- b. Mobility Restriction
- c. Doing Business
- d. Property Rights
- e. Power Relationships at Home
- f. Incentives to Work
- g. Working Restrictions
- h. Violence Against Women

Pillar V: Business Environment Resilience

1. Business Environment Resilience

- a. Property Rights Regime
- b. Quality of Judicial Processes
- c. Facilitating Entrepreneurship
- d. Paying Taxes

Pillar VI: Environmental Vulnerabilities

1. Evidence of Climate Change

- a. Wildfires
- b. Temperature Change

2. Environmental Degradation and Pollution

- a. Pesticide Use
- b. Air Pollution Deaths
- c. Renewable Energy Sourcing
- d. Fossil Fuel Subsidies
- e. Overall Post-Tax Subsidies

3. Biodiversity

- a. Tree Cover Loss
- b. Species Habitat Index
- c. Protected Marine Areas
- d. Protected Terrestrial Areas

4. Stress on Basic Needs

- a. Water Stress
- b. Access to Basic Drinking Water
- c. Food Security
- d. Cropland Area
- e. Artificial Land Area

5. Catastrophes

- a. Lowland Area
- b. Persons Internally Displaced by Natural Catastrophes
- c. Geologic Risk

6. Vulnerability

- a. Climate Change Sensitivity
- b. Climate Change Exposure
- c. Adaptive Capacity

Pillar VII: Exogenous Vulnerabilities

1. Demographics

- a. Uncontrolled Migration
- b. Population Density
- c. Population Growth Rate
- d. % of Population Living in Coastal Areas

2. Health

- a. Doctors per Capita
- b. Under-5 Mortality Rate

3. Security

- a. Security Threats
- b. External Interference
- c. Availability of Nuclear Weapons
- d. Military Spending
- e. Risk of Invasion

PILLAR I

Economic Stability

Having a stable macroeconomic environment is an essential ingredient for the successful implementation of broad-based reforms aimed at boosting human prosperity and reducing the risks of social and political upheavals. There are no known instances of countries that have managed to grow in a sustainable way while pursuing imprudent fiscal policies which have, for example, fueled inflation and exchange rate instability, and contributed to the emergence of various macroeconomic imbalances. Prudent fiscal and monetary policies that contribute to low inflation rates and a more stable domestic environment have been shown to contribute strongly to business confidence and the willingness of domestic and foreign investors to undertake investment projects.

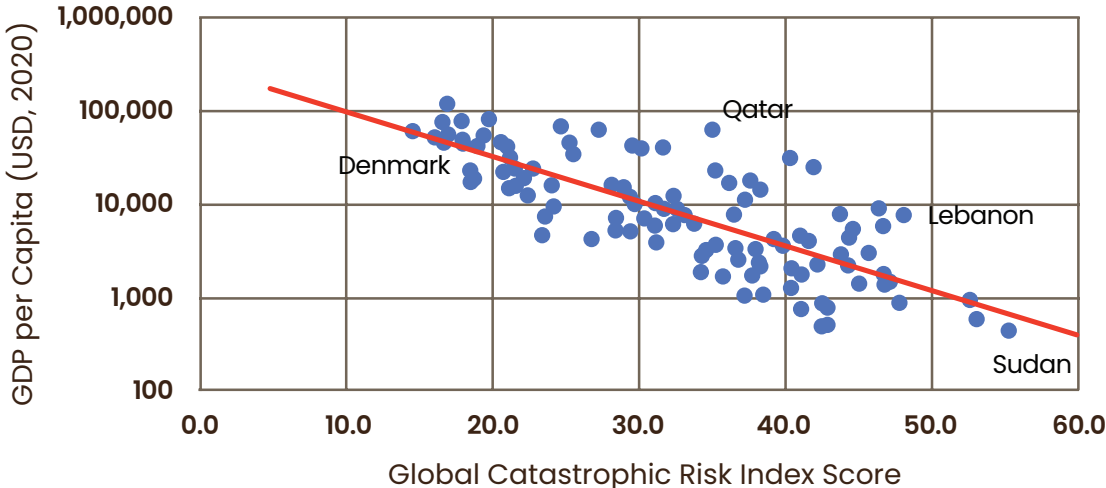
There are no known instances of countries that have managed to grow in a sustainable way, while pursuing imprudent fiscal policies.

The 2008-09 global financial crisis, its aftermath and, more recently, the need to help economies heal from the damaging effects of COVID-19-related lockdowns and other restrictive measures brought about by public health considerations have highlighted the crucial importance of sound public finances and the benefits of having fiscal flexibility. The problem with high public indebtedness in many countries according to the IMF – public debt levels in 2020 rose by some 20 percentage points of GDP on average across the world – is that it creates a difficult dilemma for

governments. Scarce public resources which could be allocated to education, public health or infrastructure - all areas that help to improve competitiveness - have to be increasingly dedicated to debt service. The primary aims of economic policy are subverted. Instead of worrying about reforms aimed at boosting productivity, governments increasingly have to worry about keeping the markets stable, making sure that debt rollovers take place smoothly and so on - i.e., day-to-day cash management.

In contrast, countries that have managed to sustain prudent levels of debt have typically been able to allocate adequate resources to productivity - enhancing areas of public expenditure. They have also been more successful in persuading the business community and civil society to pay their taxes on time and have drastically reduced the risks of financial implosion which then would have a deleterious impact on social and political stability. How well governments are able to allocate resources in a way that improves equity in society is also crucially important as there is ample empirical evidence that growing income disparities are a source of political instability, undermining the basis of democracy and the political and social order.

Figure 3 | Global Catastrophic Risk Index Score vs GDP per Capita (PPP) ²



The question of a country’s integration with the global economy has also acquired growing importance over the past decades, particularly in the context of discussion about the interactions between the process of globalization and economic development. In an increasingly interdependent world economy, a more outward-looking orientation has become an essential element of successful economic reform. In addition to the well-known gains from international trade, it is clear that relative openness and strong

² The correlation coefficient is highly significant, with p-value well below 0.01.

links with the world economy, force domestic producers to maintain discipline in the international market and provide opportunities for new exports, and provide opportunities for new exports. An open orientation can also attract much needed capital and expertise, thus enhancing the prospects for growth through increased efficiency and productivity. Greater integration with the world economy also serves as an important channel for absorbing technological advances from abroad, including improvements in management practice and positive effects on the build-up of human capital that derive from being able to tap into global systems of knowledge, as is evident from the experience of many outward-oriented economies that have developed strong export sectors based on new manufacturing industries. At the same time, the recent supply chain vulnerabilities revealed by pandemic-induced global economic shocks suggest that some balance is required between global integration and self-sufficiency. Countries need to plan for an adequate level of resilience as crises become more frequent.

Case Study 1 | High Public Indebtedness as a Risk Factor

Many economies are plagued by a high public debt-to-GDP ratio, which has been shown to hinder prospects for economic growth and stability.³ Unsustainable levels of public debt often lead to volatility in the value of the nation's currency which can then undermine trade, boost inflation and have other undesirable macroeconomic consequences, including an erosion of confidence. At its extreme, unsustainably high levels of public debt can result in a default which then can lead to interest rate spikes, tighter credit markets, unstable stock markets, and diminished welfare provisions.⁴

To better understand the disastrous consequences of high public debt levels, consider the case of Argentina. Since the country gained independence from Spain in 1816, it has defaulted nine times, with two of the most recent episodes occurring in the past 20 years. The most recent default occurred in May 2020, and was brought on by the wide-ranging effects of the COVID-19 pandemic and unsustainable fiscal policies which saw twelve consecutive years of fiscal deficit and a doubling of the public debt to GDP ratio over the same period. At the time of the default, Argentina had a total public debt burden of \$323 billion, or 103% of its GDP,⁵ well in excess of levels considered prudent in any country, let alone an emerging market.

While the GCRI includes a range of environmental and exogenous factors which have a bearing on a country's risk profile, there is no doubt that prolonged mismanagement of the macroeconomy can have significant implications for the incidence of poverty, income distribution, the strength and resilience of national institutions, for political stability, and ultimately a country's international reputation. In the context of a fully integrated global economy, these implications have a high likelihood of international spillover.

3 Reinhart, Carmen, and Kenneth Rogoff. "Growth in a Time of Debt." 2010, <https://doi.org/10.3386/w15639>.

4 Buttle, Rhett. "Defaulting On The National Debt Ceiling Would Be Catastrophic For Small Businesses." Forbes. Accessed November 15, 2021. <https://www.forbes.com/sites/rhettbuttle/2021/10/04/defaulting-on-the-national-debt-ceiling-would-be-catastrophic-for-small-businesses/>.

5 Welle (www.dw.com), Deutsche. "Why Argentina Needs More Help with Its Huge Debt | DW | 12.05.2021." DW.COM. Accessed November 15, 2021. <https://www.dw.com/en/why-argentina-needs-more-help-with-its-huge-debt/a-57506421>.

Quality of Governance

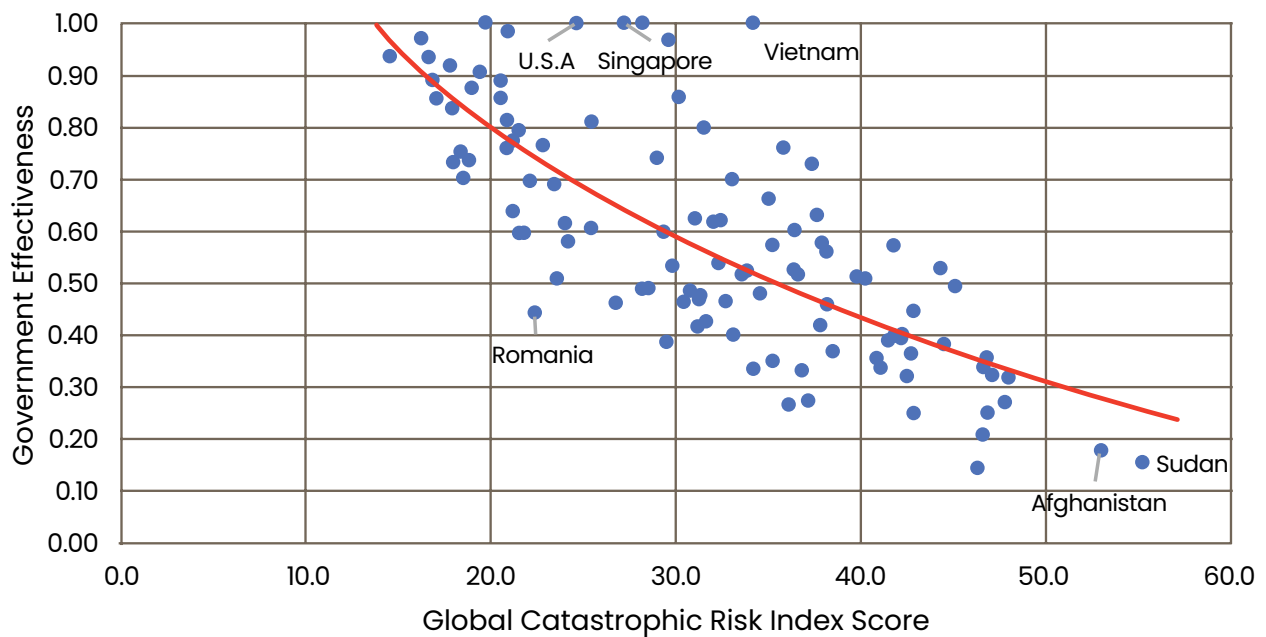


Over the last couple of decades there has been a welcome broadening of the debate as to what constitutes successful development. One element of this concerns the role of government in general and, more specifically, how political authority can be best exercised in a society for the management of its resources. The approach to mitigating the risks identified by the Global Catastrophic Risk Index must follow a top-down trajectory, beginning with the formation of policy that not only minimizes the effects of catastrophes, but prevents them from arising in the first place. A competent government thus forms the backbone of a state's ability to respond to crises as well as opportunities.

