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What to watch: Global boiling – Heatwave may cost -0.5pp of GDP in Europe

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EXECUTIVE SUMMARY

- An initial ‘back of the envelope’ calculation suggests that the recent heatwaves across Southern and Central Europe, the US and China could carry significant economic costs. Estimated GDP losses range from -0.1pp for Germany to as much as -1.4pp for Spain, with total losses of -0.5pp for Europe, -0.6pp for the US and -1.0pp for China. To put this into perspective, one day of extreme heat (above 32°C) is equivalent to half a day of strikes.
- Adaptation is key. In the short term, warning and prevention measures can be put in place. But these need to be complemented by longer-term structural adaptation measures to prepare cities for climate change (i.e. urban greening) and ways to productively adapt workplaces to an increased heat burden (i.e., adapting buildings, infrastructure and working hours).

It’s getting hot in here

The heatwaves sweeping across Central and Western Europe and the US are driving temperatures well above seasonal norms. Record-high temperatures are making headlines across the Northern Hemisphere, highlighting the physical risk of climate change and questioning economic resilience to extreme temperatures. Figure 1 shows daily two-meter air temperatures measured by satellite data and computer simulations to offer a real-time snapshot of global temperatures. According to Copernicus Climate Change Service/ECMWF, 2024 was the warmest year on record, while May 2025 was the second-warmest May globally. An extensive and persistent heat dome will cover Western and Central Europe and the US in the last days of July, meaning temperatures are set to rise further.

Climate change is increasing the frequency and intensity of extreme hot weather, making heatwaves, droughts and wildfires the “new normal”, with far-reaching economic consequences. Such events have significant direct negative effects, not only for people and wildlife but also for the economy, including high property losses in developed countries and casualties in developing countries.

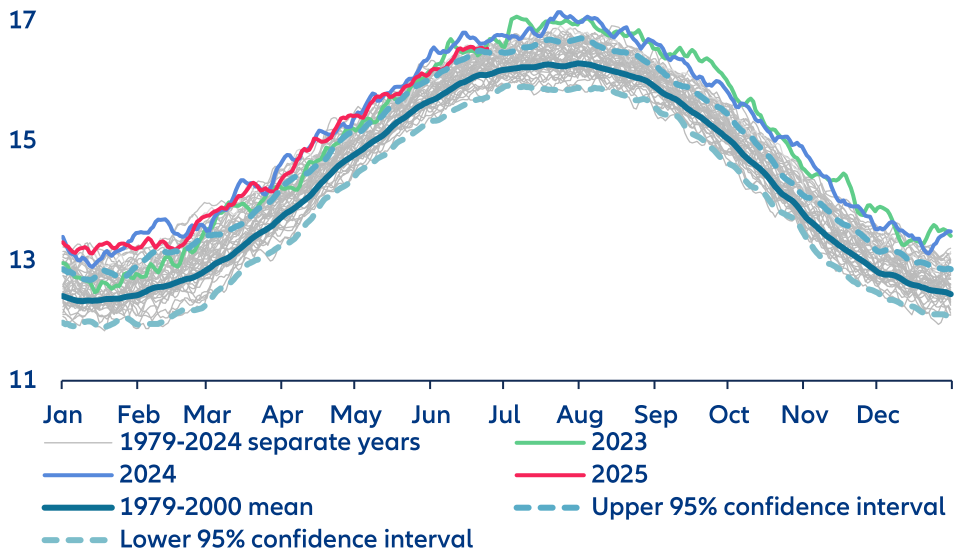
- Net macroeconomic (i.e. indirect) losses are overall negative but are likely to be small for large developed economies as they are better able to cope with negative production shocks (e.g. compensating for lost production with increased production elsewhere). Moreover, while destroyed capital stock affects GDP only slightly and rather in the long run[1], the (mostly debt-financed) relief measures show up immediately in the GDP measurement. In

[1] The infrastructure loss of the Ahrtal flood in Germany in July 2021 is estimated to equal 0.1% of GDP while the cost of the Los Angeles wildfires in January 2025 amounted to about USD4.6bn, prompting the state’s GDP to decline by -0.5% in 2025.

statistical analyses, this also leads to the phenomenon of "productive destruction": the impression that natural disasters (temporarily) have a positive impact on economic growth.

