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POLYCRISIS RESILIENCE SERIES · RESEARCH REPORT

Global Economic Convergence as a Resilience Strategy

How narrowing the gaps between rich and poor economies can reduce vulnerability to the polycrisis, 2026–2100



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ABOUT THIS REPORT

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THE REPORT AT A GLANCE

THE DEFINITION

Global economic convergence is the process through which lower-income economies progressively narrow their economic and productivity gaps relative to higher-income economies.

Central thesis: convergence is a proactive way of reducing vulnerability to the polycrisis, by improving the material conditions that decide how well societies anticipate, absorb, adapt to and recover from shocks.

EIGHT DIMENSIONS

- Income per person
- Productivity and technology
- Industrial capacity
- Education and human capital
- Infrastructure
- Energy access and reliability
- Digital connectivity
- Health and institutional capacity

THREE PATHWAYS TO 2100

Fragmented uneven growth, persistent gaps, recurring reversals

Accelerated sustained growth and wider access

Resilience-oriented growth coordinated with environment, diffusion and institutions

EXECUTIVE SUMMARY

Executive Summary

The harm done by the century's interconnected crises depends on the hazards and on how vulnerable people and systems are. Vulnerability falls as economies catch up, but catching up has stalled for most developing economies.

Floods, heatwaves, pandemics, price shocks and wars do not hit all societies equally. A storm that kills hundreds in a poor country may kill a handful in a rich one, because the rich country has stronger buildings, more reliable power, working health systems, savings, insurance and well-run institutions. This report asks whether closing the gap between rich and poor economies, which economists call *global economic convergence*, is one of the most powerful long-term ways of reducing vulnerability to the polycrisis. Its answer is a qualified yes: convergence works as a resilience strategy when it is measured in the right things, and it is not happening automatically for the people who most need it.

23%
of the high-income average is the income of the typical person in the Global South in 2024, up from 13% in 2000, and only 4% for low-income countries

+0.53
percentage points a year of income-gap closing in 2000–19; after 2019 the sign flipped to -0.30, a return to divergence

91%
is electricity access in lower-middle-income countries as a share of the high-income level, up from 57%, while income and productivity gaps closed far more slowly

133 m
fewer child deaths in 2025–2100 if economies converge at about 1% of the gap a year instead of stalling

Principal findings

- **Convergence is real, and it is concentrated.** Income in the Global South rose from 13% of the high-income level in 1990 to 23% in 2024, but almost all of it came from China and India: without them the figure was 20% in 1990 and 20% in 2024 (Figure 2). Upper-middle-income countries went from 18% to 36%; low-income countries went from 3% to 4%.
- **The catch-up was a short, strong episode.** Across 196 economies, an economy with half the income of another grew about 0.4 percentage points a year faster in 2000–19, an effect statistically indistinguishable from zero in the 1990s, after roughly 170 years in which the gap widened (Kremer et al., 2022; Patel et al., 2021). Since 2019 only 39% of developing economies have outgrown the United States, against 85% in 2000–10 (Figure 3).
- **Access has converged faster than income.** In lower-middle-income countries internet use rose from 1% to 59%, clean cooking from 24% to 64% and electricity access from 57% to 91%, while output per worker rose from 12% to 19% of the high-income level (Figure 4). Technology moves quickly across borders; productive capacity moves slowly.

- **Vulnerability falls with development, hazard does not.** Across 183 countries, income explains 75% of the variation in lack of coping capacity but only 20% of the variation in hazard exposure. Within countries, a 10% rise in income goes with a 10% fall in child mortality (Figure 6). Setbacks of more than 10% below an earlier peak occupy 14% of years in the poorest economies and 5% in middle-income ones (Figure 7).
- **Convergence pays resilience dividends in bundles.** Across 107 developing economies the pace of progress in electricity, clean cooking, internet and sanitation moves together even after income growth is held fixed (average link 0.14, against 0.43 unadjusted), and 14% of countries advanced fast on six or seven of seven dimensions against 6% by chance (Figure 9). Gains in life expectancy and schooling did not follow within two decades. This is the evidence behind the concept of *Convergent Resilience Dividends* (Section 6).
- **New technologies let some countries skip steps.** Mobile money, distributed solar, mobile broadband, digital learning and satellite links reach people without the networks that earlier generations needed. The record shows real bypassing, with limits: it needs reliable power, affordable devices, regulation and skills, and it does not replace roads, grids, clinics or schools (Section 7).
- **Three pathways to 2100 lead to very different worlds.** If the Global South converges at 1% of the gap per year, its income reaches 35% of the high-income level by 2100, against 14% in a fragmented pathway. About 314 million children under five would die in 2025–2100 if convergence fails, against 181 million with accelerated convergence and 167 million when growth is paired with deliberate resilience-building. These are conditional illustrations, not forecasts (Section 9).

How to read this report

Sections 1 and 2 set out the question and define convergence in eight dimensions. **Sections 3 and 4** present the record, first for income and then across the eight dimensions. **Sections 5 and 6** show why convergence reduces vulnerability and develop the idea of Convergent Resilience Dividends. **Section 7** examines technological bypassing and **Section 8** what could stall convergence. **Section 9** models three pathways to 2100, **Section 10** applies them to regions, **Section 11** proposes a strategy and **Section 12** concludes. All data are public, the method is in each section, and limits are stated where they apply. Figures and tables link to their sources.

CONCEPT

The definition used in this report

Global economic convergence is the process through which lower-income economies progressively narrow their economic and productivity gaps relative to higher-income economies.

In this framework, convergence is a proactive resilience strategy: it improves the economic and material conditions that decide how well societies can anticipate, absorb, adapt to and recover from systemic disruption. (Hughes, 2026a)

SECTION 01

Why Convergence Belongs in a Polycrisis Strategy

Most discussion of the polycrisis focuses on the shocks. This report starts from the other side of the equation: the conditions that decide how much damage a shock does.

IN BRIEF

- Harm = hazard × exposure × vulnerability; the third term is the one development can change.
- Rich and poor economies differ most in the material conditions that absorb shocks: power, health, schooling, savings and institutions.
- Convergence is therefore not only a growth goal. It is a proactive way of lowering vulnerability.

1.1 The polycrisis and the problem of unequal damage

A *polycrisis* is a cluster of crises in different systems, such as climate, health, finance, energy, food and security, whose causes and effects are tangled together so that the combined damage exceeds the sum of the parts (Lawrence et al., 2024; Lawrence et al., 2022). The term gained public attention after the historian Adam Tooze used it in 2022 to describe the pile-up of pandemic, war, inflation and energy shocks (Tooze, 2022). Since then the evidence has kept pointing to the same pattern: shocks arrive together, and how much harm they cause depends on who they hit.

Disaster researchers describe harm as the product of three things: the *hazard* (the flood, heatwave or price spike), *exposure* (who and what is in its path) and *vulnerability* (how easily those people and assets are damaged and how slowly they recover) (UNDRR, 2017; IPCC, 2023). Hazards are largely set by nature and geopolitics. Exposure follows where people live. Vulnerability is the term that societies can change, and it is the one that differs most between rich and poor countries. The statistical evidence is consistent: deaths from natural hazards fall as income rises, because richer societies build better, warn earlier, treat faster and insure more (Kahn, 2005; Toya and Skidmore, 2007; Formetta and Feyen, 2019; Jongman et al., 2015).

1.2 Where economic convergence enters

Convergence is usually discussed as a story about growth: do poor countries catch up with rich ones? This report asks a different question. If vulnerability is mostly a matter of material conditions, then the speed and quality of catching up should be among the main determinants of how humanity fares in the polycrisis. A household with reliable electricity can refrigerate vaccines, run a fan in a heatwave, charge a phone to receive a warning and light a classroom. A country with a productive economy can afford drainage, hospitals and social protection, and can borrow at reasonable cost when disaster strikes. A population with more schooling understands warnings and adapts faster (Lutz et al., 2014). All of these are aspects of economic convergence.

The central thesis is therefore as follows. **Global economic convergence represents a significant long-term opportunity for reducing human and systemic vulnerability to the polycrisis.** Accelerating development and narrowing the gaps in productivity, income, technology and infrastructure between advanced and emerging economies could strengthen the capacity of populations and institutions to withstand interconnected economic, environmental, technological and societal risks. Within the H Heuristics Polycrisis Resilience framework, convergence is a proactive strategy: it improves the conditions that determine how well societies can anticipate, absorb, adapt to and recover from systemic disruption (Hughes, 2026a).

THESIS

The thesis, with its conditions

Claim. Narrowing gaps in income, productivity, technology and infrastructure reduces vulnerability to interconnected crises.

Condition 1. Convergence must be measured in capabilities (power, health, skills, institutions), not income alone.

Condition 2. The route matters: a path that increases pollution, debt or fragility can raise income while raising vulnerability.

Condition 3. Convergence is not automatic. It stalled after 2019 for most developing economies (Section 3).

1.3 What this report does

The report does four things with public data covering 217 economies. It documents the record of income convergence from 1820 to 2024 and across eight dimensions (Sections 3 and 4). It tests whether development is linked to lower vulnerability and whether progress in one dimension travels to others (Sections 5 and 6). It examines how newer technologies let economies skip stages (Section 7) and what could block catch-up (Section 8). Finally it models three pathways to 2100 that differ in the speed and the quality of convergence (Section 9), and proposes a strategy (Section 11). Two cautions apply throughout. First, income groups are the World Bank's current classes, so the groups change over time. Second, correlations in cross-country data show what travels together, not what causes what; where causal evidence exists from trials or natural experiments, it is cited.

SECTION 02

What Global Economic Convergence Means

Convergence is a narrowing of gaps. Which gaps, measured how, and whether it happens on its own or only under certain conditions are all disputed, and the answers shape what the strategy should be.

IN BRIEF

- Convergence means lower-income economies narrowing income and productivity gaps with higher-income ones.
- It is more than higher GDP: it is expanding productive capacity, infrastructure, technology and living standards.
- Economists distinguish unconditional convergence (all poor countries catch up) from conditional convergence (only those with the right fundamentals).

2.1 A working definition

Global Economic Convergence

Global economic convergence is the process through which lower-income economies progressively narrow their economic and productivity gaps relative to higher-income economies.

H Heuristics working definition, consistent with the growth-economics literature (Barro and Sala-i-Martin, 1992; Baumol, 1986)

Economic convergence is not simply a rise in total GDP. A country can grow because its population grows, or because it sells oil, without becoming more productive or less vulnerable. Convergence, as used here, involves expanding the productive capabilities, infrastructure, technologies and living standards that let societies become less vulnerable to interconnected crises. For that reason the report tracks eight dimensions, not just one (Table 1).

2.2 Three ways economists measure it

Beta convergence asks whether poorer economies grow faster than richer ones. The test is a regression of each economy's growth rate on its starting income: a negative slope means catch-up. **Sigma convergence** asks whether the spread of incomes across economies is shrinking over time. **Gap closing** asks the plainest question, namely how large an economy's income, or electricity access, or schooling, is relative to the high-income level now and in the past. This report uses all three: beta convergence for income in Section 3, gap closing across the eight dimensions in Section 4, and the spread of incomes as a check.

Two features matter. Beta convergence in income can coexist with a growing absolute dollar gap, because 3% growth on a small base adds fewer dollars than 1% growth on a large base; the rele-

Table 1 Eight dimensions of convergence and how they are measured here

Dimension	What it captures	Indicators used	Link to resilience
1. Income	GDP per person and household income	GDP per person, PPP dollars of 2021 (World Bank, 2026)	Savings, ability to pay for protection and recovery
2. Productivity	Output per worker and technological sophistication	GDP per person employed (World Bank, 2026)	Wages and the tax base for public services
3. Industry	Industrialisation and productive capacity	Manufacturing value added per person, constant US dollars (World Bank, 2026)	Capacity to build, repair and supply in a crisis
4. Human capital	Education and skills	Mean years of schooling of adults (UNDP, 2025)	Understanding warnings, adapting, innovating (Lutz et al., 2014)
5. Infrastructure	Availability and quality of basic networks	Basic sanitation and drinking water (World Bank, 2026)	Disease control, flood and heat protection
6. Energy	Access, reliability and adequacy of electricity; clean cooking	Electricity access, power use per person, clean cooking (World Bank, 2026; IEA et al., 2026)	Cooling, cold chains, light, clean air, communications
7. Digital	Connectivity and adoption of technology	Internet users and mobile subscriptions (World Bank, 2026; ITU, 2025)	Early warning, mobile money, information, services
8. Health and institutions	Healthcare access and institutional capacity	Life expectancy, child mortality, government effectiveness (World Bank, 2026; World Bank, 2025a)	Preparedness, crisis response, coordination (COVID-19 National Preparedness Collaborators, 2022)

Source: H Heuristics framework; indicators from the sources cited.

vant comparison for resilience is usually the ratio, not the dollar difference. And the average hides who moves: rapid catch-up in a few very large economies can lift the Global South's average while most countries stand still. For that reason the report separates income groups and, where it matters, China and India.

2.3 Unconditional and conditional convergence

Early growth theory predicted that poor economies, with little capital and much room for improvement, should grow faster than rich ones. Observed data for most of the twentieth century said otherwise. Poor economies grew faster only when they shared other features: similar investment rates, schooling, institutions and openness. That finding is called *conditional convergence*, and the long-run empirical rule of thumb is that economies close about 2% of the gap to their own steady state each year (Barro and Sala-i-Martin, 1992; Barro, 2012). *Unconditional convergence*, in which any poor economy catches up simply by being poor, was absent in the data for decades (Baumol, 1986; Abramovitz, 1986).

Recent research found that this has changed. Poor economies began to catch up without conditions from the 1990s, and the estimated speed in 2005–15 was around 0.7% a year, well below the conditional 2% rule (Kremer et al., 2022; Patel et al., 2021). Our own estimates, from World Bank data for about 190 economies, give about 0.5 percentage points in 2000–19 and a reversal after 2019 (Section 3). The practical conclusion is that catch-up is possible but weak: where fundamentals are favourable it can approach the 2% rate, and where they are not it can be zero.