Governance is the term that is used now in the development community to underscore the fundamental role of the quality of government in this process. It is therefore not only a crucial measure of risk in itself, but also an important indicator of a state's capacity to address the risks identified in the other pillars. Because governance is fundamental to successful development, a few basic elements must be identified.

6 The correlation coefficient is highly significant, with p-value well below 0.01

Figure 4 | Global Catastrophic Risk Index Score vs Government Effectiveness Score ⁶



Building Blocks

The foundational aspects of effective governance are political stability and the absence of violence. When either of these is lacking, first-order political crises may arise wherein other indicators lose relevance. A state consumed by regime change or sectarian violence can hardly afford to focus its attention on lowering its inflation rate, increasing secondary school attendance, or sourcing its energy from renewable sources. Unfortunately, the world has seen the resurgence of autocratic, dictatorial and kleptocratic regimes that establish and maintain themselves by force. As can be seen in Figure 5, there is a strong relationship between regime type and catastrophic risk.

A stable political structure does not mean that it is unchanging. Rather, a dynamic political environment can enable a state to react more effectively to the changing landscape of risk and of geopolitics more broadly, provided the state’s dynamism is underpinned by rule of law and institutional procedures. Such stability enables the state to efficiently steward resources and provide services to its populace, while officials are held accountable through political and legal means. In the absence of stable governance, the basic needs of the population at large may not be met, let alone those of minority groups.

Regime Stability

In addition to determining a state’s political stability, assessing the stability of its ruling regime is crucial to understanding political risks and societal fault lines. Sources of

regime fragility can appear at both ends of the political spectrum – the factionalization of elites and the intensity of group grievances within the populace can both threaten the future of a regime. Elite factions and groups grievances commonly arise along ethnic, religious, or racial lines, manifest in political gridlock, and fuel exclusionary rhetoric that, at the extreme, can result in xenophobia and ethnic cleansing. The source of both may be historical and thus firmly established in a group’s identity. Groups may also perceive a lack of autonomy, political voice, or economic power to which they believe themselves entitled. Factionalized elites may be preoccupied with infighting rather than clear headedly addressing the risks and needs of their citizens. Similarly, group grievances may imperil societal cohesion and paralyze a state’s ability to operate in pursuit of a common purpose or even to agree on what the right and proper objectives are.

Rule of Law

The exercise of power must be guided by the need to improve the standard of living and well-being of the population. Adequate safeguards must be introduced to prevent the emergence of situations in which ruling elites use political power for personal gain rather than public benefit. Democracy and political pluralism can also facilitate this task which, at a minimum, involves the periodic legitimization of governments through popular choice and in a way that gives adequate voice to the opposition, making politicians thus more responsive to the needs of society. In addition, rule of law, the notion that the rules which govern a society are applicable to all, is crucial to preventing this abuse and establishing accountability.

The issue of accountability is closely linked to that of participatory development. Unless people feel that they have a say on whom they are ruled by, they cannot be expected to fully support the government’s development strategies and policies. There is increasing recognition that without a reasonably objective, efficient, and predictable judicial system and legal framework, accountability will have no legal underpinnings and the goals of good governance will be undermined. Without such public support, even well-designed plans will in the end amount to very little.⁷

Control of Corruption

In contrast to trust and accountability, corruption is a corrosive element which undermines the investment climate, discourages private-sector development and innovation, and encourages various forms of inefficiency; the more widespread, the more damaging its effects. For instance, budding entrepreneurs with bright plans and ideas will be intimidated by the bureaucratic obstacles, financial costs, and psychological burdens of starting new business ventures by having to bribe officials and engaging in activities on the margins of legality because of widespread corruption.

7 Sen (1999) convincingly argues that those countries in which governments operate in an environment of political legitimacy tend to be much better at allowing the formation of vital understandings and beliefs among the population that directly impinge upon aspects of the development process.

Corruption is particularly devastating for small and medium-sized enterprises – often the engines of economic growth and job creation in the developing world – which may not have the clout of larger companies to protect themselves from, or support the costs of, requests for bribes. Surveys have shown that the greater the incidence of corruption in a country, the greater the share of time that management has to allocate to dealing with ensuring compliance with regulations, avoiding penalties, and dealing with the bribery system that underpins them. Moreover, corruption’s reduction of government revenue limits the ability of the government to invest in productivity-enhancing areas, such as education, infrastructure and health.

The Global Governance Forum is a strong supporter of Integrity Initiatives International, a US-based civil society organization that has called for the establishment of an International Anti-Corruption Court, to more effectively address the issue of Grand Corruption – the abuse of public office for private gain by a nation’s leaders – where kleptocrats can act with impunity because they control the courts, the prosecutors and the police. This kind of large-scale corruption has dire repercussions for the process of economic development.

Case Study 2 | Effects of Corruption

The immediate impacts of corruption are obvious – the wealth and power of elites are augmented at the expense of national trust, good governance, and more vulnerable populations. However, the far-reaching effects of corruption can result in heightened economic, social, and environmental risks. In many cases, corruption can take subtler forms, even becoming codified as law in certain instances.

Economic policies that facilitate corruption can be covertly disguised as economy-strengthening initiatives. For example, trade restrictions are an easy guise for rent-seeking activity by political elites: the artificial limiting of imports will incentivize importers to bribe government officials. Furthermore, they may allow domestic industries to monopolize the production of a good and will lead producers of that good to offer financial remuneration to politicians that maintain the trade restriction and resulting monopoly. In certain countries, foreign exchange markets operate with multiple exchange rates for different sectors of the population. This is perhaps corruption at its most thinly veiled: politicians and elites can simultaneously buy and sell assets in the different exchange rate regimes in order to profit off of artificially maintained arbitrage opportunities.⁸

Corruption is also known to heighten environmental risks. Politicians are prone to enact policies that benefit extractive industries which leads to environmental damage. This phenomenon is especially prevalent in newly industrialized or industrializing economies, where profits and efficiency are often prioritized over environmental concerns. An example of corruption harming the environment can be seen in Honduras, where the interconnectedness of business leaders and governmental officials has led to extremely weak environmental regulations and a regime in which profit maximization is the rule.⁹

There is a strong, statistically significant positive correlation between catastrophic risk and corruption (measured by Transparency International’s Corruption Perceptions Index). In short, countries with higher levels of corruption face a higher catastrophic risk level. Among the ten most at-risk countries, five also score among the ten most corrupt. Meanwhile, among the fifty least at-risk countries, only Paraguay scores among the twenty-five most corrupt.

Information Freedoms

Societies operate better when there exists a presumption of trust. This is tremendously important for preventing corruption, financial misdealing and other abuses. Numerous studies have shown that where there is trust, citizens and businesses pay their taxes. This in turn enables the government to formulate policies to achieve various social ends – say, dramatically increase access to the internet in the schools – because the resources are available to invest in these areas. As societies see the fruits of these efforts, trust in the government is reinforced and the country enters into a “virtuous cycle” of development. Of course, “vicious cycles” are also possible and they will significantly worsen a country’s risk profile.

The extent to which the media are free from government meddling also reflects the extent to which there exists a presumption of trust in a society. Effectively responding to the risks and obstacles facing one’s state requires access to a free and unbiased press that can aid the public in understanding what those risks are and how severe their threat is. The first step is to ensure the media are free from intimidation and state restrictions, and can accurately report on the state of economic, education, environmental, and social issues. The better individuals understand the realities of their country and its position in the world, the better they can orient themselves to remedy ills and mitigate risk. This understanding becomes instrumental when individuals can use their knowledge to develop realistic policy preferences and voice the same through political participation.

Interaction of Elements

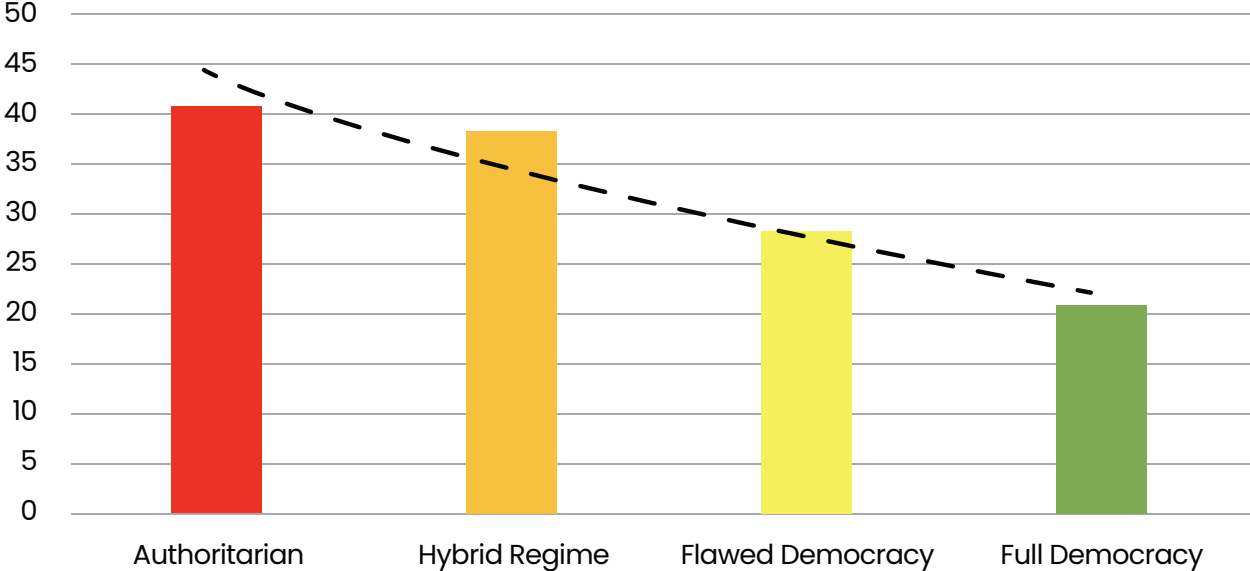
The potential benefits of an approach to development that seeks to incorporate the above mutually reinforcing elements should not be underestimated. For example, in an environment of accountability and political legitimacy, people will be far more likely to become active participants in the economy. A broadly shared sense of entitlement to economic transactions will then become an engine of economic growth. While not always an end in itself, a growing economy will boost private incomes and enable the state to collect taxes out of which it will be able to finance expenditures in vitally important social and quality of life areas, such as education, infrastructure, and social services. Higher levels of spending on education and health care have been shown to be associated with reductions in infant mortality and a fall in birth rates. Increased

8 Mauro, Paolo. “Why Worry About Corruption?” Economic Issues, International Monetary Fund 6 (n.d.). <https://www.imf.org/external/pubs/ft/issues6/>.