- The indirect economic impacts are generally more severe for low-income countries and smaller, less-diversified economies, even if international disaster and development aid leads to (short-term) increase in cash transfers.
- However, the relationship between GDP growth and natural catastrophes is highly non-linear for disaster intensity. For example, a disaster in the top 1% of the disaster index distribution might reduce the GDP growth rate by 7%, while a disaster in the top 5% of the distribution reduces it by only 0.5%.[2]
- The impact of tipping points has been ignored in IPCC-based damage projections so far as scientific consensus on quantifying these impacts is still missing.

Figure 1: Global daily two-meter air temperature, in °C



Sources: Climatereanalyzer.org, Climate Change Institute, University of Maine

Extreme temperatures also reduce labor productivity. The ILO projects that heat stress will reduce total potential working hours worldwide by -2.2% (equivalent to 80mn full-time jobs)[3]. According to the 2022 report of the Lancet Countdown, in 2021, 470bn potential working hours were lost – an increase of +37% from the annual average in 1990–99, and an average of 139 hours lost per person.[4] The negative effects are more pronounced in developing countries, where lower-income workers are often more exposed and vulnerable to heatwaves (e.g. in Africa and South Asia, given the quality of housing and limited access to air conditioning, for example). The decisive factor for productivity losses is the number of days with extreme heat (typical measure: days above 90°F/32°C). According to Foster, Smallcombe, Hodder et al.[5], the capacity to perform physical work dips by approximately -40% when temperatures hit

[2] *Felbermayr, G. and J. Gröschl (2014), Naturally negative: The growth effects of natural disasters, Journal of Development Economics 111: 92-106.*

[3] *According to ILO a year has 4,320 potential daylight working hours, which is close to 12 hours a day in a 7 work days week. ILO (2019) Working on a WARMER planet – The impact of heat stress on labour productivity and decent work, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_711919.pdf.*

[4] *The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuelsdoi.org/10.1016/S0140-6736(22)01540-9. Check also the data explorer: www.lancetcountdown.org/data-platform/health-hazards-exposures-and-impacts/1-1-health-and-heat/1-1-4-change-in-labour-capacity.*

[5] Foster, J., Smallcombe, J.W., Hodder, S. et al. An advanced empirical model for quantifying the impact of heat and climate change on human physical work capacity. Int J Biometeorol 65, 1215–1229 (2021).

90° Fahrenheit. Furthermore, when temperatures soar to 100°F/38°C, the decline in productivity is even more dramatic, plummeting by two-thirds. Using US wealth data, Behrer, Park, Wagner et al[6] say that hotter temperature can reduce labor productivity, work hours and labor income. They find that one additional day above 32 °C (90 °F) lowers the annual payroll by -0.04%, equal to 2.1% of average weekly earnings. They also find smaller impacts of heat in regions with higher average wealth. These effects are due to a combination of reductions in labor supply, labor productivity and labor demand, and an increase in firm costs. The estimates, which consider annual temperature fluctuations, account for intra-year adaptations such as intertemporal labor substitution. This adaptation occurs when workers and companies try to compensate for productivity lost during a hot day or week by catching up during a cooler period within the same year. However, trying to explicitly quantify the effects of low temperatures on the payroll did not show significant impacts. An ECB paper examining the impact of extreme temperatures finds a partial rebound in manufacturing and services, while agricultural and certain infrastructure losses tend to persist. The estimated recovery ranges from +0.05pp to +0.15pp, offsetting approximately 30–50% of the initial impact.[7] This is also supported by a recent paper by Dong et al. (2025) which finds that weather shocks have a transient effect on output.[8]

We find that China, Spain, Italy and Greece could each see GDP losses of nearly one point due to the current heatwave. The US and Romania may face a decline of around -0.6pp each, while France could lose up to a third of a point and the impact on Germany appears minimal at just -0.1pp. Based on elasticities from the two academic articles above, we ran a 'back of the envelope' calculation of the consequences of the recent heatwaves[9]. Overall, using weights in global GDP, the heatwave translates to a reduction of -0.5pp in Europe's GDP growth for 2025, and about -0.6pp globally, underscoring the growing burden of physical climate risk.