2.4 Why the polycrisis changes the question

The classic convergence literature asks about growth. The polycrisis adds a second question: how quickly do the conditions that make societies vulnerable converge? These two questions can have different answers. A country with fast growth built on coal and unplanned cities may be more exposed to heat, air pollution and floods than a slower grower that invests in health, power and adaptation. A country with slow average growth may still make large gains in electrification or connectivity because those technologies have become cheap. This is the reason for the eight-dimension approach, and for the later focus on Convergent Resilience Dividends: the opportunity is not merely higher incomes but the simultaneous reduction of several vulnerabilities by the same investments.

2.5 Ratios, levels and thresholds

Two more distinctions help later. The first is between *ratios* and *levels*. A poor economy growing at 3% while a rich one grows at 1% narrows the ratio of their incomes, but the dollar gap can still widen for decades. For resilience the dollar level often matters more than the ratio, because a household needs a given amount of electricity, water, schooling and savings to be safe, whatever the neighbours have. The second distinction is about *thresholds*. Many protections work only above a minimum: a vaccine fridge needs power every hour of every day, a flood defence needs to be built to a standard, and a warning system needs coverage of the whole population at risk. Below the threshold the benefit is small, and just above it the benefit is large. This is why the report pays attention to reliability and adequacy, not just averages, and why it counts people below income and service lines as well as comparing group means.

TERMS

Three terms used in this report

Convergence speed is the percentage of the income gap to the high-income level that closes each year. A speed of 1% means an economy at half the frontier income closes the gap by 0.5% of the frontier each year.

High-income average is the population-weighted mean income of economies the World Bank classes as high income (86 economies, 1.4 billion people).

Global South means the 131 low-, lower-middle- and upper-middle-income economies, 6.7 billion people or 83% of humanity (World Bank, 2025b).

SECTION 03

The Record: Divergence, Then a Short Catch-Up

For about 170 years the gap between rich and poor economies widened. Since the 1990s it has narrowed, mostly because of a few very large economies, and since 2019 the narrowing has stopped for most developing economies.

IN BRIEF

- The Global South's income was 18% of the high-income level in 1950, fell to about 14% in 1968, and rose to 25% by 2022.
- Without China and India the Global South stood at 20% in 1990 and 20% in 2024: no convergence.
- Catch-up ran at about 0.5 points a year in 2000–19 and reversed after 2019; low-income countries are at 4%.

3.1 A long view: the great divergence and the great convergence

For most of human history the world's societies were poor by modern standards and not very different in income. The Industrial Revolution changed that, because the economies that industrialised first pulled away. Using the Maddison Project's historical estimates, the typical (median) high-income country today was already 1.6 times richer than the typical developing country in 1820. The multiple was 2.0 in 1870, 3.1 in 1900 and 3.8 by 1950 (Figure 1, left) (Bolt and van Zanden, 2024). Historians call this the *great divergence*.

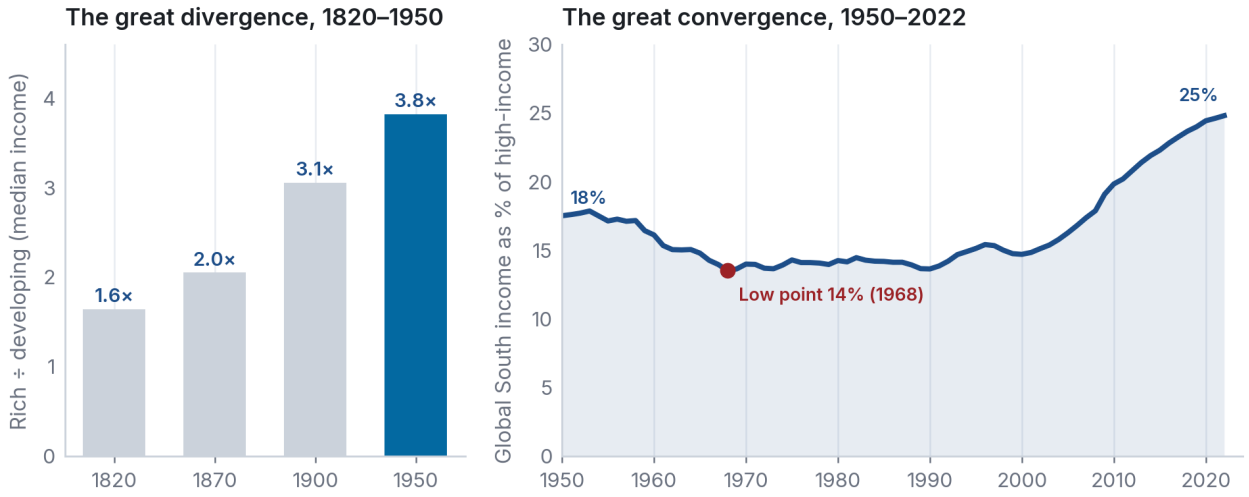
Divergence continued, more slowly, after 1950. Weighting by population, the Global South's income fell from 18% of the high-income level in 1950 to a low of about 14% in 1968 and was still only 14% in 1990. Then the direction changed. By 2022 the figure was 25%, the highest in the whole 1950–2022 record (Figure 1, right). The turn came from a set of changes in the 1990s and 2000s: the opening of China and India to world trade, cheaper transport and communications, better macroeconomic management in many developing economies, and a long commodity boom (Kremer et al., 2022; Patel et al., 2021). The pattern is a *great convergence* that is real but very recent, and it has to be seen against the long divergence that came before.

3.2 Since 1990: convergence in three tiers

World Bank data on income per person (adjusted for price differences, in dollars of 2021) let us follow the modern period closely. Between 2000 and 2024 the average income in **upper-middle-income** countries (59 economies, including China, Brazil and Türkiye) rose from 18% to 36% of the high-income average. In **lower-middle-income** countries (47 economies, including India, Nigeria and Indonesia) it rose from 9% to 15%. In **low-income** countries (25 economies, 0.75 billion people) it did not rise: it moved from 3.4% to 3.7% (Figure 2, left) (World Bank, 2026).

Figure 1 Rich and poor economies drifted apart for 170 years and have been closing the gap only since the 1990s

Left: median income of today's high-income countries ÷ median of today's developing economies (countries with data in each year). Right: population-weighted income of 93 Global South economies as % of 48 high-income ones, covering 96% of world population

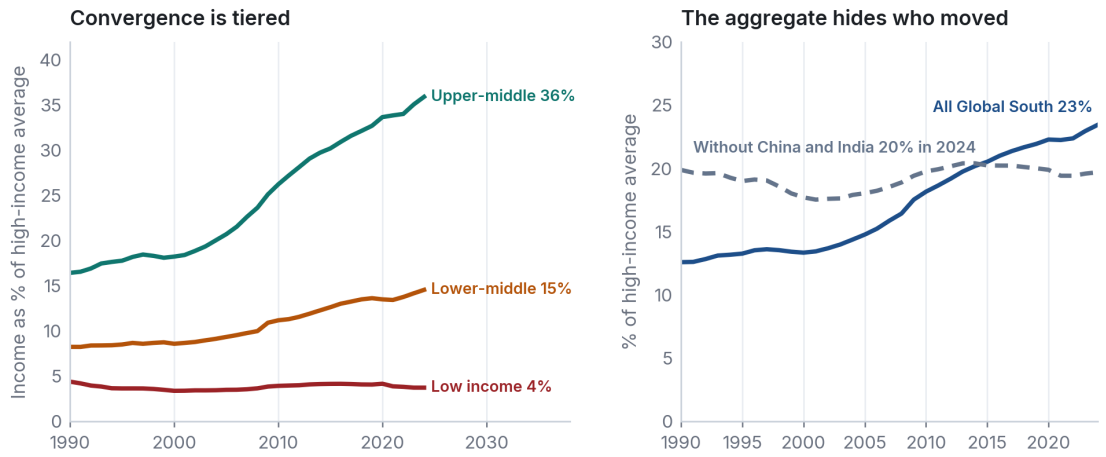


Source: Maddison Project Database 2023 (Bolt and van Zanden, 2024), with UN population weights (United Nations, 2024); high-income = World Bank class today (World Bank, 2025b). H Heuristics calculations.

The aggregate hides how concentrated this was. Taking all 131 Global South economies together, income rose from 13% of the high-income level in 1990 to 23% in 2024. Remove China and India, which together hold 2.8 billion people, and the same calculation gives 20% in 1990 and 20% in 2024 (Figure 2, right). For the rest of the developing world, there has been no convergence in thirty-four years: strong growth in the 2000s was offset by weak growth before and after. Several caveats apply. These are population-weighted averages of national figures, they exclude differences within countries, and the high-income average itself is rising. All the same, a conclusion that holds under both definitions is that convergence has so far been a story about a limited number of very large economies.

Figure 2 Upper-middle-income countries are closing the gap; low-income countries are not, and the Global South outside China and India is level

Average income per person as % of the high-income average, 1990–2024



Source: World Bank World Development Indicators, GDP per capita, PPP, constant 2021 international dollars (World Bank, 2026); classification (World Bank, 2025b). H Heuristics calculations (population-weighted).

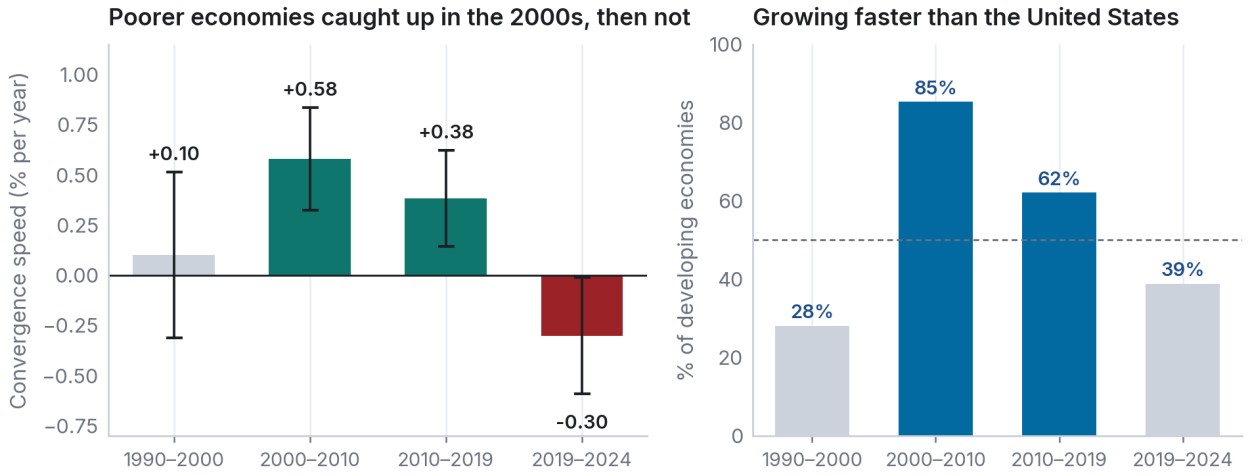
3.3 A short episode: the speed of catch-up

The test of beta convergence is whether, across all economies, those that start poorer grow faster. Figure 3 reports the answer for four periods. In the 1990s the relation was weak and not statistically different from zero. In 2000–10 it was clearly negative: an economy with half the income of another grew about 0.4 percentage points a year faster. In 2010–19 the effect was about two-thirds as strong. Over 2000–19 as a whole, the estimate is 0.53 per unit of log income, with a standard error of 0.10 (196 economies). These results are consistent with published work that finds unconditional convergence emerging from the 1990s (Kremer et al., 2022; Patel et al., 2021).

Then the pattern reversed. In 2019–24 the estimate turned positive (-0.30, standard error 0.15): poorer economies grew *more slowly* than richer ones. The share of developing economies growing faster than the United States fell from 85% in 2000–10 to 39% in 2019–24. The causes are those of the polycrisis itself: the pandemic's uneven recovery, the energy and food price shocks of 2022, high interest rates and debt burdens, conflict, and weaker world trade. The World Bank's January 2026 outlook found that about one in four developing economies still had lower per-person income than in 2019 at the end of 2025 (World Bank, 2026a), and its June 2026 edition warned that the 2020s risk becoming a lost decade for much of the developing world (World Bank, 2026b).

Figure 3 Poorer economies grew faster than richer ones in 2000–19, then slower since 2019

Left: convergence speed (negative of the slope of annual income growth on log starting income). Right: share of low- and middle-income economies outgrowing the United States



Source: World Bank World Development Indicators (World Bank, 2026); H Heuristics calculations. Bars show OLS slopes with 95% confidence intervals (robust standard errors); right panel uses developing economies with more than 1 million people.

3.4 Who caught up, and who fell behind

Catch-up has been uneven even within the poorer group. Of 95 economies with less than 30% of United States income in 1990 (6.3 billion people today), 37 gained more than two points of US income by 2024, 37 stayed within two points of where they began, and 21 lost ground. Table 2 lists the largest gainers and losers among economies that began below 40% of US income. Winners combined sustained investment, export diversification and, in several cases, the pull of a larger neighbouring market, as with Poland and Romania in the European Union. The losers include commodity exporters hurt by price falls (Angola, Congo, Iraq), economies suffering conflict (Iraq, Haiti, Zimbabwe) and some middle-income economies whose growth stalled (Mexico, South Africa).

Table 2 The largest gainers and losers among economies starting below 40% of US income in 1990

Largest gainers	1990	2024	Change	Largest losers	1990	2024	Change
Korea, Rep.	32%	73%	+40	Moldova	36%	22%	-14
Poland	29%	60%	+31	Congo, Rep.	20%	8%	-11
China	4%	31%	+28	Mexico	39%	29%	-10
Panama	23%	48%	+25	Iraq	24%	17%	-7
Bosnia and Herzegovina	5%	27%	+22	Angola	19%	12%	-7
Turkiye	27%	48%	+20	Zimbabwe	14%	7%	-7
Malaysia	27%	45%	+18	South Africa	24%	18%	-6

Source: World Bank WDI, GDP per capita PPP (World Bank, 2026); income as % of United States. Economies with more than 1 million people and data in both years. Equatorial Guinea's gain reflects oil.