9 Glandorf, Kelsey Landau and Joseph. “Corruption Is a Threat to Planet Earth.” Brookings (blog), June 5, 2020. <https://www.brookings.edu/blog/up-front/2020/06/05/corruption-is-a-threat-to-planet-earth/>.

female literacy and improved schooling change women’s fertility behavior and end up having widespread implications for the environment, the pressures on which are often linked to rapid population growth. Conversely, the fruits of economic growth in the absence of strong governance can be quite disappointing, as has been seen in many countries over the last half century.

Figure 5 | Global Catastrophic Risk Index Score by Regime Type



Data Source: Economist Intelligence Unit (Democracy Index 2020)

PILLAR III

Education and Skills



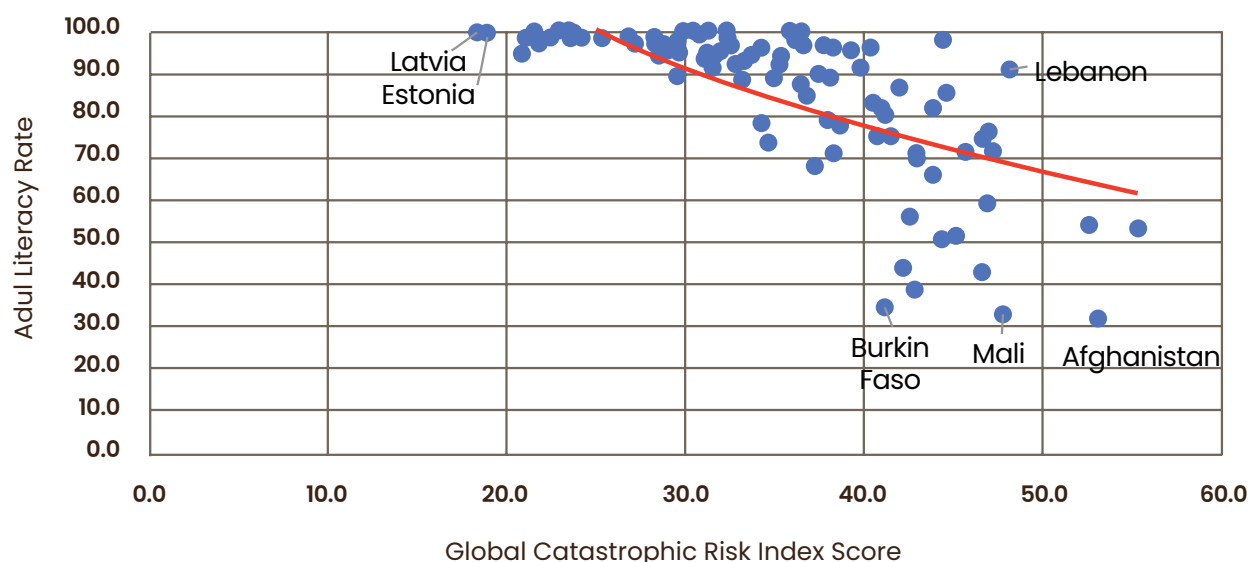
As best distilled by Amartya Sen (1999), education and good public health allow for more effective participation in the economic and political life of the nation. Illiteracy, for instance, can be a major barrier to participation in economic activities and the use of, and access to, technological innovations. Lack of basic skills severely limits the possibilities of citizens to participate in the development process, to be gainfully employed, to be well-informed judges of government policies and politicians, and to avoid falling prey to the manipulations of demagogues.

Education and training are indeed emerging as key drivers of productivity growth. The global economy has become more complex, nations must boost the human capital endowments of their labor force in order to be competitive in the global market. Workers must have access to new knowledge, including continual training in new processes – and in the operation of the latest technologies.

Harvard’s Michael Porter (1990) provides useful insights in his discussion of the role education plays in upgrading an economy’s productive apparatus. Worth highlighting is the emphasis he places on high educational standards – which typically require some

¹⁰ The correlation coefficient is highly significant, with p-value well below 0.01.

Figure 6 | Global Catastrophic Risk Index Score vs Literacy Rate ¹⁰



form of state involvement in the setting of norms – as well as the need for students to receive education and training that has a strong practical orientation.

He also notes that when teaching is perceived to be a prestigious job – hence, adequately compensated – it can have a measurable impact on the quality of the teaching staff and, more generally, the excellence of the education system. Porter highlights the importance of close collaboration between the educational institutions and potential employers, with universities and other institutions of higher education called upon to adapt to the changing needs of industry. Also not to be neglected is the need for firms to “invest heavily in ongoing in-house training through industry associations or individually.” He also praises the role of technical and vocational education, and highlights the benefits of inward migration policies that allow the movement of workers with specialized skills.¹¹ In this respect, improving the effectiveness and capacities of the educational system is also likely to have beneficial effects on job creation and employment. High unemployment is a huge waste of productive resources, some of it explained by incongruencies between the skills fostered by the education sector and the demands of a rapidly evolving and technologically driven modern economy.

Higher education, would appear to be particularly important, given the gains made in recent decades in expanding the coverage of primary and secondary education. Countries which have invested heavily in creating a well-developed infrastructure for tertiary education have reaped enormous economic benefits. Education has been a uniquely important driver in the development of the capacity for technological innovation, as the experiences of Japan, Finland, Sweden, Korea, Taiwan, and Israel have clearly shown.

¹¹ Ibid., 1990, pp. 628–30.

Case Study 3 | Importance of Education

Education is universally desired in societies, albeit with significant variance in the extent to which all parts of the population are allowed and encouraged to seek educational opportunities. While it is clear that education generates positive societal outcomes, it is important to examine the tangible ways in which it has this effect. Education propels individuals and societies through several channels, with outcomes including financial wellbeing, quality leadership, and better environmental policies.

First, greater financial literacy leads individuals to make better economic decisions in their everyday lives, which leads to better outcomes in national economies more broadly. Financial education is a broad category that includes subjects such as managing money, understanding banking and credit, and using financial knowledge to plan financial decisions.¹² With a greater financial education, individuals increase their economic security and contribute to community-level economic development.

Second, educated populations often have better governments. When citizens are educated, they are more likely to complain about negative government behavior, and an educated populace can hold government officials more accountable.¹³ Similarly, more highly educated societies have been shown to have lower incidences of crime and corruption, as misconduct is more likely to be effectively monitored and reported.

Third, a lack of environmental literacy hinders beneficial environmental policy-making. Often, communities suffering from the effects of environmental degradation can identify the source of the problem, but lack crucial information on the exact nature of the dangers that they are facing or how they can act to mitigate the problem. Environmental literacy and education programs, therefore, are crucial in creating healthy societies with robust environmental policies.¹⁴

There is a strong, statistically significant negative correlation between catastrophic risk and literacy rate (see Figure 6). As countries' literacy rate increases, their catastrophic risk score tends to decrease. Among the ten most at-risk countries, only Lebanon has a literacy rate above 90%, while the mean literacy rate among this group is 58.8%. Conversely, not one of the sixty least-at risk countries has a literacy rate below 90%.

12 Hogarth, Jeanne M. "Financial Education and Economic Development." Improving Financial Literacy: International Conference Hosted by the Russian G8 Presidency in Cooperation with the OECD, November 2006.

<https://www.oecd.org/finance/financial-education/37742200.pdf>.

13 Botero, Juan, Alejandro Ponce, and Andrei Shleifer. "Education, Complaints, and Accountability." *The Journal of Law & Economics* 56, no. 4 (2013): 959–96. <https://doi.org/10.1086/674133>.

14 Chepesiuk, Ron. "Environmental Literacy: Knowledge for a Healthier Public." *Environmental Health Perspectives* 115, no. 10 (October 2007): A494–99.

Gender Equality



A number of studies have shown that there is a close connection between national economic performance and the degree to which societies have succeeded in integrating women into the economy and other representative bodies.