The World Bank's 2024 World Development Report adds a warning about the middle of the distribution. Of 108 middle-income economies, only 34 reached high-income status between 1990 and 2023, and more than a third of those did so through membership of the European Union or the discovery of oil. The report places a typical stall point near 10% of United States income, about $8,000 per person today, and recommends a sequence of policies that moves from investment, to adopting foreign technology, to innovation (World Bank, 2024). Convergence, in other words, has an entrance (getting growth started), a long middle, and an exit that few economies have found.

3.5 How many people live where

One way to capture the change is to count people. In 1990, 59% of humanity lived in economies with income below $5,000 per person (in 2021 dollars adjusted for prices) and 67% below $10,000. By 2024 the first figure had fallen to 11% (0.9 billion people), a very large advance. But 42% of the world (3.3 billion people) still live below $10,000 and 59% (4.7 billion) below $20,000, about a third of the high-income average. The first rungs of the ladder have been climbed by most of the world; the middle rungs, where industrial capacity, infrastructure and institutions are built, are where most of the world's people now stand.

SECTION 04

Convergence Across Eight Dimensions

Income is only one gap. Access to power, connectivity and clean cooking has closed fast; productivity, industry and electricity use per person have closed slowly or not at all.

IN BRIEF

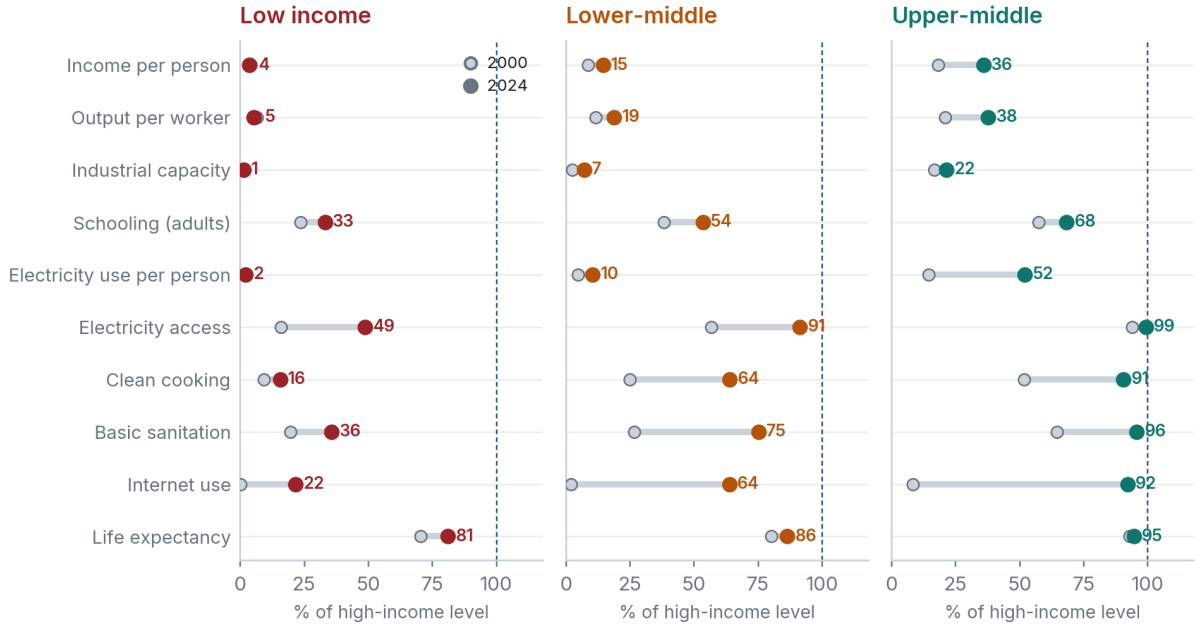
- Lower-middle-income countries now stand at 91% of the high-income level on electricity access, but 19% on output per worker.
- Low-income countries closed gaps in access (electricity 16% to 49%) but not in income (4% to 4%).
- Fast-diffusing technologies and slow-building capabilities converge at different speeds, and the slow ones are the binding constraint.

4.1 The scorecard

Figure 4 places each income group's level, as a percentage of the high-income level, on ten measures covering the eight dimensions, in 2000 and 2024. A dot at 100 would mean full convergence. The figure shows a clear sorting. Gaps in access (electricity, clean cooking, sanitation, internet) closed fast, and for upper-middle-income countries these gaps are nearly closed. Gaps in income, productivity, industrial capacity and electricity use per person are still wide: lower-middle-income economies stand at 15%, 19%, 7% and 10% of the high-income level on these four, and low-income economies at 4%, 5%, 1% and 2%.

Figure 4 Access gaps are closing fast; income, productivity, industry and power-use gaps are not

Level of each income group as % of the high-income level, 2000 (open dot) and 2024 (filled dot)



Source: World Bank WDI (World Bank, 2026); UNDP schooling data via Our World in Data (UNDP, 2025). Population-weighted group averages; H Heuristics calculations. Industrial capacity is manufacturing value added per person.

Table 3 Levels behind the scorecard, 2024 (2000 in brackets for the poorest groups)

Indicator	Low income	Lower-middle	Upper-middle	High income
Income per person, 2021 PPP $	2,178 (1,726)	8,498	20,973	58,377
Output per worker, 2021 PPP $	6,331	22,378	44,880	118,673
Manufacturing value added per person, US$	69	359	1,088	5,058
Mean years of schooling, adults	4.2 (2.7)	6.9	8.8	12.8
Electric power use per person, kWh	190	928	4,606	8,850
Electricity access, % of people	49 (16)	91	99	100
Clean cooking, % of people	16 (9)	64	90	100
Basic sanitation, % of people	35 (19)	74	94	98
Internet users, % of people	20 (0)	59	86	93
Life expectancy, years	65.2 (53.6)	69.5	76.0	80.4
Deaths under 5 per 1,000 births	62 (144)	39	11	5
Government effectiveness (−2.5 to +2.5)	-1.2 (-1.5)	-0.0	+0.3	+1.1

Source: World Bank WDI (World Bank, 2026); WGI (World Bank, 2025a); UNDP via Our World in Data (UNDP, 2025). Population-weighted averages; schooling is adults aged 25+.

4.2 Fast movers: access and connectivity

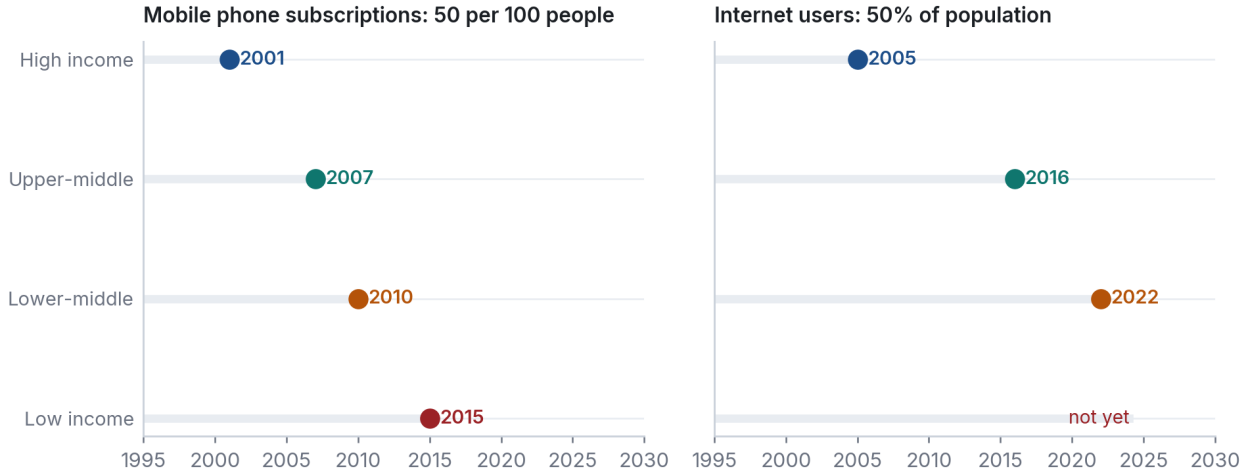
Technologies with low and falling cost per household, and with a business model that can serve poor customers, converged quickly. In 2000, 1% of people in lower-middle-income countries used the internet; in 2024 it was 59%. Mobile subscriptions rose from 1 to 88 per 100 people. In low-income countries the internet went from about zero to 20%, and the International Telecommunication Union counts 6 billion people online worldwide with 2.2 billion still offline, 96% of whom live in low- and middle-income countries (ITU, 2025; World Bank, 2026). Account ownership, a measure of financial inclusion, reached 75% of adults in low- and middle-income economies in 2024 from 42% in 2011, with mobile money the main driver in Sub-Saharan Africa (World Bank, 2025).

Energy access also moved: electricity reached 49% of people in low-income countries in 2024, up from 16% in 2000, and 91% in lower-middle-income countries. The 2026 energy progress report puts the global figure at 92%, leaving 655 million people without electricity, 86% of them in Sub-Saharan Africa, where the rural deficit has kept growing, and about 2 billion without clean cooking (IEA et al., 2026). Clean cooking rose from 24% to 64% in lower-middle-income countries but only from 9% to 16% in low-income countries, which is why cooking is the sharper gap.

Figure 5 shows the delay. High-income countries passed 50 mobile subscriptions per 100 people in 2001, upper-middle-income in 2007, lower-middle in 2010 and low-income in 2015. For internet use at 50% the dates are 2005, 2016 and 2022; low-income countries have not yet reached it. A lag of this kind is a sign of convergence: the delay between rich and poor countries adopting a new technology has been falling with each generation of technology, a pattern studied in the diffusion literature (Comin and Hobijn, 2010).

Figure 5 Each new technology reached the poorer groups with a shorter delay, but low-income countries are still years behind

Year each income group first averaged 50 mobile subscriptions per 100 people (left) and 50% internet use (right)



Source: World Bank WDI, mobile subscriptions per 100 people and internet users (World Bank, 2026); population-weighted group averages; H Heuristics calculations.

4.3 Slow movers: productivity, industry, power use and schooling

The dimensions that need accumulated capital, skills and firms moved far more slowly. Output per worker in lower-middle-income countries rose from 12% to 19% of the high-income level, and in low-income countries *fell* from 7% to 5%. Manufacturing value added per person in low-income countries stayed near 1% of the high-income figure. Electric power use per person in low-income countries was 190 kWh in 2024, 2% of the high-income 8,850 kWh, so electricity access can reach a household without giving it enough power to run machinery, refrigeration or cooling. This is the difference between *access* (a connection) and *adequacy* (enough reliable power to produce and protect).

Schooling closed faster than income but from a low base: adults in low-income countries averaged 4.2 years in 2024 against 12.8 in high-income countries (33% of the high-income level, up from 24%). Adult schooling changes slowly because it reflects whole age cohorts (UNDP, 2025), yet it matters for resilience: more educated populations suffer fewer disaster deaths and adapt faster (Lutz et al., 2014).

4.4 Health and institutions: slow, then stuck

Life expectancy gaps narrowed: low-income countries stood at 70% of the high-income level in 2000 and 81% in 2024, partly because high-income countries gain slowly near the limit. Child mortality fell by more than half in low-income countries (144 to 62 deaths per 1,000 births), but this is still 13 times the high-income rate of 4.8. At the 2000–24 pace, closing this ratio to a factor of two would take about 208 years, an arithmetic illustration of how slowly the last stretch goes. Government effectiveness, a World Bank index of the quality of public services and policy implementation, improved little in low-income countries (from -1.5 to -1.2) and rose from -0.7 to -0.0 in lower-middle-income ones, still well below the high-income +1.1 (World Bank, 2025a). Institutional capacity is the dimension on which resilience to systemic shocks appears to depend most, as pandemic outcomes showed (COVID-19 National Preparedness Collaborators, 2022).

4.5 What the pattern means

The pattern has a clear logic. A technology that can be bought, shipped and switched on (a phone, a solar panel, a stove, a bank account on a phone) converges at the speed of its falling cost. A capability that must be built (a skilled workforce, a productive firm, a competent agency, a grid that can run an industry) converges at the speed of investment and learning. At the 2000–24 pace, lower-middle-income economies would need about 56 years to reach half the high-income income level and 48 years to reach half its output per worker, while low-income economies show no closing at all. The first group of gaps will largely close this decade. The second will not unless something changes, which is why it matters for resilience and what the next sections examine.

Table 4 How long would it take? Years to reach a given share of the high-income level at the 2000–24 pace

Indicator	Group	2000	2024	Years to 50%	Years to 75%
Income per person	Low income	4%	4%	no convergence	no convergence
Income per person	Lower-middle	9%	15%	56	75
Output per worker	Low income	7%	5%	no convergence	no convergence
Output per worker	Lower-middle	12%	19%	48	68
Electricity use per person	Low income	2%	2%	694	783
Electricity use per person	Lower-middle	5%	10%	48	61
Schooling	Low income	24%	33%	29	58
Schooling	Lower-middle	38%	54%	already above	24

Source: H Heuristics calculations from World Bank WDI (World Bank, 2026) and UNDP (UNDP, 2025). Mechanical extrapolation of the 2000–24 average annual rate of change in the log ratio to the high-income level; an arithmetic illustration, not a forecast.

The table shows what continuing at the recent pace would imply for the slow-moving dimensions. It is not a prediction, since paces change, but it indicates the scale of the acceleration that would be needed. At the 2000–24 pace, lower-middle-income economies would take about half a century to reach half of high-income output per worker, and low-income economies show no convergence at all. Closing the productivity and power-use gaps within a lifetime would take a convergence speed several times the one observed.

SECTION 05

Why Convergence Reduces Vulnerability

Resilience is not a single trait. It is the ability to anticipate, absorb, adapt to and recover from shocks, and each of these depends on material conditions that development builds.