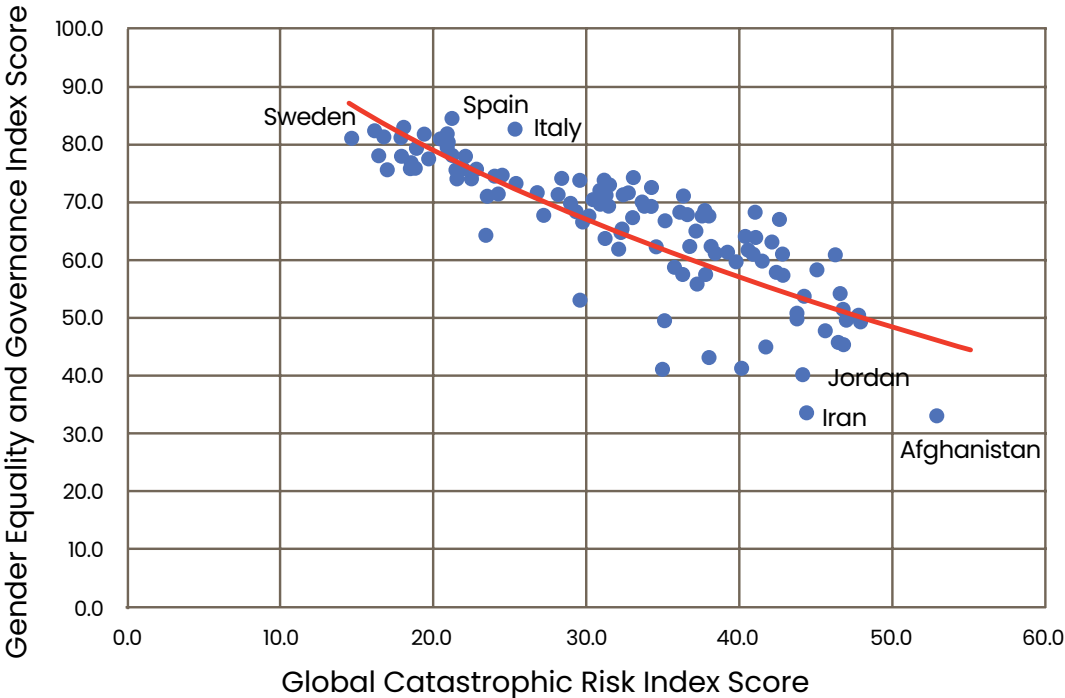
International competitiveness and productivity have much to do with the efficient allocation of resources, human resources included. The efficient operation of our increasingly knowledge-based economy is not only a function of adequate levels of available finance and a reasonably open trade regime for goods and services, but is also more and more dependent on our ability to tap into a society's reservoir of talents and skills. When, because of tradition, a misunderstanding of the purpose of religion, social taboos or outright prejudice, half of the world's population is prevented from making its contribution to the life of a nation, the economy will suffer. The skill-set which the private sector can tap will be necessarily narrower and shallower, and productivity, the engine of prosperity, will be impaired. Indeed, it is no surprise that the most competitive countries in the world, those that have been better able to operate on the boundaries of the technology frontier, are also those in which women have been given the greatest opportunities

The most competitive countries in the world... are also those in which women have been given the greatest opportunities to be equal partners with men.

to be equal partners with men. Thus, gender equality has not only an ethical or moral dimension, but is, in fact, an issue of economic efficiency and, thus, may be at the very basis of creating a more prosperous world.

Beyond this, countries that are committed to phasing out the multiple human rights violations that are implicit in the confinement of women to the status of second-class citizens will be less prone to the social and political tensions that often accompany the injustice. As a result, their risk profile will be more favorable. The Global Governance Forum’s Gender Equality and Governance Index makes very clear the benefits of greater gender equality for improved government effectiveness, greater rule of law, higher levels of political stability, less violence, and enhanced competitiveness.

Figure 7 | Gender Equality and Governance Index Score vs Global Catastrophic Risk Index Score ¹⁶



¹⁶ The correlation coefficient is highly significant, with p-value well below 0.01.

PILLAR V

Business Environment Resilience



The quality of a country's business environment reflects not only the ease with which firms can enter and operate in the national economy, but also is an indicator of the extent to which a country's institutions are functioning effectively. Like the businesses that operate in it, a business environment thrives on efficiency and established rules. Property rights, an independent judiciary, stable regulations, and a transparent tax regime can work in tandem to promote investment and entrepreneurship. However, in their absence, business can be held back, forced into the underground economy, or be inhibited from starting in the first place.

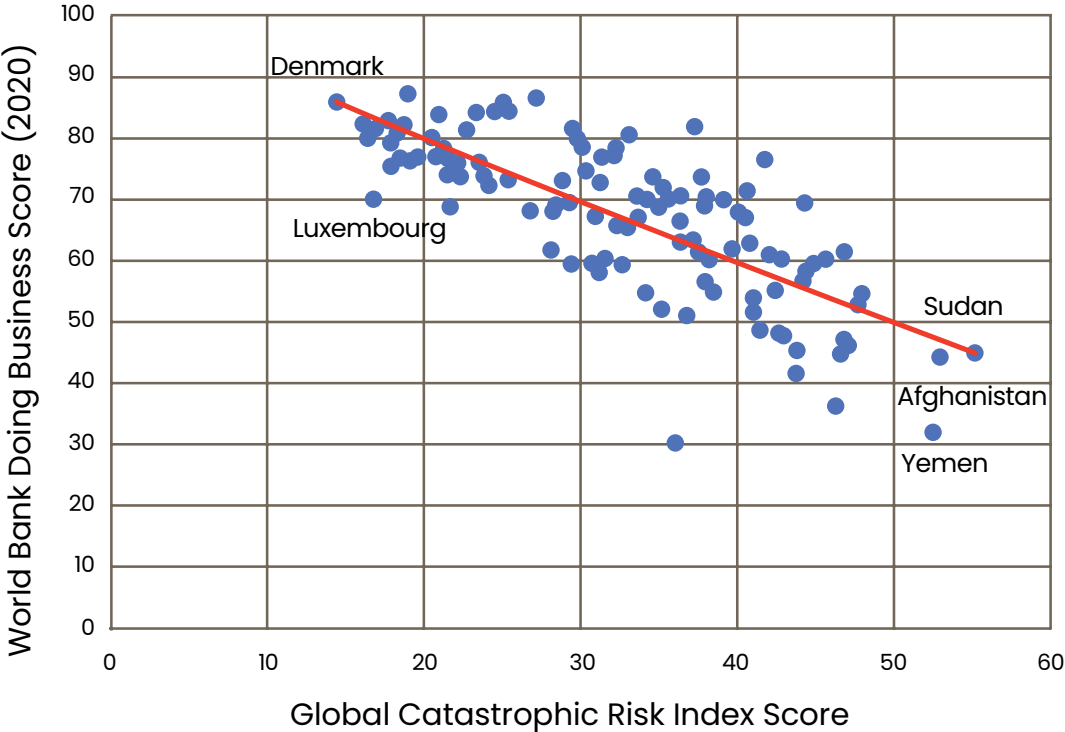
Like the businesses that operate in it, a business environment thrives on efficiency and established rules.

Property rights are one of the fundamental guarantees that a state must underwrite for its citizens. As a key mandate of the modern state, property rights determine the terms of peaceful competition for scarce resources in markets (which are ideally transparent and inclusive). An effective regime in this regard gives individuals and businesses the exclusive right to employ their resources as they see fit and protect them from expropriation. This in turn eliminates distortions caused by partisanship or crime, and leads to more efficient economic outcomes. Property rights can be bolstered by judicial independence which broadly helps to ensure that laws are applied freely and fairly, without discrimination or unfair preference. To ensure the rule of law, a judiciary

must be insulated from other arms of the government, the whims of ruling elites, and the winds of public opinion. An independent judiciary, free from political pressure and patronage, can ensure that businesses face predictable regulations and that those regulations are applied evenly such that no firms enjoy an unfair advantage.

Regulation is the major avenue through which governments can influence the business environment of their country. However, regulations must be transparent, efficient, and equitable in order to foster, rather than restrict, entrepreneurship and investment. Unfair or excessively burdensome regulation can hamper growth and encourage underground economies.

Figure 8 | World Bank Doing Business Score vs Global Catastrophic Risk Index Score



Tax collection is another pillar of the modern state’s mandate. Efficient and effective tax collection provides the state the resources it requires to perform its duties. An effective tax regime can discourage evasion and the resulting growth of the underground economy. An excessively burdensome business environment, with arbitrary rules that often are purely intended as vehicles for bureaucratic discretion and corruption will have adverse economic effects, with higher levels of unemployment and lower levels of revenue collection, both of which impair the ability of the state to respond to vital social needs and foster social discontent, political instability, and heightened risk.

PILLAR VI

Environmental Vulnerabilities



With the rapid growth in the human population combined with the global development of a material civilization powered by fossil fuels, we have in many cases reached, or are on a trajectory to reach, the material boundaries of our planet. The environmental pillar highlights the risks that now result from damaging or destabilizing the complex systems that have allowed life to evolve and have created a habitable environment for human civilization to advance to where it is today. The speed with which these threats are increasing is producing existential threats to human society at the global level, while the fundamental challenge of transforming the foundations and aspirations of our civilization to reduce these risks warrant giving this pillar a high weighting in future editions of the GCRI.

Climate Change

The latest IPCC report documents the catastrophic impacts of climate change, from extreme temperature events, stronger cyclones, wildfires, floods and droughts, to melting ice caps and rising seas. These disasters are already occurring, and with growing human and economic costs. Some changes are already irreversible, but most could be attenuated with rapid action toward both mitigation and adaptation in the next decade. The unprecedented nature of certain of the extreme climate events seen globally has resulted in the lack of appropriate data sets to quantify them. In order

to remedy this, the GCRI has attempted to select reliable indicators that can be used as effective proxies. Indicators of past crisis response speed and adequacy are also useful for projecting risk into an uncertain future.

Environmental Degradation and Pollution

The global push for development to meet the needs of an expanding population has proceeded within the paradigm of linear supply chains and an economy maximizing profits, all while treating environmental and social impacts as externalities. The result has been the pillaging of a major part of Earth's land surface and of the natural resources with which our planet was once so abundantly endowed. Moreover, these efforts have generated, pollution and waste on a massive scale. The oceans are similarly being stripped of resources, overwhelmed with plastics, acidified, and filled with our pollutants. Our future is threatened as non-renewable resources become increasingly scarce and expensive, while normally renewable resources are consumed beyond their rates of regeneration. To use an economic metaphor, we are living off the capital

Our future is threatened as non-renewable resources become increasingly scarce and expensive, while normally renewable resources are consumed beyond their rates of regeneration.

rather than the interest of our planetary biocapacity, with environmental footprints, especially of the affluent, far beyond what the Earth can sustain. Indicators of these negative trends, together with those of restoration and regeneration, can guide policy responses.

Biodiversity

Millions of years of evolution have populated the planet with rich and productive ecosystems that maintain a livable biosphere, provide invaluable ecosystem services, support human food systems, moderate our climate, and, last but not least, provide beauty. In our inability to protect sufficient natural areas, prevent illicit wildlife trade, control pollution, and limit global warming, we are causing a sixth mass extinction event, in which one million species are threatened in the immediate future and major ecosystems such as coral reefs and tropical rainforests are being degraded beyond recovery. Extinct species cannot be replaced, and without them, the complex web of life upon which we depend will be fundamentally weakened. Unfortunately, the human cost of our neglect will only be apparent after it happens, unless we have the foresight to take preventive measures.

Recent years have seen the world produce less food than it consumed, effectively signaling that we are living off reserves.

Stress on Basic Needs

We cannot escape the fact that we are biological organisms whose lives are dependent on food, water, and some form of shelter. Unfortunately, unwise development is putting our water supplies at risk and without water, the rest of development becomes

meaningless. Similarly, our food systems – both the highly industrialized agriculture in some parts of the world and subsistence farming in poorer rural areas – are poisoning and degrading soils, eroding the biodiversity on which they depend, and increasing their susceptibility to the damages of climate change. Some recent years have seen the world produce less food than it consumed, effectively signaling that we are living off reserves and, at the extreme, blindly failing to meet one of our most basic needs.

Catastrophes

Some natural disasters are beyond any human control or often prediction, such as volcanic eruptions, earthquakes, tsunamis, or objects from outer space striking the earth. It is thus hard to provide statistics about the resulting risks. However, there are areas that are predictably more vulnerable than others, where precautionary measures can reduce the human consequences. Obviously, areas near active volcanoes are at risk, and some regions are known to be earthquake-prone. Low-lying coastal areas may be more subject to tsunamis as well as storm damage. Since the human and economic costs of such natural catastrophes can be very high, every effort should be made to design infrastructure, provide early warning, anticipate necessary displacement or evacuations, and ensure adequate emergency responses with these risks in mind.

PILLAR VII

Exogenous Vulnerabilities



The preceding pillars each focus on thematically grouped indicators. Although not stand-alone pillars, the following indicators grouped under the subheadings of demographics, health, and security are nonetheless crucial considerations for the development of an accurate risk index. In addition, they are often both causal and symptomatic of the indicators explored in the Index's prior pillars.

Demographics

Migration is a global phenomenon and a process with far-reaching implications for origin and destination countries alike.¹⁷ Worldwide, the number of migrants continues to grow rapidly, reaching 281 million – 3.6% of the global population – in 2020 according to UN figures.¹⁸

Although immigration contributes positively to inclusive growth and sustainable development, it remains a controversial political subject in countries around the world. Native populations often fear competition for finite employment opportunities, a depression in salaries at the lower end of income distribution, free – riding on public resources, and a perceived dilution of their culture.¹⁹ With respect to the allegation of free – riding, research has shown that even low – educated migrants have a better public resource footprint – the difference between their contributions and the

benefits they receive – than native – born peers.²⁰ With respect to inter – group conflict, the increased heterogeneity of destination countries resulting from significant migration flows can, at its worst, adversely impact political stability when conflict arises among different groups living in close proximity.²¹

Low-educated migrants have a better public resource footprint – the difference between their contributions and the benefits they receive – than native-born peers.

As has been seen across Europe in the wake of Syria’s civil war, regulating immigration is rarely a simple task. Significant time, effort, and resources have been devoted to controlling the entry of migrants and asylum seekers. Even so, many migrants enter countries illegally. This increases the need for border and police expenditure away from other more productive ends. Once in the country, undocumented migrants may fall prey to extortion, imprisonment, or deportation and, as a result, often having their economic prospects relegated to existence in the underground economy. This may in turn result in long – term inequality and vulnerability to exploitation due to a lack of legal protections.

Swelling populations within fixed borders have resulted in significantly increased population densities in most countries over the past thirty years. The rise in population density has been reflected in increased living standards, but has also led to a strain on resources, increased congestion, and damage to the environment. Overfishing, loss of habitat, a stress on clean water, and a reliance on pesticides and steroids to augment the food supply are all examples of increased population density’s negative impacts.

The risks of high population densities are most evident when in coastal areas (elevation under 5m above sea level). Such areas are already at an increased risk of natural disasters such as hurricanes and flooding, and climate change will only exacerbate these risks. The rise of sea levels will force migration away from inundated coastal lands,²² and the resulting increase in saline and brackish water bodies will increase the transmission risk

17 One of the most impactful benefits of migration is the augmentation of human capital in destination countries. In contrast to the perception of migrants as homogeneously uneducated, the data shows a much more complicated picture. Over one third of migrants entering the labor force have completed tertiary education, according to OECD data, although a similar proportion has not achieved an upper-secondary level of education. The same bimodal distribution emerges in an analysis of what professions migrants are pursuing. In the United States, 22% of new workers in health care and STEM professions were migrants (the figure is 15% in Europe). On the other side of this coin, migrants represented approximately one quarter of new workers in the most strongly declining occupations in Europe and the United States. Despite the bimodal distribution in both education level and occupation, migrants fill important positions in destination countries.

18 United Nations. World Migration Report 2020. United Nations, https://www.un.org/sites/un2.un.org/files/wmr_2020.pdf.

19 Alesina, Alberto, and Marco Tabellini. “The Political Effects of Immigration: Culture or Economics?” https://www.hbs.edu/ris/Publication%20Files/21-069_b5792b5c-bff8-42d7-a6ff-1bec06797b8d.pdf.

20 OECD. “Is migration good for the economy?”. Migration Policy Debates – OECD (2014).

21 Gebremedhin, Tesfaye A, and Astghik Mavisakalyan. Immigration and Political Stability. OECD. <https://www.oecd.org/dev/pgd/46923664.pdf>

22 WHO. “Emerging Issues in Water and Infectious Disease.” WHO (2003).

23 Ramasamy, Ranjan, and Sinnathamby N Surendran. “Possible Impact of Rising Sea Levels on Vector-Borne Infectious Diseases – BMC Infectious Diseases.” BioMed Central, BioMed Central, 18 Jan. 2011.

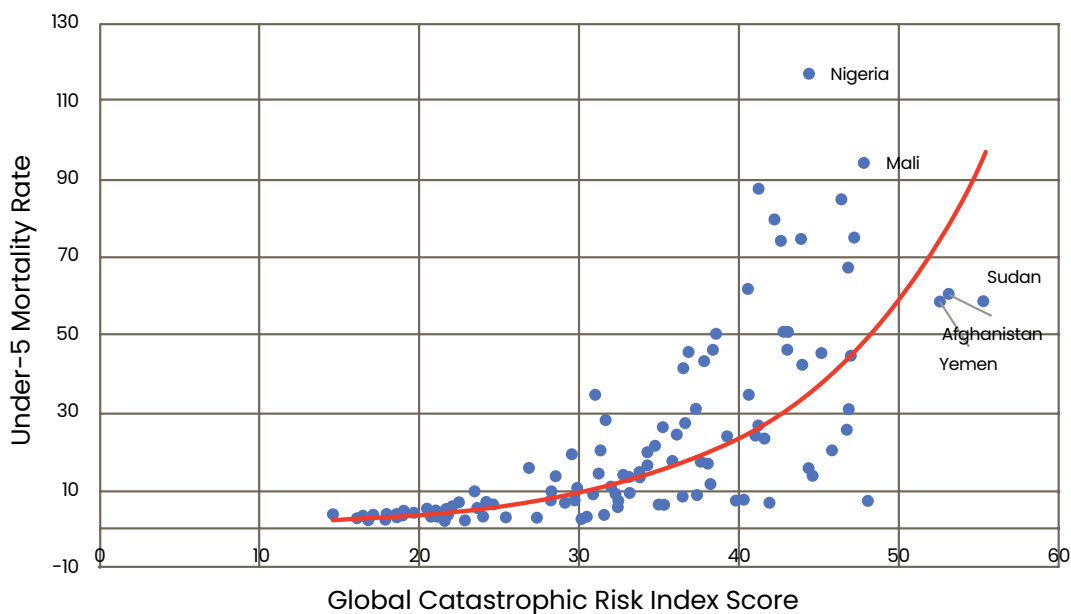
of many water - borne infectious diseases such as cholera, typhoid, and hepatitis.²³

Health

The establishment and maintenance of an effective healthcare infrastructure is fundamental to mitigating a range of risks facing a country's populace. In recent decades, health infrastructure around the world has been augmented to ensure broader coverage, a greater array of services, and increased funding for research.²⁴ However, there is still vast progress that must be made, particularly in developing countries. In order to assess the quality of countries' health care, the GCRI employs proxy indicators for both breadth and quality of service.

With respect to the former, the number of doctors per capita is used. At the low end of the spectrum, Tanzania has approximately one physician for every 100,000 citizens. At the high end, Georgia has 700. Available data shows that over 40% of countries have fewer than one physician per 1,000 people. According to United Nations estimates, over 18 million additional health workers will be needed by 2030 to ensure high quality, accessible coverage. This need is greatest in those areas that are currently underserved. The need for an increase in the number of doctors per capita was felt globally as the COVID-19 pandemic overwhelmed capacities in countries rich and poor.²⁵ In addition, the pandemic further underscored the inequities in medical coverage that exist across countries, regions, and socio - economic groups.

Figure 8 | Global Catastrophic Risk Index Score vs Under - 5 Mortality Rate²⁶



24 United Nations. "The Sustainable Development Goals Report - 2017. <https://unstats.un.org/sdgs/files/report/2017/TheSustainableDevelopmentGoalsReport2017.pdf>.

25 <https://www.aamc.org/news-insights/we-already-needed-more-doctors-then-covid-19-hit>.

26 The correlation coefficient is highly significant, with p-value well below 0.01.

With respect to quality of service, the GCRI employs the under-5 mortality rate as a proxy. Fortunately, global progress in lowering this rate has been nothing short of remarkable over the last three decades: between 1990 and 2019, the global under-5 mortality rate dropped 59%, from 93 deaths per 1,000 live births to 38.²⁷ Despite this progress, however, regional disparities persist. Of the ten highest rates in 2020, nine of the countries were in Africa; of the ten lowest rates, eight were in Western Europe.

Case Study 4 | Infant Mortality: Signal of Catastrophic Risk

Over the past 30 years, there has been a significant reduction in the global under-5 mortality rate: since 1990, the rate has dropped by 59%. Despite this overall progress, the decline has been unequal as immense variation in the under-5 mortality rate exists between different countries and regions. Western European and Scandinavian countries have seen lower under-5 mortality rates, while rates in sub-Saharan Africa have remained stubbornly high. Over the past 30 years, Turkey, Estonia, Mongolia, Saudi Arabia, and China have made the most progress, each seeing a nearly 85% reduction in their under-5 mortality rate.

This variance begs the question: *how, in a globalized and interconnected world, can such extreme variance exist?* First, a lower infant mortality rate is often a product of improved infrastructure. Countries like China and Turkey have seen metropolitan booms in the last 30 years, with significant populations migrating from rural villages to urban centers. In addition to greater infrastructure access for these migrants, this shift has also seen national and local governments alike prioritize infrastructure improvements to further incentivize urbanization. Among these improvements, better sanitation, hospitals, and schools in particular contribute to a lower infant mortality rate. Another crucial factor is the extent a country is globally integrated: such integration includes active exchange of goods, services, knowledge, and people with the rest of the world. To illustrate this point, Mongolia and Estonia have rapidly integrated with the rest of the world over the past three decades. This has resulted in broader and more affordable access to technologies, goods, and expertise that have been instrumental in lowering their under-5 mortality rates.