IN BRIEF

- Across 183 countries income explains 75% of the variation in lack of coping capacity, 60% of vulnerability and 20% of hazard exposure.
- Within countries, a 10% rise in income goes with about a 10% fall in child mortality.
- Setbacks of more than 10% below a past peak take up 14% of years in the poorest economies and 5% in middle-income ones.

5.1 Four capacities, four sets of material conditions

The H Heuristics framework describes Polycrisis Resilience as the capacity to anticipate, withstand, adapt to, recover from and reduce vulnerability to multiple interacting crises (Hughes, 2026a). Each of these capacities has a material base. Warning requires weather services, sensors, communications and the electricity to run them. Absorbing a shock requires buffers: savings, fiscal space, food stocks, spare capacity and insurance. Adapting requires skills, technology and investment in resilient buildings, drainage and cooling. Recovering requires functioning credit, institutions, supply chains and a state able to deliver help quickly. Table 5 links these capacities to the eight dimensions of convergence.

5.2 The gradient: income and vulnerability

The INFORM Risk Index, produced by the European Commission's Joint Research Centre and United Nations agencies, scores 191 countries on three parts of risk: hazard and exposure, vulnerability, and lack of coping capacity, each from 0 to 10 (European Commission JRC, 2026). Matching these scores to income per person for 183 countries gives a gradient that is steep and tight. Lack of coping capacity falls with each doubling of income by about 0.9 points on the 0–10 scale, and income alone explains 75% of the variation (Figure 6, left). Infrastructure and health-care access are even more closely linked to income (R^2 of 0.81 and 0.81), while the institutional component is less so (0.47), a sign that well-run institutions exist at many income levels.

Hazard and exposure behave differently. They are only partly related to income (R^2 0.20). The remaining link comes mainly from human hazards, since conflict and epidemic risk are higher in poor and fragile countries, while physical hazards such as floods and earthquakes are spread across the income scale. Among income fifths, the poorest fifth (median income about $2,988) scores 5.3 on hazard, 6.0 on vulnerability and 6.5 on lack of coping capacity, against 2.4, 2.5 and 2.2 for the richest fifth (median $66,209). The gap in vulnerability and coping capacity is far larger than the gap in hazard (Figure 6, right). These are cross-country correlations, so they do not

Table 5 How convergence builds the four resilience capacities

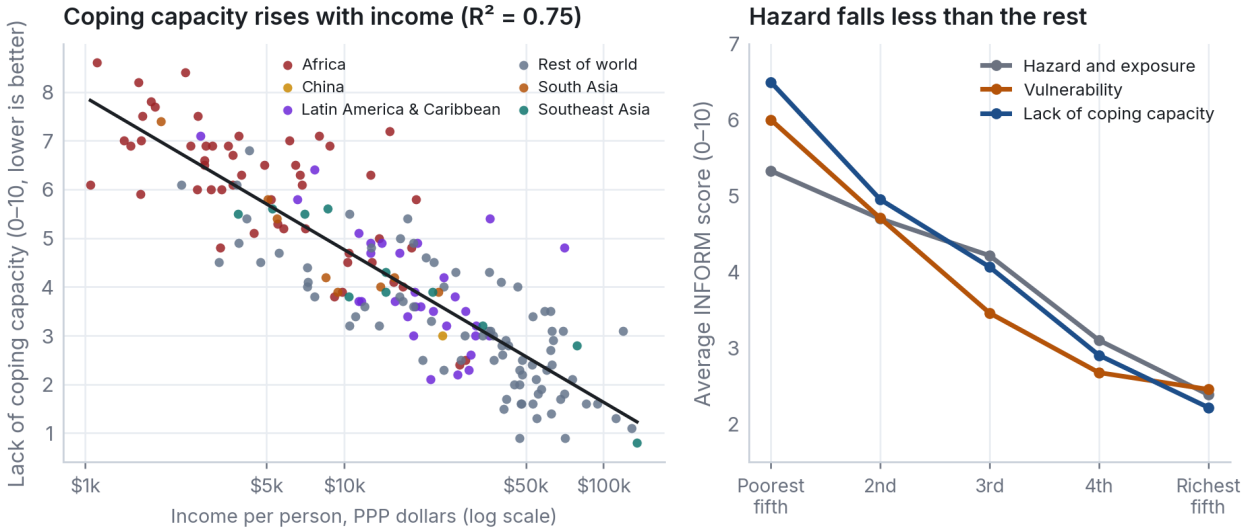
Capacity	What it needs	Convergence dimensions that supply it	Example of the effect
Anticipate	Data, forecasting, communications, trust	Digital, energy, human capital, institutions	Warning coverage and mobile phones raise the share of people reached before a hazard (UNDRR and WMO, 2023; WMO, 2025)
Absorb	Savings, buffers, fiscal space, health reserves, insurance	Income, productivity, health, institutions	Mobile money lets households share risk across distance after a shock (Jack and Suri, 2014); pre-arranged finance pays out faster than appeals (Clarke and Dercon, 2016; CCRIF SPC, 2025)
Adapt	Skills, technology, resilient infrastructure, cooling	Infrastructure, energy, industry, human capital	Each $1 in more resilient infrastructure yields about $4 in benefits in low- and middle-income countries (Hallegatte et al., 2019); schooling predicts lower disaster mortality (Lutz et al., 2014)
Recover	Credit, supply chains, state capacity, productive firms	Industry, productivity, institutions, income	Disaster losses can depress income for years; stronger economies recover faster (Hsiang and Jina, 2014; Cerra and Saxena, 2008)

Source: H Heuristics framework (Hughes, 2026a); evidence from sources cited.

show that raising a country's income would produce these gains by itself. They do show where the differences between countries are concentrated.

Figure 6 Income tracks coping capacity closely, and the gap between rich and poor is larger in vulnerability than in hazard

Left: lack of coping capacity vs income, each dot a country. Right: INFORM component scores by income fifth (0–10, higher is worse)



Source: INFORM Risk 2026 (European Commission JRC, 2026); World Bank WDI GDP per capita PPP 2024 (World Bank, 2026). H Heuristics calculations; 183 countries. Line: ordinary least squares fit on log income.

5.3 Within-country evidence: child survival

Cross-country comparisons can be confounded by geography and history. A sharper test follows the same country over time. For the economies with data over 1995–2024, the within-country relation between income and child mortality has an elasticity of -1.02 (standard error 0.06, errors clustered by country): in years when a country's income was 10% higher than its own average, child mortality was about 10% lower. The cross-country elasticity is -0.81. The two are close, which supports the idea that the cross-country gradient reflects a relationship that operates over time within countries and is not simply a difference in where countries start. It is still an association: technology and health programmes that were introduced over the same decades also reduced mortality, and the estimate does not separate the contribution of income from theirs.

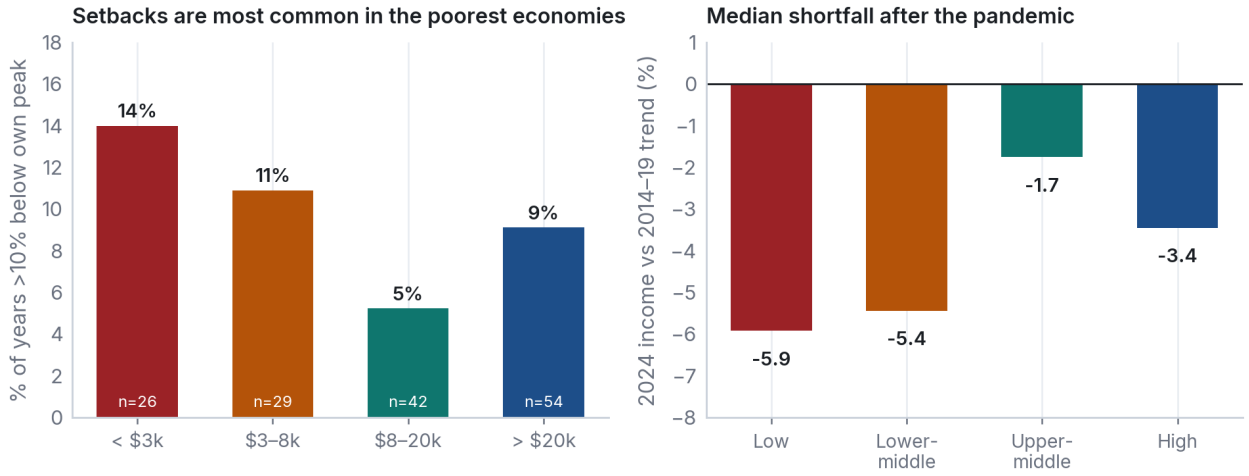
5.4 Shocks: absorbing and recovering

Does a richer economy absorb shocks better? The answer from growth data is mixed and instructive. The typical swing in annual per-person growth (its standard deviation, 1996–2019) is large in low-income countries (4.0 percentage points) and smaller elsewhere (2.6, 3.5 and 2.7 for lower-middle-, upper-middle- and high-income countries), but across individual countries income explains almost none of the differences in volatility. What does differ sharply is how much time economies spend in setbacks. Counting the years in which income is more than 10% below the economy's own earlier peak, the poorest economies (average income under $3,000) spent 14% of 1995–2019 in this condition, against 5% for economies with $8,000–$20,000 (Figure 7, left). Among low-income countries 57% had at least one such setback, against 36% of high-income ones. In the richest group (9%) the figure includes oil exporters and countries hit by the 2008 financial crisis, so the pattern is not a straight line.

The pandemic offers a recent test. The median fall in per-person income in 2020 was 3% in lowincome countries and 6% in upper-middle-income ones, so the initial hit was not larger for the poor. The difference is in the recovery. By 2024, income in the median low-income economy stood 5.9% below its 2014–19 trend, and in the median lower-middle-income economy 5.4% below, against 1.7% for upper-middle- and 3.4% for high-income economies (Figure 7, right); 45% of low-income economies had still not regained their 2019 income, against 20% of high-income ones. A shortfall against the pre-pandemic trend is common to all groups, since most economies had not returned to the old path. But the poorest recovered least, which fits the evidence that income losses from disasters and crises can persist for years (Hsiang and Jina, 2014; Cerra and Saxena, 2008). Fiscal room is part of the story: the median interest bill takes 11% of government revenue in low-income countries and 8% in lower-middle-income ones, against 3% in high-income ones, and UNCTAD counts 51 developing countries that spend more on interest than on either health or education (World Bank, 2026; UNCTAD, 2026).

Figure 7 The poorest economies spend more time in setbacks and recovered least from the pandemic

Left: % of years more than 10% below an economy's own earlier income peak, 1995–2019. Right: 2024 income relative to the 2014–19 trend, by income group



Source: World Bank WDI GDP per capita PPP (World Bank, 2026); H Heuristics calculations. Left: economies with more than 1 million people, grouped by average income 1995–2019. Right: median across economies of 2024 income against the continuation of the 2014–19 growth trend.

5.5 What this adds up to

Four conclusions follow. First, development is linked to large reductions in vulnerability and coping deficits, and weakly to hazard, which is why development is a good lever: it acts on the part of risk that can be changed. Second, the link is strongest for the material services (infrastructure, health care, communications) and weaker for institutions, which have to be built deliberately. Third, the benefits show in how long shocks last and how completely economies recover, more than in whether shocks happen. Fourth, the route matters: the same income can be reached with high or low pollution, debt and fragility, which is why Section 6 turns from income to the bundle of vulnerabilities that development can reduce together.

SECTION 06

Convergent Resilience Dividends

A single development investment often reduces several vulnerabilities at once. This section defines that effect, sets out the evidence for it and shows where, in the data, it does and does not appear.

IN BRIEF

- Reliable electricity, connectivity and clean cooking each improve many resilience dimensions at once.
- Across 107 developing economies, progress in infrastructure and access travels in bundles even after income growth is held fixed.
- Dividends are not automatic: a connection without reliability or use produces little, and health and schooling outcomes follow more slowly.

6.1 The concept

Convergent Resilience Dividends

The simultaneous reduction of multiple forms of human and systemic vulnerability resulting from a single development intervention or interconnected group of interventions.

H Heuristics concept

Take reliable electricity. It improves health care delivery, because clinics can refrigerate vaccines, sterilise instruments and operate at night. It increases educational opportunities, because pupils can study after dark and schools can run computers. It enables industrial productivity and the jobs that come with it. It improves access to cooling, supports digital connectivity and reduces dependence on polluting energy sources. Expanding internet access, in the same way, improves education, economic participation, health care access, institutional efficiency and access to information. The idea is related to *multisolving*, the practice of choosing interventions that solve several problems at once (Sawin, 2018), and to the long-standing view of development as the expansion of people's capabilities (Sen, 1999). What is specific here is the framing: a dividend is counted in units of *vulnerability reduced*, across the dimensions of the polycrisis, and it is something one can test with data.

6.2 The ledger: what single interventions have been shown to deliver

Table 6 collects evidence for five common interventions. Some of it comes from careful trials and quasi-experiments, which can show cause and effect; some comes from surveys and reports that document scale. The strength of evidence differs by row and the table says so.

Table 6 Dividends from single interventions: what the evidence shows

Intervention	Vulnerabilities it reduces	Evidence	Strength
Reliable electricity	Health-care delivery, schooling, productivity, cooling, clean air	About 1 billion people are served by health facilities with no or unreliable power (WHO et al., 2023). South African rural electrification raised female employment by about 9.5 percentage points (Dinkelman, 2011). A Kenyan trial found limited short-run household gains from connections alone (Lee et al., 2020)	Mixed: strong for facilities, weaker for households
Mobile money and digital finance	Poverty, shock absorption, gender gaps, access to credit	Kenya's M-Pesa lifted about 194,000 households (2%) out of poverty, more among women-headed households (Suri and Jack, 2016); it helped households share risk after shocks (Jack and Suri, 2014). Account ownership is 75% in low- and middle-income economies (World Bank, 2025)	Strong: quasi-experimental
Fast internet	Unemployment, skills mismatch, market information	Arrival of submarine cables raised employment by 6.9% and 13.2% in two groups of African countries and shifted jobs to skilled work (Hjort and Poulsen, 2019). Mobile phones cut price differences and waste in Indian fish markets (Jensen, 2007)	Strong: quasi-experimental
Clean cooking	Child pneumonia, air pollution, women's time, forests	Household air pollution is a leading environmental risk factor (WHO, 2024). The HAPIN trial found that LPG did not cut severe infant pneumonia significantly under trial conditions, so exclusive use matters (HAPIN Investigators, 2024)	Mixed: depends on exclusive use
Adult and girls' schooling	Disaster deaths, child mortality, adaptive capacity	More educated populations suffer fewer disaster deaths and adapt faster under climate scenarios (Lutz et al., 2014)	Moderate: modelled and observational

Source: studies cited. The table reports published findings and does not generalise beyond their settings.

6.3 Do dividends show up in the data?

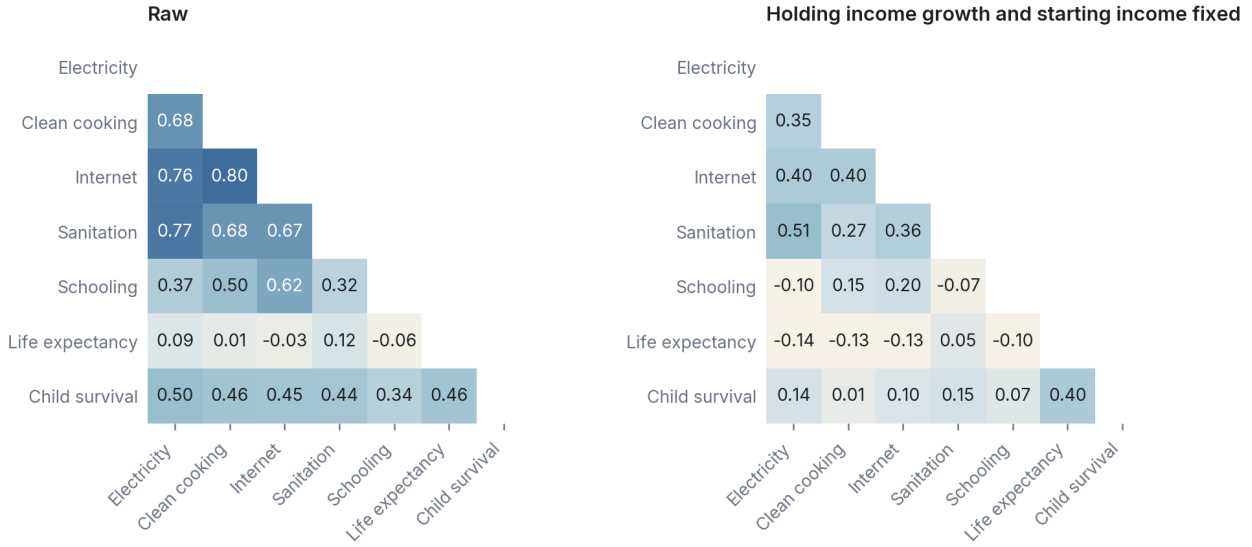
The ledger shows that single interventions have several effects. A broader question is whether, at national scale, progress on different dimensions *travels together*. To test this, we measured for each of 107 developing economies the share of its 2000 gap to a feasible frontier that it closed by 2022, for seven dimensions: electricity, clean cooking, internet, sanitation, schooling, life expectancy and child survival. Using shares of the remaining gap, instead of raw changes, avoids the problem that countries already near the ceiling cannot improve further.

Countries closed on average 58% of their electricity gap, 56% of the internet gap, 43% for sanitation and 38% for clean cooking, against 30% for life expectancy, 29% for child survival and 27% for schooling. Figure 8 shows how the progress rates relate. Taken at face value, 90% of the 21 pairwise relations are positive, with an average of 0.43. Since fast-growing economies improve everything, a better test holds income growth and starting income fixed. The average falls to 0.14, so about two-thirds of the co-movement is explained by income growth, but a robust core remains: electricity, clean cooking, internet and sanitation progress still move together (correlations 0.27 to 0.51 after the adjustment).

Figure 9 shows the same thing in another way. If the seven dimensions advanced independently of one another, only about 6% of countries would be fast on six or seven of them (faster than the peer median), and about 6% would be fast on at most one. In fact 14% were fast on six or seven

Figure 8 Progress in energy, connectivity and sanitation moves together, even after income growth is removed; health and schooling gains do not

Correlation between the share of the 2000 gap closed by 2022, for seven dimensions; right panel after removing the effect of income growth and starting income

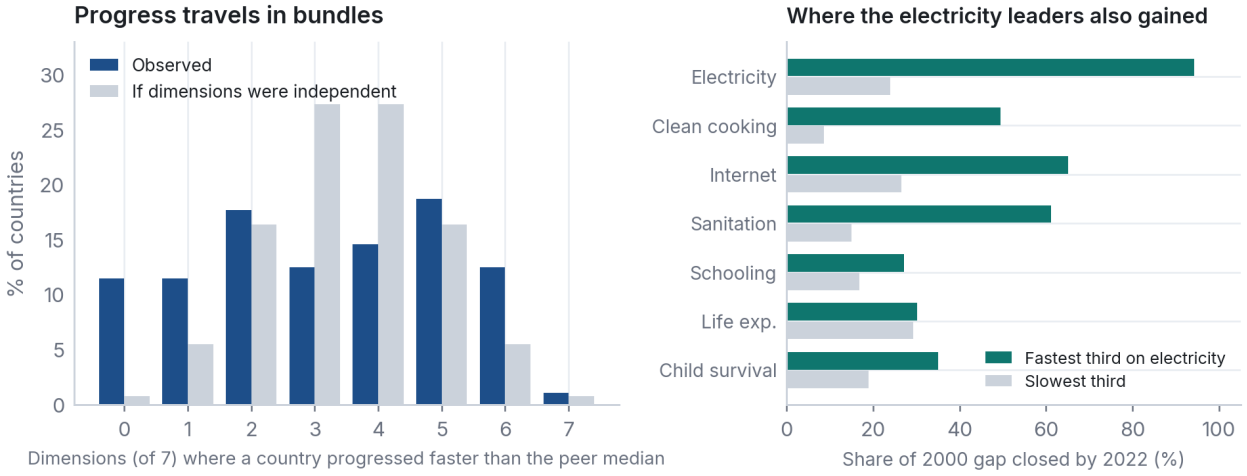


Source: World Bank WDI (World Bank, 2026); UNDP schooling (UNDP, 2025); H Heuristics calculations on developing economies with more than 1 million people (n varies by pair; 67–107).

and 23% on one or none: countries tend to move forward on many fronts together or on very few. The right panel compares the countries in the fastest third on electricity progress (n = 23) with the slowest third (n = 22). The leaders closed 94% of their electricity gap against 24%, and also 65% against 27% of the internet gap, 61% against 15% for sanitation and 49% against 9% for clean cooking. Their income also rose by about 95% against 30%.

Figure 9 Countries advance on many fronts at once or on very few, and electricity leaders also gain on connectivity, cooking and sanitation

Left: number of dimensions where a country progressed faster than the peer median, observed vs independent. Right: progress by electricity-progress tercile



Source: World Bank WDI (World Bank, 2026); UNDP (UNDP, 2025); H Heuristics calculations. Independent benchmark: binomial with probability one-half for each of seven dimensions.

6.4 Where dividends do not show up

The data also show limits. Controlling for income growth and starting income, faster progress in electricity is associated with faster progress in internet use (coefficient 0.25, $p = 0.006$), clean cooking (0.33, $p < 0.001$) and sanitation (0.49, $p < 0.001$). It is *not* significantly associated with faster progress in schooling, life expectancy or child survival over 2000–22 (-0.06, -0.11 and +0.10, all $p > 0.15$). Progress in internet use shows the same pattern: significant for electricity, cooking and sanitation, not for life expectancy or child survival. Three reasons are plausible. Health and schooling outcomes respond with a lag of a generation or more; electricity connections are not the same as reliable power; and national averages hide the benefits of local programmes. The dividends from infrastructure are visible in other infrastructure first, and in health and learning only after other conditions are in place.

This is consistent with the best-identified evidence. The Kenyan experiment that connected households to the grid found small short-run gains in income and other outcomes, because the connections were often unused or unreliable and customers lacked appliances or activities that made use of the power (Lee et al., 2020). The South African study, which looked at a larger rollout over a longer period, found notable employment effects (Dinkelman, 2011). The lesson is that a dividend depends on *use*: a connection that powers a clinic's vaccine fridge or a workshop's machines yields much more than one that powers a single bulb. The policy design therefore matters as much as the investment: link electrification to schools, clinics, enterprises and cooling, and measure reliability and adequacy, not connections alone.

METHOD

How to count a Convergent Resilience Dividend

1. Name the investment. Electricity connection, mobile-money access, clean cooking stove, flood-proof road.

2. List the vulnerabilities it touches. Health, education, income, cooling, pollution, information, shock absorption.

3. Check the evidence for each link. Trial, natural experiment, survey, or reasoning only. Rate it.

4. Count only verified links. The dividend count is the number of dimensions with at least moderate evidence.

5. Measure use and reliability. A connection that is unused or unreliable earns no dividend.

6. Track outcomes with the right lag. Access gains show in years, health and schooling in decades.

SECTION 07

Bypass Pathways: Skipping Stages

Late-arriving economies do not have to repeat the path of early industrialisers. New technologies let them skip some resource-intensive stages, and the record shows this is real, though limited.

IN BRIEF

- Distributed solar, mobile money, mobile broadband, digital learning, satellite links, modern cooling and AI-assisted services each let people skip an older infrastructure.
- Bypassing works when power, devices, regulation and skills are in place, and fails without them.
- The objective is not to copy the advanced economies but to find more accessible, advanced and sustainable pathways.

7.1 The idea of leapfrogging

The idea of the *latecomer's advantage* is that economies behind the frontier can borrow technology instead of inventing it and adopt the best available methods without being locked into old ones. An influential early statement was Abramovitz's, who argued that the greater the gap, the greater the potential for catch-up, but also that the capacity to absorb new technology depends on education, institutions and capital (Abramovitz, 1986). Mobile phones provided the clearest example: countries with few landlines went straight to mobile networks, and mobile subscriptions rose from 0.2 per 100 people in low-income countries in 2000 to 67 in 2024 (Figure 5). The question for resilience is whether the same logic can be applied to the larger infrastructure systems, such as energy, finance, education, communications and cooling, that determine vulnerability.

7.2 Six bypass pathways

Table 7 sets out six pathways that match the examples most often cited in the development literature. For each it lists what the technology can replace, the best evidence of it working and, as important, the conditions under which it works and the limits that remain.

7.3 The record so far

Evidence for bypassing is strongest where a technology is cheap and can be sold in small units. Mobile subscriptions averaged 67 per 100 people in low-income countries in 2024 and 88 in lower-middle-income countries. Mobile money turned phones into bank accounts for people who had no branch nearby, and the studies cited above link this to lower poverty and better shock absorption. Solar is following the same route: Ember's analysis of customs data suggests a take-off in African imports and a much bigger one in Pakistan, where most panels are on rooftops and farms and not in utility plants, so official capacity statistics understate the change. The pace is not uniform. Africa is, in Ember's words, not yet the next Pakistan, and imports only measure panels shipped (Ember, 2025).

Table 7 Six ways late-arriving economies can skip stages

Technology	What it can replace	Evidence	Conditions and limits
Distributed renewable energy	Exclusive dependence on centralised fossil-fuel systems	Solar module cost fell about 90% in 2010–2023 (IRENA, 2024). Pakistan imported about 18 GW of Chinese panels in 12 months to mid-2025, much of it behind the meter, and Africa imported 15 GW, up 60% (Ember, 2025)	Import data show panels shipped, not installed; storage, grid integration and financing needed; adequacy (kWh per person) still low
Mobile-first financial services	Extensive legacy bank-branch infrastructure	Account ownership 75% in low- and middle-income economies in 2024, from 42% in 2011; Sub-Saharan Africa 58% (World Bank, 2025); poverty and risk-sharing gains (Suri and Jack, 2016; Jack and Suri, 2014)	Needs agent networks, regulation and identity; cash-out and credit still need physical presence
Digital education	Part of the need for conventional school buildings and teachers alone	Fast internet raised skilled employment in Africa (Hjort and Poulsen, 2019); but only 23% of people in low-income countries use the internet (ITU, 2025)	Works alongside schools, not instead of them; needs devices, power and local-language content; learning evidence is mixed
Satellite connectivity	Terrestrial networks in remote areas	Internet use is 85% in cities and 58% in rural areas worldwide; only 34% in least developed countries (ITU, 2025)	Terminal and subscription costs are high for poor households; useful for schools, clinics and communities first
Modern cooling and climate-responsive design	Dependence on energy-hungry air conditioning built after decades of overheated cities	Passive-first cooling (shade, insulation, ventilation, cool roofs, fans) can cut energy use and emissions sharply; more than 1 billion people lack adequate cooling (UNEP, 2025)	Design must be built into housing and city plans before demand locks in; finance for the poor
AI-assisted services	Scarcity of specialist expertise (diagnosis, agriculture advice, tutoring)	Potential is large, but 2.2 billion people are offline and 96% of them live in low- and middle-income countries (ITU, 2025)	Needs connectivity, languages, oversight and accountability; evidence on outcomes is early

Source: studies cited; H Heuristics assessment of conditions.

There are also cases of bypassing that failed to arrive. Electricity use per person in low-income countries was 190 kWh in 2024, and rural electrification in Sub-Saharan Africa is not keeping pace with population growth, with the rural deficit rising from 376 million in 2010 to 447 million in 2024 (IEA et al., 2026). Solar home systems can power lights, phones and fans, but they do not power an irrigation system or a small factory without larger investment. The way to think about it is by service tiers: distributed energy can give households the first rungs of reliable power quickly, and moving up to productive use, which is what drives the higher dividends, requires storage, networks and demand.