While progress grabs headlines, it remains essential to monitor the rate in areas that have not been so successful. Beyond its utility as a single statistic, the under-5 mortality rate is an effective signal for other critical aspects of development and risk mitigation. The rate indicates better access to maternal prenatal, postnatal, and pediatric healthcare. Not only are children living to the age of five, they are likely doing so in greater health. It also indicates the presence of a more robust sanitation and healthcare infrastructure that doesn't just benefit infants, but the general population as a whole. To illustrate the strength of this indicator as a signal, the countries with the five highest under-5 mortality rates are also among the most at-risk overall: Nigeria (120 deaths per 1,000 live births and a GCRI rank of 53rd most at-risk), Mali (97.4, 41st), Burkina Faso (90.7, 26th), the Democratic Republic of the Congo (87.6, 11th), and Côte d'Ivoire (82.4, 23rd).

27 WHO. "Children: Improving Survival and Well-Being." World Health Organization, <https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality>

Defense and Security

The Institute for Economics and Peace, an independent non-partisan think-tank, estimated the total economic impact of violence in 2017 to be \$14.8 trillion (12.4 percent of global GDP or \$1,988 per annum per person).²⁸ These economic impacts, in addition to the severe human costs of such violence, pose a crucial risk to countries who fail to take effective mitigation measures.

The extent to which a country faces security threats is perhaps one of the most obvious catastrophic risk factors at the international level. Such threats include actions of overt aggression such as war, rebel attacks, coups, and terrorism. They also include domestic security threats such as organized crime. In certain situations, threats can even arise from within the security apparatus of a state when, for example, covert units serve the interests of a particular party or individual at the expense of political and civil opposition. Less obvious than the threats described above, though still crucial to a country's risk profile, is the extent to which foreign actors have influence over a state's internal policies.²⁹ A rapidly-emerging threat comes from our increasing dependence on information and communications technologies, with all that this implies for cybersecurity. A major disruption from cyberwarfare, terrorism, criminal activity or even a coronal mass ejection from the sun could be catastrophic.

Reductions in military spending at the national level could be re-allocated to other ends, including education, public health, infrastructure and other productivity-enhancing areas, thereby giving rise to a real “peace dividend.”

One risk mitigation measure may actually be to reduce military expenditures, which the IMF has called “unproductive.” They are often large in relation to countries' unmet needs and with few collateral benefits. Reductions in military spending at the national level could be re-allocated to other ends, including education, public health, infrastructure and other productivity-enhancing areas, thereby giving rise to a real “peace dividend”.

28 This exceptional cost is approximately 105 times more than annual Official Development Assistance and exceeds the total net outflow of global foreign direct investment by a factor of 8. It also exceeds by a factor of 350 the total annual lending commitments made by the World Bank.

29 Foreign actors' ability to influence and affect the functioning of a state can take many forms, including overt and covert involvement by foreign militaries and intelligence services. It can also take the form of well-meaning involvement by international organizations in the form of humanitarian aid, development projects, or conditional loans.

Case Study 5 | Nuclear Risk: A Precarious Equilibrium

Since the beginning of the atomic age, international agreements have been made to prevent the proliferation and use of nuclear weapons. While no nuclear weapon has been used in combat against another state since the United States detonated its second atomic weapon, the 21kt Fat Man bomb in August 1945, the international nuclear order rests precariously on three major pillars: strategic stability, a normative taboo, and nonproliferation.

Strategic stability refers to the absence of incentives for a state to launch a nuclear attack. Domestic political stability, integration with global markets, and a low security threat level can bolster this stability while economic and/or political isolation, domestic strife, and a high security threat level (real or perceived) can increase the likelihood of a state using nuclear weapons. Despite statements at global summits on the subject, “global zero” is not a near-term goal nor likely reality for nuclear-armed states and their allies. The normative understanding rests primarily on a tradition of non-use of nuclear weapons, rather than binding arms control agreements (only one of which, 2010’s New START, remains in effect).

Regarding nonproliferation, the dispersion of nuclear weapons is fortunately narrow – of the 118 states included in the GCRI, 8 currently have nuclear weapons (China, France, Russia, the United States, the United Kingdom, Israel, India, and Pakistan), while 3 formerly possessed such weapons (Belarus, Kazakhstan, and Ukraine).

Among the handful of nuclear-armed states, however, strategic stability is particularly strained in two areas. India and Pakistan have experienced repeated crises and persistent episodes of saber-rattling. The contested border, religious strife, and nuclear one-upmanship have created a landscape in which nuclear war is not beyond the realm of possibility. Such a war would prove truly catastrophic for the countries’ combined population of over 1.5 billion, their combined economies of over \$3 trillion, and the environment globally.

Despite the conclusion of the Cold War, the United States and Russia continue to have a rocky nuclear relationship. Neither state is committed to a “no first use” posture (in 1993 Russia abandoned this prior pledge of the USSR). Moreover, both countries are currently working on modernization overhauls of their nuclear arsenals. One bright spot in this relationship is the effort underway to resurrect the 1985 Reagan-Gorbachev statement that “a nuclear war cannot be won and must never be fought.” Although Russia and the United States recently reaffirmed this statement, the key is the extent to which it is affirmed globally and, in particular, by all nuclear-armed states.

See Also: The Erosion of the Global Nuclear Order. Some Ideas For Halting It by Jeffrey Knopf. <https://globalgovernanceforum.org/erosion-global-nuclear-order-ideas-halting-it/>

Overview of Findings

The most at-risk countries in the Global Catastrophic Risk Index are Sudan (Index score of 55.2), Afghanistan (53.0), Yemen (52.5), Lebanon (48.0), and Mali (47.8). The least at-risk countries are Denmark (14.6), Sweden (16.2), Ireland (16.5), Finland (16.7), and Luxembourg (16.8). While the factors leading to these scores are complex and nuanced, the general results can be effectively illustrated by looking at the recent histories and domestic contexts of both groups.

The high-risk countries have GCRI scores that are nearly four times higher than those in the lowest risk group. Across each of these countries, low-quality governance, poor education, and significant gender inequality were the norm. In recent years, each of these low-income countries has been shaken by domestic strife: Sudan has experienced a civil war in which South Sudan became an independent state in 2011 and

The high-risk countries have GCRI scores that are nearly four times higher than those in the lowest risk group. Across each of these countries, low-quality governance, poor education, and significant gender inequality were the norm.

a military coup in 2019; Afghanistan has remained war torn in the wake of the United States' 2001 invasion and the attempted establishment of a democracy has failed; Yemen has struggled to contain domestic insurgent groups and the infiltration of regional terror cells, which led to a civil war; and violent protests in Lebanon against

economic stagnation, corruption, and Syrian refugees - stresses exacerbated by the COVID-19 pandemic - brought down the Hariri regime. As explained elsewhere in the report, mitigating risk requires states to have the effective institutions and governance structures that to date none of these states have been able to establish.

In contrast, countries in the low-risk group are stable, high-income, European states that not only have seen little violence or domestic strife in recent years, but are also established democracies that put a premium on civil rights and rule of law. Moreover, each of these countries is a member of the European Union, evidencing their commitment to international cooperation and embodiment of shared norms. Each of these countries enjoys strong trade, cultural, and intellectual ties with their European neighbors and the global north more generally. These highly developed states see little stress of access to basic resources, have established strong social safety nets, have strong state institutions, and low levels of corruption. Generally speaking, citizens and governments in these states have the luxury of focusing their attention on improving established structures rather than building them from the ground up.

Figure 9 | The Most At-Risk Countries Compared to the Least At-Risk Countries

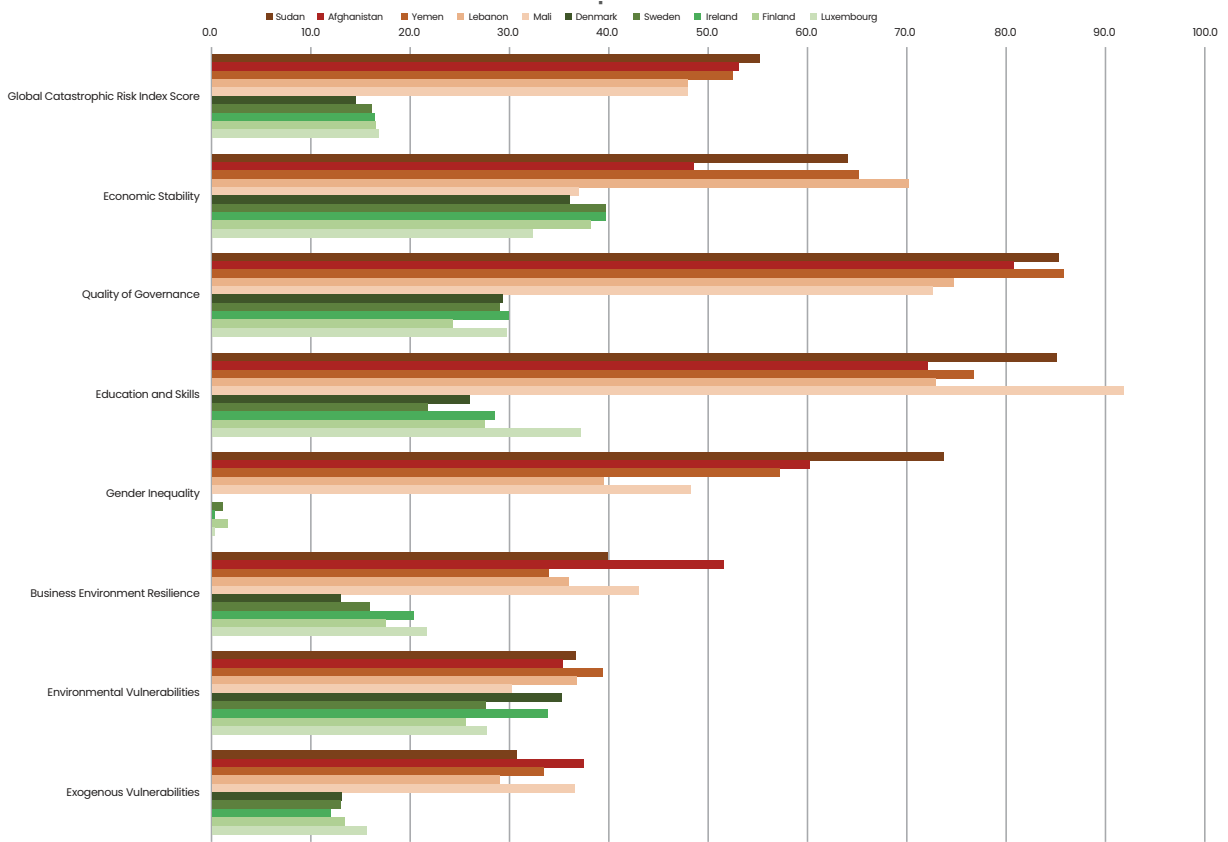
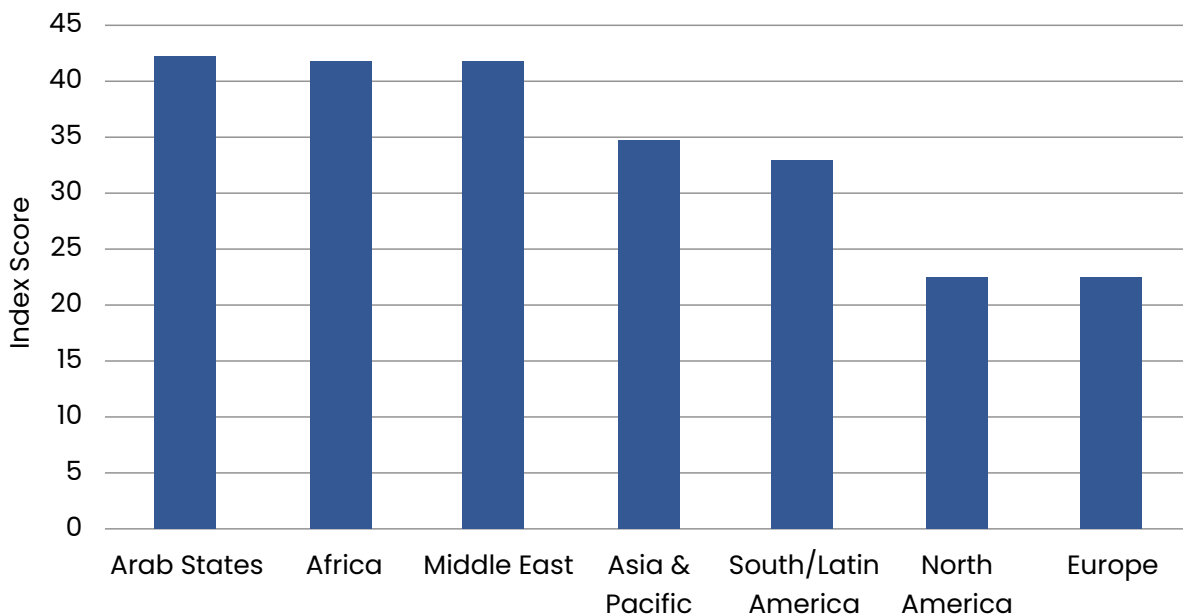