7.4 When bypassing works and when it does not

A bypass technology is most likely to deliver when five conditions are met. **Cost**: the unit price is low and falling, and can be paid in small instalments. **Complements**: reliable power, devices, identity and payments systems exist or arrive with it. **Rules**: regulation allows new providers while protecting users. **Skills**: people can use it, repair it and build businesses on it. **Scale**: networks grow with the number of users. Where any of these is missing, the technology reaches only the better-off, or stays unused. Bypassing also has costs to manage: dependence on imported equipment, electronic waste, data protection and the risk of locking in a lower-quality service for the poor.

TEST

Three tests for a bypass strategy

Does it reach the poorest, not only the urban middle class? Check coverage by income, gender and location.

Does it come with its complements? Power for the phone, identity for the account, skills for the platform.

Does it add a rung, or replace the ladder? A bypass that leaves roads, grids, clinics and schools unbuilt moves the problem; it does not solve it.

The objective is not simply to replicate the development trajectories of advanced economies. It is to identify more accessible, technologically advanced and environmentally sustainable convergence pathways. Evidence says that they exist, that they work in some places and that they are no substitute for the slow work of building capabilities. Section 8 turns to what could block them.

SECTION 08

What Can Stall Convergence

Convergence is not a law of nature. The same polycrisis that makes it urgent also threatens the routes by which poor economies have caught up.

IN BRIEF

- Manufacturing, the classic escalator, now peaks at lower incomes and smaller shares of the economy.
- Debt service, falling aid and trade fragmentation squeeze the investment that convergence needs.
- Climate damage, conflict and a digital divide in AI can each widen gaps; policy can offset them.

8.1 Premature deindustrialisation

Rapid growth in East Asia ran through factories: workers moved from farms to manufacturing, where productivity is high and where, as Dani Rodrik showed, labour productivity in manufacturing converges toward the frontier even in poor countries (Rodrik, 2013). The concern is that this escalator is shorter than it was. Rodrik found that developing economies now reach their peak manufacturing share earlier and at lower incomes than early industrialisers, a pattern he called premature deindustrialisation (Rodrik, 2016). Recent work disputes part of this: using other data, Herrendorf, Rogerson and Valentinyi find no unconditional convergence in manufacturing productivity but some in services (Herrendorf et al., 2026). The question is therefore open.

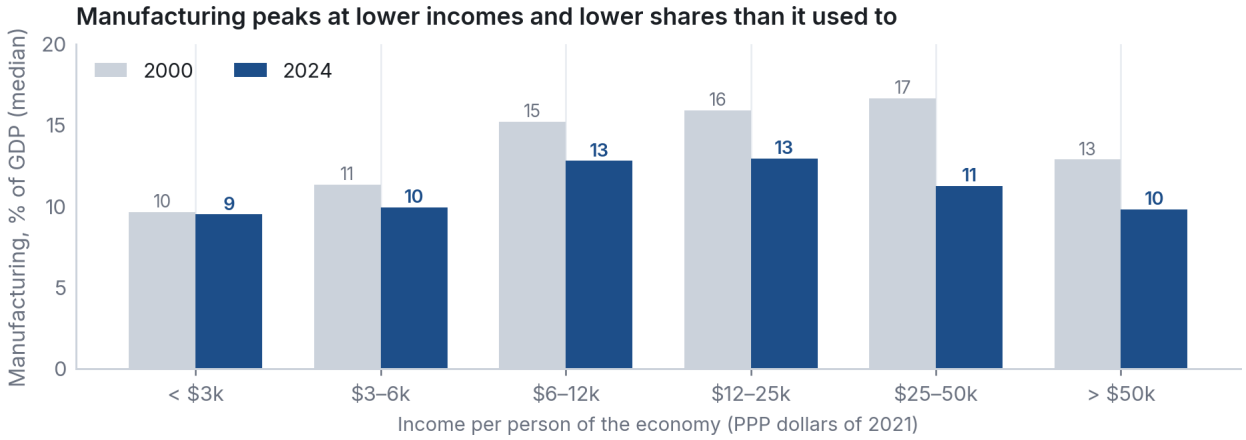
Our data are consistent with a lower and earlier peak. The median manufacturing share of GDP among economies with $12,000–$25,000 per person was 16% in 2000 and 13% in 2024; for economies with $25,000–$50,000 it fell from 17% to 11% (Figure 10). A quadratic fit puts the peak at about $21,000 per person. In low-income countries 56% of jobs were still in farming in 2024 (from 66%), and the growth in services employment (23% to 33%) outpaced industry, which stayed at about 11% of jobs. If services can lift productivity as manufacturing did, convergence can continue through them; if not, workers may move out of farms into low-productivity services without raising output per worker, which is what the output-per-worker data in Section 4 show for low-income countries.

8.2 Debt, aid and the cost of capital

Convergence needs investment, and investment needs affordable finance. UNCTAD estimates that developing countries paid about $995 billion in net interest on public debt in 2025, that the median country now spends 8.1% of government revenue on interest, nearly double its 2010 share, and that 51 countries, with 3.7 billion people, spend more on interest than on either health or education (UNCTAD, 2026). In our World Bank data the median interest bill is 11% of revenue in low-income countries against 3% in high-income ones. At the same time, official development assistance from donors fell in 2025 by an estimated 23% in real terms (OECD, 2026). The two trends reinforce each other: when borrowing costs rise and grants fall, the investments with the highest resilience payoffs, such as grids, schools and flood defences, are the first to be postponed.

Figure 10 The manufacturing share of the economy peaks at middle incomes and is lower than it was in 2000

Median manufacturing share of GDP by income per person (PPP dollars of 2021), 2000 and 2024



Source: World Bank WDI manufacturing value added (% of GDP) and GDP per capita PPP (World Bank, 2026); H Heuristics calculations. Medians by income band; 17–60 economies per band.

8.3 Trade, geopolitics and the energy shock

Convergence in the 2000s was powered by open trade and by cheap, stable energy and capital. The World Bank cut its 2026 global growth forecast to 2.5% in June, citing higher energy prices, inflation and borrowing costs linked to conflict in the Middle East, and described the 2020s as at risk of becoming a lost decade for much of the developing world (World Bank, 2026b). The World Economic Forum's survey of experts ranks geoeconomic confrontation among the most severe global risks in 2026 (World Economic Forum, 2026). Fragmenting trade and higher energy costs hit importers of fuel and food hardest, and raise the cost of the imported capital goods and technologies that bypassing depends on.

8.4 Climate damage, pollution and demography

Climate change and pollution act as a tax on catch-up. Studies of tropical cyclones find that growth effects of major storms can persist for two decades (Hsiang and Jina, 2014). Adaptation finance for developing countries is far below estimated needs, and the gap is growing (UNEP, 2025). Population change cuts both ways. Africa's population is projected to roughly double by 2100 (United Nations, 2024): a larger workforce can raise income per head if jobs, schools and clinics expand in step, and can lower it if they do not. Conflict and displacement, which the UN refugee agency records at over 117 million people forcibly displaced, absorb capital and talent and are concentrated in the poorest countries (UNHCR, 2026).

8.5 A digital and artificial intelligence divide

Digital technologies can accelerate convergence, but they can also widen the gap if the benefits go first to places that already have connectivity, data centres, skills and capital. Internet use is 94% in high-income countries and 23% in low-income ones, and 2.2 billion people are offline (ITU, 2025). Artificial intelligence services that need broadband, devices and local-language models are out of reach of most people in the poorest countries today. Whether AI becomes a source of convergence, by spreading expertise cheaply, or of divergence, by rewarding those who already hold the data and capital, depends on connectivity and on policy choices taken now.

Table 8 Six headwinds to convergence, their resilience cost and what could offset them

Headwind	How it slows convergence	Resilience cost	What could offset it
Premature deindustrialisation	Shorter, lower manufacturing escalator	Fewer high-productivity jobs; narrower tax base	Services-led productivity growth; export diversification
Debt service	Interest crowds out health, schooling and infrastructure	Less fiscal space to absorb shocks	Debt restructuring, concessional finance, domestic revenue (UNCTAD, 2026)
Falling aid	Fewer grants for the poorest	Delayed energy, health and adaptation investment	Blended finance, risk pooling (OECD, 2026; CCRIF SPC, 2025)
Trade fragmentation	Higher costs of imported technology and fuel	Slower bypassing; price shocks	Regional trade, diversified supply chains
Climate and pollution damage	Lasting income losses after shocks	Compounded vulnerability	Early warning, resilient infrastructure (Global Commission on Adaptation, 2019; Hallegatte et al., 2019)
Digital and AI divide	Benefits flow to the connected	Wider capability gaps	Affordable connectivity, local content, public digital infrastructure

Source: studies cited; H Heuristics assessment.

SECTION 09

Three Pathways to 2100

How fast economies converge, and how deliberately the process is steered toward resilience, produces very different centuries. These are conditional illustrations built from observed relationships, not forecasts.

IN BRIEF

- If the Global South converges at 1% of the gap a year, its income reaches 35% of the high-income level by 2100; if convergence stalls it falls to 14%.
- Cumulative child deaths in 2025–2100: 314 million (fragmented), 181 million (accelerated), 167 million (resilience-oriented).
- All projections are explicitly conditional on stated assumptions and use 2024 relationships between income and outcomes.

9.1 The three pathways

The three pathways answer one question: what if convergence went one way or another, and what if it were steered? Each is a simplified, transparent set of assumptions applied to 196 economies, covering 98% of the world's population, from 2024 to 2100. Population follows the United Nations medium projection in every pathway (United Nations, 2024). The differences are in the speed of income convergence and in the quality of conversion of income into resilience.

Table 9 The three pathways and their assumptions

Pathway	Story	Income assumption	Conversion of income into outcomes
1. Fragmented convergence	Uneven productivity growth, persistent technology gaps, insufficient infrastructure investment and recurring development reversals	Convergence speed 0%: each economy grows at the 1% frontier rate, less 0.3 points a year if its income is below $20,000 (reversals)	Today's country-specific relationships between income and outcomes stay fixed
2. Accelerated convergence	Sustained economic growth, wider access to clean energy, education, digital infrastructure and improved climate adaptation	Convergence speed 1% of the gap to the frontier per year, double the 2000–19 pace of about 0.5%	Same as pathway 1; outcomes rise only as income rises
3. Resilience-oriented convergence	Accelerated development deliberately coordinated with environmental protection, technological diffusion, institutional strengthening and systemic vulnerability reduction	Same as pathway 2	Half of each country's gap between its actual outcomes and those its income predicts closes by 2100 (better services per dollar)

Source: H Heuristics scenario design; parameters in the Methods note.

Convergence speed in pathway 2 is about twice the observed 2000–19 average of 0.5, and well below the long-run conditional rule of thumb of 2% a year (Barro, 2012; Kremer et al., 2022). It is an *accelerated* pathway and is meant to be difficult but not implausible. Pathway 3 does not assume

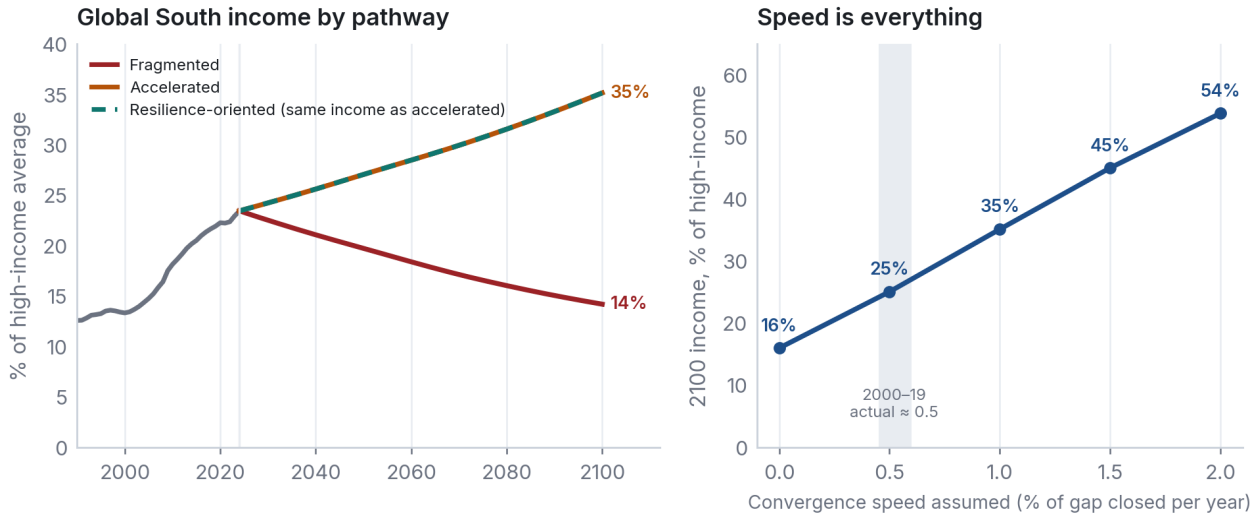
faster income growth than pathway 2. It assumes that countries get more resilience for each dollar of income: more reliable power, cleaner cooking, better health systems and stronger institutions than their income level would otherwise buy. Outcomes are computed from each economy's income through the 2024 cross-country relationship between income and each outcome, with each country keeping its own distance from that line (its 'residual'). Because the relationships are those of 2024, the pathways ignore future technology gains, which makes the absolute levels conservative.

9.2 Income: the speed of convergence is the main lever

Figure 11 (left) shows the Global South's income as a share of the high-income level. In the fragmented pathway it falls from 23% today to 14% in 2100, which in practice means that the Global South's income per person in 2100 is 18,000 dollars, against 130,000 in high-income economies. In accelerated convergence it rises to 35% and 47,000 dollars. The right-hand panel shows how the 2100 outcome depends on the assumed speed. At zero speed the ratio is 16%; at the 2000–19 pace of about 0.5% it is 25%; at 1% it is 35%; at the conditional-convergence rule of 2% it is 54%. Even at 2% the Global South does not close the gap by 2100, because convergence slows as the gap narrows. The result does not depend on the assumed frontier growth rate: moving it from 0.5% to 1.5% a year changes the 2100 ratio by less than 0.1 point, because the model works through the gap.

Figure 11 The speed of convergence determines whether the Global South ends the century at 14% or 35% of high-income living standards

Left: Global South income as % of the high-income average, 1990–2100. Right: 2100 outcome by assumed convergence speed (frontier growth 1% a year)



Source: H Heuristics scenario model using World Bank WDI income data (World Bank, 2026) and UN population (United Nations, 2024); illustrative, conditional on stated assumptions. Historical line is the 1990–2024 observation.

9.3 Seven outcomes

Table 10 reports the seven outcomes the scenarios were designed to examine, for 2024 and for 2100. Economic development moves as in the previous figure. **Exposure to hazards**: about 6.0 billion people live in the third of countries with the highest natural hazard scores in every pathway, since the model does not change the climate. What changes is how many of them are weakly protected: 1.4 billion today, 1.8 billion in 2100 in the fragmented pathway, 0.7 billion with accelerated convergence and 0.0 billion in the resilience-oriented one (a country is counted as weakly protected if its lack of coping capacity score is above 4 on the 0–10 INFORM scale). **Infrastructure**: the number of people without electricity is 1,159 million in 2100 in the fragmented pathway against 154 million and 79 million; without clean cooking the figures are 2.6 billion, 266 million and 182 million.

Table 10 Seven outcomes in 2100 under the three pathways

Outcome	Indicator	2024	1. Fragmented	2. Accelerated	3. Resilience-oriented
Economic development and productivity	Global South income per person, $ (2021 PPP)	13,706	18,450	46,557	46,557
Population exposure to hazards	People in top-third hazard countries with weak coping capacity, bn	1.4	1.8	0.7	0.0
Access to essential infrastructure	People without electricity, millions	650	1,159	154	79
	People without clean cooking, millions	1,938	2,632	266	182
Climate adaptation capacity	Lack of coping capacity, INFORM 0–10 (lower is better)	4.0	4.0	2.5	2.6
Health and educational outcomes	Under-5 deaths per 1,000 births (world average)	25	24	8	7
	Adult years of schooling (world average)	8.4	8.9	11.3	11.7
Economic shock absorption	People in economies below $10,000 per person, bn (setbacks most frequent)	3.3	3.3	0.0	0.0
Long-term systemic vulnerability	INFORM vulnerability score 0–10 (world average)	3.9	4.1	2.8	2.6

Source: H Heuristics scenario model (World Bank, 2026; European Commission JRC, 2026; United Nations, 2024). Conditional illustrations, not forecasts; population-weighted averages; 2024 values are the model's fit to current data.

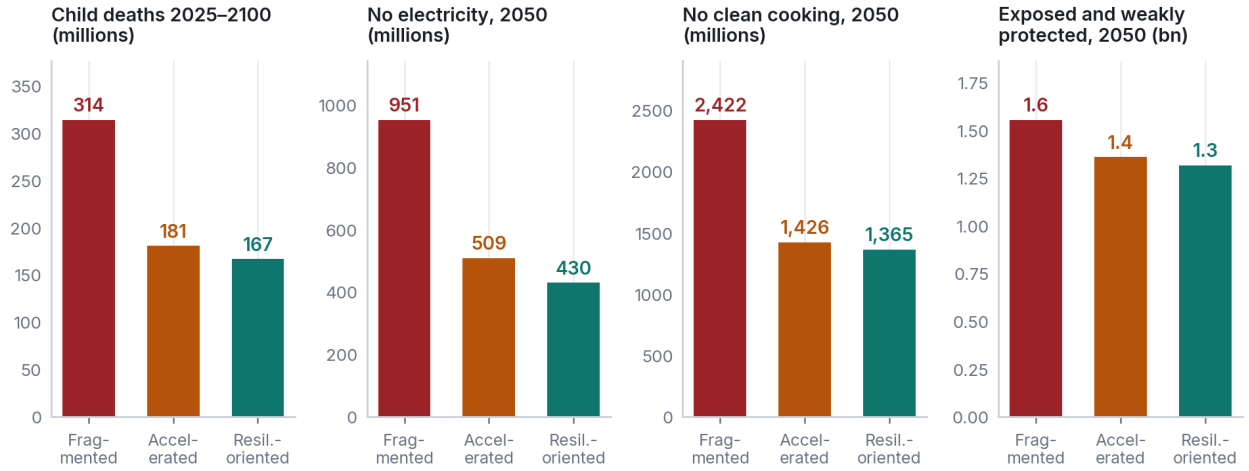
Adaptation capacity and health: lack of coping capacity falls from 4.0 to 2.5 with accelerated convergence but stays near 4.0 in the fragmented pathway. Under-five mortality averaged over the world's children falls from 25 per 1,000 to 8 in pathway 2 and 7 in pathway 3, against 24 in pathway 1. **Shock absorption**: in the fragmented pathway 3.3 billion people still live in economies below $10,000 per person in 2100, where setbacks of more than 10% below an earlier peak were recorded in 5–14% of years in Section 5, against none in the accelerated pathways. **Systemic vulnerability**: the vulnerability score falls from 3.9 to 2.8 and 2.6.

9.4 People: lives and years

Over 2025–2100, children dying before their fifth birthday total about 314 million in the fragmented pathway, 181 million in the accelerated one and 167 million in the resilience-oriented one (Figure 12, left). The difference between pathways 1 and 2 (133 million) shows what the speed of income convergence alone is worth; the further 14 million between pathways 2 and 3 shows the value of getting more resilience per dollar of income. By 2050 the number of people without electricity is 951 million in the fragmented pathway and 509 million in the accelerated one, and without clean cooking 2.4 billion against 1.4 billion (Figure 12). The gains arrive early: the pathways diverge within the first decades.

Figure 12 Accelerated, resilience-oriented convergence avoids about 150 million child deaths and hundreds of millions of deprivations

Cumulative under-5 deaths 2025–2100, and people without electricity, without clean cooking and in hazard-exposed countries with weak coping capacity (2050), by pathway



Source: H Heuristics scenario model (World Bank, 2026; European Commission JRC, 2026; United Nations, 2024; World Bank, 2025b); births and population from UN WPP 2024. Conditional illustrations, not forecasts.

9.5 What it means for individual economies

The accelerated pathway implies different timetables for different economies, because the model closes a fixed share of each economy's remaining gap each year, so poorer economies start with a lower level but faster proportional growth. Table 11 shows income per person in 2024 and 2100 for thirteen large economies, and the year each reaches $20,000 per person, about a third of the high-income average today.

The table is a reminder that the accelerated pathway is demanding. Economies that start very poor, such as Ethiopia or the Democratic Republic of the Congo, take most of the century to reach $20,000 even when they close 1% of the gap each year, while those already near $10,000 get there within about thirty years. The model treats every economy alike. In the real world, differences in institutions, geography, conflict and policy will make some economies converge much faster than 1% and others much slower, which is the central point of the conditional-convergence literature.

Table 11 Illustrative income paths for selected economies (income per person in 2021 PPP dollars)

Economy	2024	2100, accelerated	Year reaching $20,000: fragmented	Year reaching $20,000: accelerated
Bangladesh	8,487	46,928	after 2100	2059
India	9,416	49,296	after 2100	2055
Pakistan	5,502	38,206	after 2100	2071
Indonesia	14,471	60,409	2071	2039
Philippines	10,378	51,620	after 2100	2052
Viet Nam	14,396	60,262	2072	2040
Egypt, Arab Rep.	16,798	64,819	2050	2033
Kenya	5,842	39,308	after 2100	2070
Ghana	7,073	43,043	after 2100	2064
Tanzania	3,713	31,691	after 2100	2081
Ethiopia	2,892	28,135	after 2100	2087
Nigeria	7,994	45,616	after 2100	2061
Congo, Dem. Rep.	1,602	21,221	after 2100	2098

Source: H Heuristics scenario model on World Bank WDI income (World Bank, 2026). Illustrative; all economies converge at the same speed in the accelerated pathway, which hides large differences in institutions and endowments.

9.6 Reading the scenarios responsibly

CAVEATS

What these scenarios are, and are not

They are conditional. Each result follows from the stated assumptions; none is a forecast of what will happen.

They use 2024 relationships. Outcome-income links are cross-sectional; they omit technology gains (conservative in level) and causal feedbacks from health and schooling to growth (conservative in speed).

They hold population and climate hazard fixed. Richer societies tend to have lower fertility, and climate change will alter hazards; both would change the numbers.

They average over countries. Wars, financial crises and disasters are absent, and the poor within countries are not separately modelled.

The gap between pathways is the finding, not the level. Sensitivity tests (Methods note) show the ranking is stable, while levels are not.

SECTION 10

Where Convergence Matters Most: Regions

The global story is a story of very different regional experiences. Asia converged; Africa and much of Latin America did not.

IN BRIEF

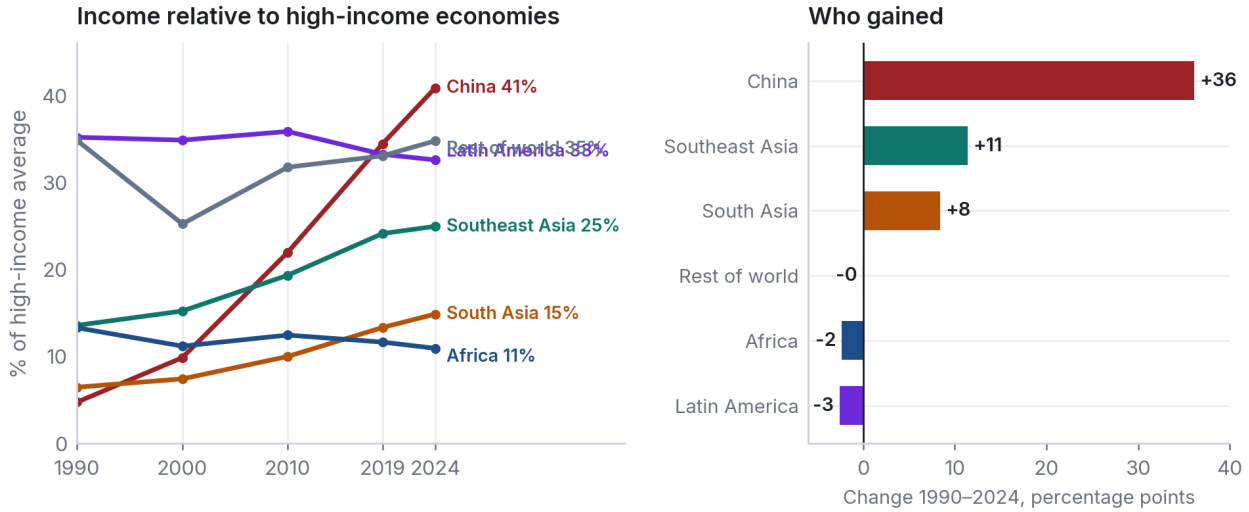
- China rose from 5% to 41% of the high-income level in 1990–2024 and South Asia from 6% to 15%.
- Africa went from 13% to 11%; Latin America stayed near 33%.
- The resilience payoff of convergence is largest where income is low, hazard is high and population is growing.

10.1 Four decades, four trajectories

Figure 13 follows five regions (excluding high-income economies in each) from 1990. **China** is the outlier, rising from 5% to 41% of the high-income average. **Southeast Asia** (nine economies and 690 million people) went from 14% to 25%, and **South Asia** (2.0 billion people) from 6% to 15%, with the acceleration concentrated after 2000. **Latin America and the Caribbean** began the period well ahead (35%) and ended slightly behind it (33%), a pattern often described as a middle-income trap (World Bank, 2024). **Africa** (1.5 billion people in 51 economies) fell from 13% to 11%, with a recovery in 2000–10 that was reversed afterwards.

Figure 13 Asia converged; Africa and Latin America did not

Left: income per person as % of the high-income average. Right: change 1990–2024 in percentage points



Source: World Bank WDI GDP per capita PPP (World Bank, 2026); high-income economies excluded from each region; H Heuristics regional grouping (China shown separately).

10.2 What convergence would mean for each region

Table 12 combines the regional record with the scenario results. The 2100 values are population-weighted averages of the economies in each region under the fragmented and accelerated pathways, so they show the range of outcomes that depends on convergence speed, not a forecast.

Table 12 Regional income today and under accelerated convergence

Region	People (m)	Income, % of high-income 1990 / 2024	Income 2100 ($): fragmented / accelerated	Main gate to resilience
Africa	1,497	13% / 11%	9,388 / 34,909	Adequate, reliable power; industrial base; debt; jobs for a growing workforce
South Asia	1,971	6% / 15%	13,760 / 45,267	Productive jobs; heat adaptation; air quality; women's participation
Southeast Asia	689	14% / 25%	27,512 / 59,201	Middle-income transition; coastal flooding; clean industry
Latin America and the Caribbean	583	35% / 33%	37,950 / 66,744	Productivity growth; inequality; institutional trust; hurricanes and drought

Source: World Bank WDI (World Bank, 2026); H Heuristics scenario model; regional groups exclude high-income economies.

Africa has the most to gain and the most to lose. It holds the largest share of the people without electricity (86% in Sub-Saharan Africa) and clean cooking, its population is projected to double by 2100, and its income has fallen relative to the high-income average since 1990 (IEA et al., 2026; United Nations, 2024). In the fragmented pathway its average income in 2100 is about $9,388, scarcely above today's $6,368; in the accelerated pathway it is $34,909. The dividends from reliable power, mobile finance and solar are the most visible here. **South Asia**'s gains after 2000 came with a strong demographic dividend; the next stage depends on whether productive jobs appear for 1.97 billion people, and on heat and air pollution as limits to labour productivity. **Southeast Asia** must complete a middle-income transition while exposed to coastal flooding and typhoons. **Latin America** is the clearest example that income convergence stalls without productivity growth and trust in institutions, and its resilience gap lies in governance and inequality more than in infrastructure access.

SECTION 11

A Convergence Strategy for Resilience

If convergence reduces vulnerability, policy should steer it toward the dimensions that carry the most resilience, in the order the evidence supports.