Figure 10 | Global Catastrophic Risk Index Score by Region



Perhaps more surprising results can be found among those countries in the middle of the Index' score distribution. One interesting finding is that the size of the economy rankings do not correlate with economic stability scores – GDP is shown not to be an end in itself. Rather, efficient and transparent stewardship of a nation's resources, however abundant they may be, will mitigate the risks facing a country more than pursuing GDP growth for its own sake. Among the 25 largest economies, 4 are among the 25 most at-risk countries according to the index (Nigeria, Iran, Egypt, and Pakistan). The two largest economies, China and the United States, tell a similar story: both countries fall short in some areas while excelling in others. While China scores among the top-25 environmentally at-risk countries, the United States is much safer in 80th place. Similarly, looking within the Quality of Governance pillar, we see that the United States has significantly lower risk levels regarding Rule of Law, Control of Corruption, and Building Blocks of Good Governance. On the other hand, China ranks 53rd most at-risk in the Economic Stability pillar, while the United States ranks in the top 20.

The indicators comprising Pillar 6 (Environmental Vulnerability) contain fascinating stories in their own right and illustrate the extent to which individual indicators can tell more nuanced stories than the pillar scores they comprise. For instance, among the ten most environmentally at-risk countries, six are dynamic, high-growth economies that have been touted as developmental darlings in past decades: Hong Kong, Japan, Vietnam, Qatar, Singapore, and Bahrain. Clearly, it is not just those countries with poor governance, weak economies, and major exogenous risks that neglect to address and effectively mitigate their environmental risks. Geographically, these countries lie within a relatively narrow latitudinal band in which rising sea levels and/or increasing global temperatures will be felt acutely. Japan ranks high in environmental vulnerability because of major earthquakes, tsunamis and the presence of active volcanoes. In the cases of Singapore and Hong Kong, small city states whose location has helped their economies become hubs of global trade and finance also puts them at severe risk for sea level rise. Comparing overall GCRI ranks to Environmental Vulnerability pillar ranks, one can see that Singapore and Bahrain, the two most environmentally at-risk states are separated by 57 countries in the overall index rank. This result highlights the challenge countries face in allocating resources and establishing policies to address and mitigate all of the diverse risks they face.

The data within Pillar 6 also shows that it is not always those countries that are likely to be most impacted by a ravaged environment that do the most to address their environmental footprint. Comparing scores for the Climate Change Sensitivity indicator and the Percent of Total Energy Derived from Renewable Sources indicator, we see an inverse correlation. It is those countries most sensitive to climate change that use less renewable energy, while countries relatively less sensitive to the effects of climate change derive a greater percentage of their energy from renewable sources. Looking at extremes, Uganda (the 4th most sensitive to climate change) only derives 11% of its energy from renewable sources. Meanwhile, Australia (the 2nd least sensitive) sources 91% of its energy from renewable sources.

Policies misaligned with the risks they are intended to mitigate are not confined to the Environmental pillar. The same can be seen in Exogenous Risks data. Although defense risks grab headlines and global attention daily, the data show widespread failure in countries' ability to effectively mitigate them. As noted above, the IMF has called military spending "unproductive". To illustrate this statement, the data show that there is no correlation between the Security Risks facing a state and the percent of GDP a state spends on its military. This finding shows that, to the extent the Security Risks indicator is an accurate proxy for the real world, countries do not allocate military resources in proportion to the risk they face, nor does an increased allocation of resources lead to diminished security threats. Globally, the mean for military spending is 2.08% of GDP. Among the countries with the 25 lowest security threat scores, the mean is 1.83%. Among the countries with the 25 highest security threat scores, the mean is 1.95%.

The data also show a positive correlation between military expenditure and the budget deficit. Among the countries with the 25 lowest budget deficits, average military spending is equivalent to 1.46% of GDP. Among the countries with the 25 highest budget deficits, it is 2.78% of GDP. Other things being equal, military spending is a contributor to budget deficits, perhaps not an unsurprising result. But given the finding that risk and expenditure are unrelated it appears countries' military expenditures are allocating a non-negligible amount of their scarce resources to an unproductive end. Instead of investing in education, healthcare, infrastructure, or climate change mitigation technologies, countries globally are prioritizing military expenditure even though it may not actually decrease security threats.

Conclusion

This first publication of the Global Catastrophic Risk Index sheds light on the complex risks facing countries globally. It complements the existing discourse on catastrophic risk, as exemplified by the Global Challenges Foundation's 2021 report on Global Catastrophic Risks, by combining diverse indicators into a single indexed measure of risk for each country included in the index. In contrast to the World Economic Forum's annual Global Risks Report, which is based solely on expert opinions and is therefore subjective, the GCRI relies almost exclusively on hard data. The findings are unique as they demonstrate not only that no country is free of risk, but also that policymakers globally have often failed to take collective action against systemic and environmental risks.

There is the obvious correlation between the general level of development and vulnerability to catastrophic risks, with poor countries with weak or failing governments and low investment in human capital clearly much more at risk. More surprising is the much smaller difference with respect to environmental risks, showing that these largely planetary risks threaten countries more equally and must be addressed globally. Alongside the overall risk rankings, the details within the index ratings can be a useful guide to where national efforts to reduce vulnerability or increase resilience can most usefully be focused. Frequently a country may face high risk in one or more specific areas relevant to its own particular situation and geography, where it should concentrate its attention.

Future editions of the index will attempt to broaden country coverage as far as data availability allows, particularly to include small island developing states known to be particularly vulnerable. There is still considerable potential to enhance and update data, and include new indicators deemed to have meaningful descriptive power. This first edition of the Global Catastrophic Risk Index is therefore a preliminary attempt to capture some of the most important factors that bear on individual country risk, and is to be expanded in future editions as we are able to harness the insights within emerging datasets. However, the COVID-19 pandemic has shown just how rapidly threats can develop and there will always be surprises. As the Global Catastrophic Risk Index is refined and improved, it will increasingly be able to provide governments with the early warnings and insights necessary to take action to reduce their vulnerability and increase their resilience for the well-being of their citizens.

Appendices

Indicator	Source
[1.1.a] [1.1.b] [1.1.c]	International Monetary Fund, World Economic Outlook, 2021
[1.2.a]	International Monetary Fund, Freidrich Schneider, 2018
[1.3.a] [1.3.b] [1.3.c] [1.3.d]	International Monetary Fund, Financial Soundness Indicators, 2021
[2.1.a] [2.1.b] [2.1.c] [2.1.d] [2.1.e]	The World Bank, World Governance Indicators, 2020
[2.2.a] [2.2.b] [3.3.b] [7.3.a] [7.3.b]	Fund For Peace, Fragile States Index, 2021
[1.2.b] [1.2.c] [7.2.b]	The World Bank, World Development Indicators, 2019
[1.2.d] [2.3.b] [2.3.c] [2.3.d]	World Economic Forum, Global Competitiveness Report, 2019
"	The World Bank, World Integrated Trade Solution, 2017
[1.2.g]	Fernández, Klein, Rebutti, Schindler and Uribe, "Capital Control Measures: A New Dataset" (2017)
[2.3.a]	Transparency International, Corruption Perceptions Index, 2020
[2.4.a]	Freedom House, 2020
[2.4.b]	Reporters Without Borders, 2021
[3.1.a] [3.1.b] [3.1.c]	The World Bank / UNESCO, 2018
[3.2.a] [3.2.b] [3.2.c] [3.2.d]	UNESCO, 2018
[3.3.a]	The World Bank, Enterprise Surveys, 2019
[4.1.a] [4.1.b] [4.1.c] [4.1.d] [4.1.e]	World Bank, Women, Business, and the Law, 2020
[4.1.h]	OECD, International Development Statistics, 2019
[5.1.a] [5.1.b] [5.1.c] [5.1.d]	World Bank, Doing Business, 2020

Indicator	Source
[6.1.a]	The World Bank, Food and Agriculture Statistics, 2020
[6.1.b] [6.2.a] [6.2.c] [6.4.b]	The World Bank, Food and Agriculture Statistics, 2017
[6.2.d]	The World Bank, 2015
[6.2.b]	Institute for Health Metrics and Evaluation, 2015
[6.3.c] [6.3.d]	Protected Planet, 2018
[6.2.e] [6.2.f]	International Monetary Fund, 2017
[6.4.d]	The World Bank, Food and Agriculture Statistics, 2016
[6.4.a]	The World Bank, Food and Agriculture Statistics, 2014
[6.3.a] [6.3.b]	Yale University, Environmental Performance Index (2020)
[6.4.e]	The World Bank, Food and Agriculture Statistics, 2018
[6.4.c]	Economist Intelligence Unit 2021
[6.5.a]	The World Bank, Enterprise Surveys, 2019
[6.5.b]	Internal Displacement Monitoring Center, 2020
[6.5.c]	NOAA, 2019
[6.6.a] [6.6.b] [6.6.c]	ND-Gain Index (2019)
[7.1.a]	United Nations, Dept. of Economic and Social Affairs, 2018
[7.1.b]	The World Bank, 2018
[7.1.c]	United Nations, Population Division, 2020
[7.1.d]	Center for International Earth Science Information Network, 2013
[7.2.a]	World Health Organization, Global Health Workforce Statistics, 2018
[7.3.c]	The International Campaign to Abolish Nuclear Weapons, 2021
[7.3.d]	SIPRI, Military Expenditure Database, 2021

" The cutoff point for data incorporated in the Global Catastrophic Risk Index was September 1, 2021

Appendix II | Global Catastrophic Risk Index Rankings

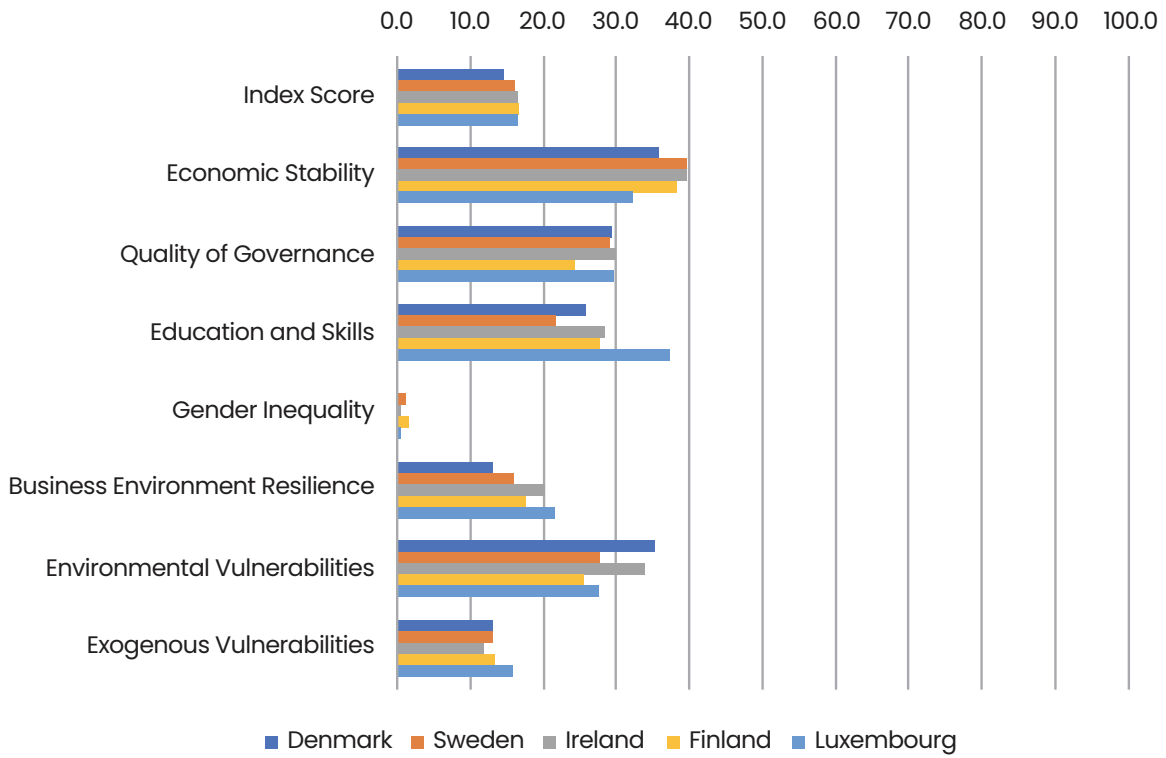
Country	Overall Index Score	Index Rank (Most to Least At-Risk)
Sudan	55.2	1
Afghanistan	53.0	2
Yemen	52.5	3
Lebanon	48.0	4
Mali	47.8	5
Cameroon	47.1	6
Myanmar	46.9	7
Pakistan	46.8	8
Bangladesh	46.7	9
Iraq	46.6	10
DR of Congo	46.3	11
Egypt	45.7	12
Senegal	45.1	13
Iran	44.5	14
Jordan	44.3	15
Nigeria	44.3	15
Angola	43.8	17
Gabon	43.8	17
Madagascar	42.9	19
Uganda	42.9	19
Ethiopia	42.7	21
Mozambique	42.5	22
Côte d'Ivoire	42.2	23
Bahrain	41.8	24
Algeria	41.5.2	25
Burkina Faso	41.1	26
Cambodia	41.1	26
Guatemala	40.9	28
India	40.6	29
Zambia	40.5	30
Kuwait	40.2	31
Sri Lanka	39.8	32
Indonesia	39.2	33
Tanzania	38.5	34
Ghana	38.2	35
Oman	38.1	36
Honduras	38.0	37
Tunisia	37.9	38
Madagascar	37.8	39
Trinidad and Tobago	37.6	40

Country	Overall Index Score	Index Rank (Most to Least At-Risk)
Malaysia	37.3	41
Nepal	37.2	42
Lao PDR	36.8	43
Philippines	36.6	44
Botswana	36.4	45
Ukraine	36.4	45
Venezuela	36.1	47
Uzbekistan	35.8	48
Bolivia	35.2	49
Saudi Arabia	35.2	49
Qatar	35.0	51
Morocco	34.6	52
Nicaragua	34.2	53
Vietnam	34.2	53
Colombia	33.8	55
Panama	33.7	56
El Salvador	33.1	57
Thailand	33.1	57
Brazil	32.7	59
Bosnia and Herzegovina	32.4	60
China	32.4	60
Russia	32.3	62
Turkey	32.1	63
Dominican Republic	31.6	64
Israel	31.5	65
Azerbaijan	31.3	66
Ecuador	31.2	67
Mexico	31.2	67
South Africa	31.0	69
Argentina	30.8	70
Belarus	30.4	71
Japan	30.2	72
Kazakhstan	29.8	73
United Arab Emirates	29.6	74
Paraguay	29.5	75
Costa Rica	29.4	76
Chile	29.0	77
Peru	28.5	78
Albania	28.3	79

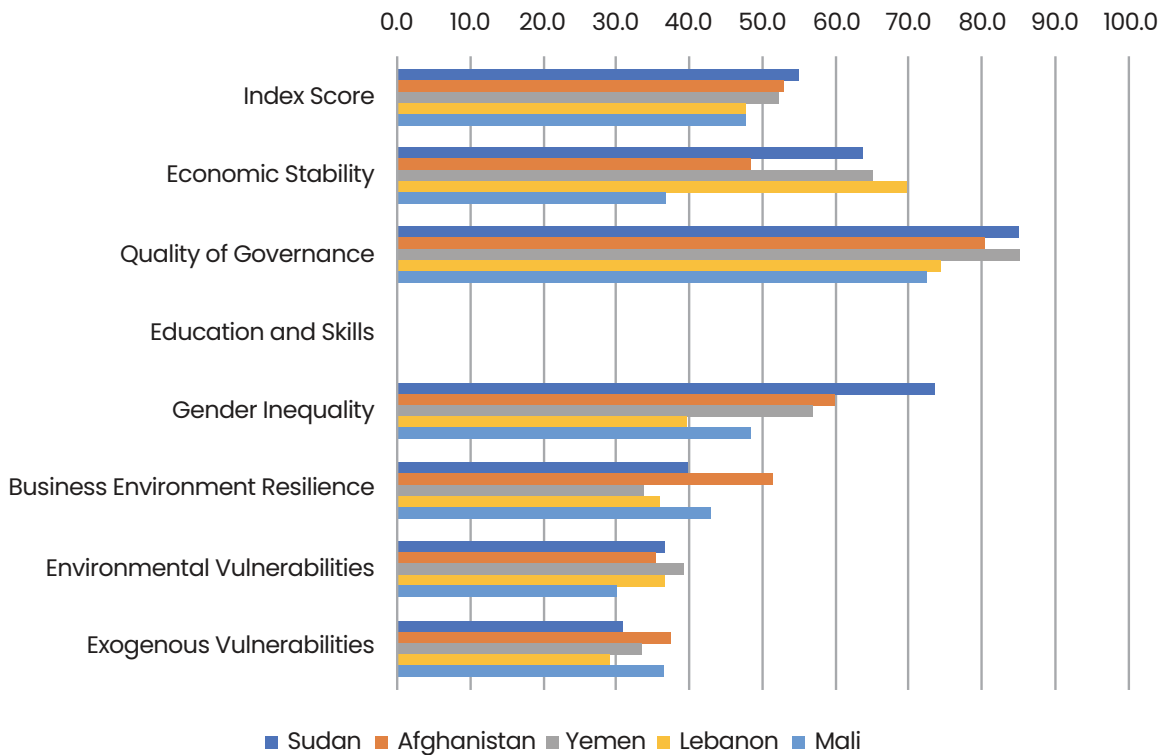
Country	Overall Index Score	Index Rank (Most to Least At-Risk)
Uruguay	28.2	80
Singapore	27.2	81
Mongolia	26.8	82
Italy	25.4	83
Korea	25.4	83
Hong Kong SAR	25.1	85
United States	24.6	86
Bulgaria	24.2	87
Hungary	24.0	88
Serbia	23.6	89
Georgia	23.4	90
Estonia	22.8	91
Romania	22.4	92
Slovak Republic	22.1	93
Greece	21.8	94
Croatia	21.6	95
Slovenia	21.5	96
Poland	21.2	97
Spain	21.2	97
France	20.9	99
Portugal	20.9	99
United Kingdom	20.9	99
Germany	20.6	102
Canada	20.5	103
Switzerland	19.7	104
Netherlands	19.4	105
New Zealand	19.0	106
Lithuania	18.8	107
Czech Republic	18.5	108
Latvia	18.4	109
Belgium	18.0	110
Austria	17.9	111
Norway	17.8	112
Australia	17.0	113
Luxembourg	16.8	114
Finland	16.7	115
Ireland	16.5	116
Sweden	16.2	117
Denmark	14.6	118

Appendix III | Pillar Scores for Most and Least At-Risk Countries

Pillar Scores for the Least At-Risk Countries



Pillar Scores for the Most At-Risk Countries



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