IN BRIEF

- Eight levers cover the dimensions of convergence; each has a measurable baseline.
- Sequence matters: close access gaps first, then adequacy and reliability, then productive use.
- Finance and institutions decide whether the plan is carried out.

11.1 Eight levers

The strategy rests on eight levers, one for each dimension of convergence. Table 13 gives for each the baseline for low- and lower-middle-income economies in 2024, the main resilience dividends and the actions that the evidence in this report supports.

Table 13 Eight levers: baseline, dividends and priority actions

Lever	Baseline (low-income / lower-middle, 2024)	Main dividends	Priority actions
1. Raise incomes through productive jobs	$2,178 / $8,498 per person (4% / 15% of high-income)	Savings, ability to pay for protection	Export diversification, investment climate, small-firm finance
2. Build productive capacity	Output per worker 5% / 19% of high-income; manufacturing per person 1% / 7%	Jobs, repair and supply capacity	Industrial parks, skills, services productivity, technology adoption
3. Invest in people	Adult schooling 4.2 / 6.9 years; under-5 mortality 62 / 39 per 1,000	Adaptive capacity, health, lower disaster deaths (Lutz et al., 2014)	Primary care, nutrition, schooling for girls, learning quality
4. Provide adequate, reliable power and clean cooking	Power use 190 / 928 kWh per person; electricity access 49% / 91%; clean cooking 16% / 64%	Health, learning, cooling, clean air, jobs (WHO et al., 2023)	Distributed solar and storage, grid reliability, clinic and school power, exclusive clean cooking
5. Extend connectivity and public digital infrastructure	Internet use 20% / 59%	Warning, payments, markets, services (Hjort and Poulsen, 2019)	Affordable broadband, identity and payment rails, local-language content
6. Strengthen water, sanitation and adaptation infrastructure	Basic sanitation 35% / 74%; basic water 61% / 91%	Disease control; flood and heat protection	Resilient design standards, early warning, passive cooling (Hallegatte et al., 2019; UNEP, 2025)
7. Improve institutions and public finance	Government effectiveness -1.2 / -0.0; interest 11% / 8% of revenue	Crisis response, trust, fiscal space (COVID-19 National Preparedness Collaborators, 2022)	Revenue mobilisation, debt management, adaptive social protection (Bowen et al., 2020)
8. Link convergence to resilience finance	ODA down about 23% in 2025 (OECD, 2026); adaptation finance short of needs (UNEP, 2025)	Faster, cheaper recovery (Clarke and Dercon, 2016)	Concessional and blended finance, risk pooling, debt relief for climate-vulnerable economies

Source: World Bank WDI (World Bank, 2026) and WGI (World Bank, 2025a); studies cited; H Heuristics framework (Hughes, 2026a).

11.2 Sequencing and targeting

The evidence suggests three principles. **First, sequence by service tier.** Close basic access gaps (a connection, a phone, a stove, a toilet) where technology makes it cheap, then raise adequacy and reliability (power for machines and cooling, broadband quality), then support productive use (firms, jobs, public services). Skipping the second and third steps leaves the access dividend unrealised, as the electrification experiment in Kenya suggests (Lee et al., 2020). **Second, bundle.** The co-movement in Section 6 means that infrastructure investments are cheapest and most effective when planned together: a clinic with power, water and a phone line is a different asset from three separate connections. **Third, target the economies where gaps are widest and growth has stalled.** Low-income countries closed gaps in access but not in income, productivity or industry, and the countries in this group, with 0.75 billion people, depend on concessional finance and technical help more than other groups.

11.3 Finance, institutions and measurement

A convergence strategy fails if it cannot be financed or carried out. On finance, the conditions are the opposite of what the plan needs: 51 developing countries spend more on interest than on health or education, aid is shrinking and adaptation finance is far below need (UNCTAD, 2026; OECD, 2026; UNEP, 2025). Debt relief and lower-cost finance for climate-vulnerable economies, together with multilateral lending, risk pools and parametric insurance, are the main ways to protect investment in resilience during shocks (CCRIF SPC, 2025; African Risk Capacity, 2025). On institutions, the largest gains come from competent administration of services at the local level, predictable regulation for private investors in energy and telecoms, and social protection that expands automatically when shocks hit (Bowen et al., 2020).

Table 14 A convergence and resilience scorecard: baseline and the accelerated pathway at 2050

Indicator	2024	2050, accelerated	2050, fragmented
Global South income, % of high-income	23%	27%	20%
People in economies below $10,000 per person, bn	3.3	1.4	2.6
People without electricity, millions	650	509	951
People without clean cooking, millions	1,938	1,426	2,422
People not using the internet, millions	2,148	1,878	2,636
Deaths under 5 per 1,000 births (world average)	25	16	25
Lack of coping capacity, INFORM 0–10	4.0	3.5	4.0

Source: H Heuristics scenario model (World Bank, 2026; European Commission JRC, 2026; United Nations, 2024). Values for 2050 are conditional illustrations, not targets or forecasts.

The scorecard gives a short list of indicators, all available from public sources, that a country, a region or a development agency could track. A national version should add reliability measures (hours of outage, share of clinics with power), outcomes at the local level and measures of who is left behind. These indicators measure the inputs and the outcomes of convergence; they are not an index of Polycrisis Resilience, which the framework treats as a separate, multi-dimensional concept.

SECTION 12

Conclusion: Convergence as Resilience Strategy

Narrowing the gaps between rich and poor economies is one of the most powerful ways of reducing vulnerability to interconnected crises. It is neither automatic nor sufficient.

IN BRIEF

- The record shows real but concentrated and recently stalled convergence.
- Convergence reduces vulnerability mainly through access, capability and institutions, and its benefits arrive in bundles.
- The century's outcomes depend on the speed and the quality of convergence.

THESIS

The thesis, in the evidence's words

Global economic convergence represents a significant long-term opportunity for reducing human and systemic vulnerability to the polycrisis. Accelerating economic development and narrowing productivity, income, technological and infrastructural disparities between advanced and emerging economies could strengthen the capacity of populations and institutions to withstand interconnected economic, environmental, technological and societal risks.

Within the H Heuristics Polycrisis Resilience framework, convergence is a proactive development strategy: it improves the economic and material conditions that determine how well societies can anticipate, absorb, adapt to and recover from systemic disruption.

12.1 What the evidence shows

The evidence supports six conclusions. **First**, convergence is real but young and concentrated: the Global South rose from 13% to 23% of high-income income per person between 1990 and 2024, but outside China and India it did not move, and low-income countries stand at 4% (Figure 2). **Second**, it is fragile: the catch-up of 2000–19 reversed in 2019–24 (Figure 3). **Third**, access gaps closed faster than capability gaps, so the binding constraints are output per worker, industrial capacity, adequate power, skills and institutions (Figure 4). **Fourth**, vulnerability is far more closely tied to development than hazard is, and poorer economies spend more time in setbacks and recover less (Figure 6, Figure 7). **Fifth**, resilience dividends are real in the infrastructure and access bundle and not visible in health and schooling within two decades (Figure 8, Figure 9). **Sixth**, the choice is large: about 147 million fewer children die in 2025–2100 when convergence is both fast and steered toward resilience than when it stalls (Figure 12).

12.2 Priorities

1. **Treat convergence as a resilience policy, not only a growth policy.** Measure it across eight dimensions, with particular attention to power adequacy, productivity and institutions.
2. **Start with the gaps that technology can close fast, and plan the rest from day one.** Electricity, connectivity, mobile finance and clean cooking can reach hundreds of millions within a decade; make sure they are reliable and used.
3. **Design for dividends.** Link electrification to clinics, schools and enterprises; link connectivity to services; count verified dividends.
4. **Protect investment from the polycrisis.** Reduce the debt burden, keep concessional finance flowing, pool risks and protect social spending in shocks.
5. **Choose clean routes.** Pursue passive-first cooling, distributed renewables and urban design that avoid locking in pollution and energy-intensive buildings.
6. **Do not assume convergence.** Monitor it, and treat reversals as early warning that the gap is widening.

12.3 Limits and what would change the conclusions

The analysis has limits. Income groups are today's World Bank classes, and national averages hide large differences within countries. The convergence regressions describe associations and say little about causes. The dividend analysis uses shares of gaps closed between 2000 and 2022 for around 100 developing economies, and several indicators have limited coverage. The scenarios use cross-sectional relationships from 2024 and ignore feedbacks, shocks, climate change, and the demographic effects of higher income. Several results would change with better evidence: if rural electrification trials with productive-use components continued to show small gains, the electricity dividend would be smaller than the table suggests; if the post-2019 divergence proves temporary, the case for convergence as a baseline would strengthen; and if AI and robotics raise the returns to capital relative to labour, the manufacturing and services routes to convergence could narrow further.

The polycrisis cannot be prevented by any single strategy. But the damage it does depends on the conditions in which it lands, and those conditions are the ordinary things that development has always meant: power, schools, clinics, jobs, savings and institutions that work. Narrowing the gap between those who have them and those who do not is a way of making the whole world less fragile. It is not guaranteed. It is possible, and it has started.

METHODS NOTE

Methods and Data

How the figures were calculated, and what to check before reusing them.

IN BRIEF

- All data are public; the full calculations are reproducible from the sources cited.
- Scenario results are conditional on the parameters stated here.

Data

Income, productivity, energy, digital and health indicators are from the World Bank's World Development Indicators, retrieved in November 2026 (World Bank, 2026): GDP per capita (PPP, constant 2021 international dollars), GDP per person employed, manufacturing value added, electricity access and consumption, clean cooking, internet users, mobile subscriptions, basic sanitation and drinking water, life expectancy, under-5 mortality, sector employment, interest payments and population. Years with missing values were filled by linear interpolation inside the series and by carrying values forward or back for at most three years; indicators with less coverage (power use, sanitation) use fewer economies, shown in the data notes. **Governance** uses the Worldwide Governance Indicators (World Bank, 2025a). **Schooling** is the UNDP series on adult mean years of schooling (UNDP, 2025). **Long-run income** is the Maddison Project Database 2023 (Bolt and van Zanden, 2024). **Population projections** are the UN World Population Prospects 2024 medium variant (United Nations, 2024). **Risk components** are from INFORM Risk 2026 (European Commission JRC, 2026). Groups are the World Bank's current income classes (World Bank, 2025b); 217 economies are covered, 131 in the Global South.

Calculations

Group levels are population-weighted averages of national values, and all 'as % of high-income' figures divide by the high-income average of the same year. **Beta convergence** regresses annualised growth of log income per person on the log of starting income across economies with more than 1 million people, with heteroskedasticity-robust standard errors. **Gap closed** in the dividend analysis is the change between 2000 and 2022 divided by the distance to a frontier (100% for access and sanitation, 14 years for schooling, 85 years for life expectancy, and for child mortality the log distance to 3 per 1,000); the sample is the low- and middle-income economies with more than 1 million people and a gap above the minimum for each indicator, and correlations are computed pairwise. Partial correlations use residuals from regressions on log income growth and log starting income. **Setback years** are years in which income is more than 10% below its own earlier peak. **Within-country elasticity** is the slope of demeaned log under-5 mortality on demeaned log income, with standard errors clustered by country.

Scenario model. For each of 196 economies, log income grows at the frontier rate of 1% a year plus the convergence speed times the gap to the frontier (the high-income mean), less 0.3 points for economies under $20,000 in the fragmented pathway. Outcomes are computed from log income using the cross-sectional 2024 fit for each outcome (log for child mortality, logit for electric-

Table 15 Main data series and identifiers

Series	Source and identifier	Years used
GDP per capita, PPP (2021 intl $)	World Bank WDI, NY.GDP.PCAP.PP.KD	1990–2024
GDP per person employed	World Bank WDI, SL.GDP.PCAP.EM.KD	2000–2024
Manufacturing value added; share of GDP	World Bank WDI, NV.IND.MANF.KD; NV.IND.MANF.ZS	2000–2024
Electricity access; power use; clean cooking	World Bank WDI, EG.ELC.ACCS.ZS; EG.USE.ELEC.KH.PC; EG.CFT.ACCS.ZS	1990–2024
Internet users; mobile subscriptions	World Bank WDI, IT.NET.USER.ZS; IT.CEL.SETS.P2	1990–2024
Sanitation; drinking water	World Bank WDI, SH.STA.BASS.ZS; SH.H2O.BASW.ZS	1995–2024
Life expectancy; under-5 mortality	World Bank WDI, SP.DYN.LE00.IN; SH.DYN.MORT	1990–2024
Employment by sector; interest payments	World Bank WDI, SL.AGR/IND/SRV.EMPL.ZS; GC.XPN.INTP.RV.ZS	2000–2024
Government effectiveness	Worldwide Governance Indicators, GE.EST	1996–2024
Mean years of schooling, adults 25+	UNDP HDR 2025 via Our World in Data	1990–2022
Long-run GDP per capita	Maddison Project Database 2023 via Our World in Data	1820–2022
Population, births, projections	UN World Population Prospects 2024, medium variant	1950–2100
Hazard, vulnerability, coping capacity	INFORM Risk 2026 (JRC / IASC)	2026 release

Source: as listed (World Bank, 2026; World Bank, 2025a; UNDP, 2025; Bolt and van Zanden, 2024; United Nations, 2024; European Commission JRC, 2026).

ity, cooking and internet, linear for life expectancy, schooling, sanitation and INFORM scores). Each country keeps its own residual from the fit; in pathway 3 half of the residual is closed by 2100. Population and births are the UN medium projection; child deaths are births times the modelled under-5 mortality, floored at 2 per 1,000. Sensitivity: convergence speeds from 0 to 2% and frontier growth from 0.5 to 1.5%. The 2100 ratio is insensitive to the frontier rate; child deaths fall from about 290 million at zero speed to 139 million at 2%.

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About H Heuristics. H Heuristics is an independent research practice founded by Hunter Hughes, publishing research on polycrisis, resilience, development and the clean transition at researchreports.hheuristics.com.

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