Table 1: Reductions in GDP due to the number of hot days over 32° Celsius

	Number of days with temperature higher than 32° (01/05 - 14/07)	Payroll cost (%)	GDP cost (pp)
Southern and Central Europe			
Greece	43	1.7	1.1
Spain	52	2.1	1.4
Italy	44	1.8	1.2
France	12	0.5	0.3
Germany	5	0.2	0.1
Romania	23	0.9	0.6
Bulgaria	16	0.6	0.4
US	24	1.0	0.6
China	38	1.5	1.0

Sources: Visual Crossing, Behrer et al. *(2021), Allianz Research. Notes: Including forecasted temperatures for 30 June 2025 – 14 July 2025.*

[6] Behrer, A. P., Park, R. J., Wagner, G., Golja, C. M., & Keith, D. W. (2021). Heat has larger impacts on labor in poorer areas. Environmental Research Communications, 3(9), 095001.
[7] Faccia, D., Parker, M., Stracca, L. (2021). Feeling the heat: extreme temperatures and price stability. ECP Working Paper Series 2626.
[8] Dong, J., Tol, R., Wang, J. (2025). The effects of Climate and Weather on Economic Output: Evidence from Global Subnational Data.
[9] This first-order estimate comes with several strong assumptions: (i) temperature data is not final and we limited ourselves in scope to six countries; (ii) we used daily country averages instead of grid cell data; (iii) the elasticities for payroll impacts were calibrated on US county-level data, and payroll to GDP sensitivity was taken as two-thirds and (iv) other channels of impact such as agricultural productivity were not taken into account.

Adaptation is key: workers' conditions are influenced by societal decisions, suggesting that the productivity losses due to heat can be mitigated. Several approaches, including technological, infrastructural, regulatory and behavioral changes, can be employed by individuals, businesses and governments. Although the relevance of these methods depends on local contexts, many of them seem cost-effective. Strategies such as optimizing work schedules, working in early morning or evening hours and using passive cooling mechanisms are promising. Climate-aware urban planning and modifications to building design can best tackle high base temperatures, whereas air conditioning can adapt to brief temperature spikes, given adequate, affordable, reliable and clean electricity. Arriazu-Ramos et al.[10] show that the residential buildings most prone to overheating are those with windows on only one side, which prevents cross ventilation, and those located on top floors. Upgrading building envelopes to meet current energy standards can reduce indoor overheating hours by an average of -8.6%, with reductions reaching up to -15.3% in the most vulnerable types of buildings.

Additionally, incorporating green roof systems can further enhance thermal comfort, lowering indoor temperatures by up to -0.5°C compared to standard roof renovations without vegetative coverage. Popular studies tend provide a distorted picture by neither accounting for these adaptation potentials, nor for the fact that due to climate change labor productivity might see increases in winter months as well, which compensates for some of the summer losses. The methodology in a report on the economic and social consequences of extreme heat for the US[11] makes this visible by quantifying annual losses at USD100bn in recent years.

While the report quantifies the potential extreme heat impact in the summer to double by 2030, reaching an estimated loss of -0.5% of projected GDP, the seminal work by Heal and Park[12] suggest a net effect over a particularly warm year in the US of GDP gains of up to +0.5% GDP. In the study we used for our calculation (Behrer, Park, Wagner et al.), adaptation is partially factored in, as mentioned above

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[10] Facing Climate Change in a Temperate European City: Urban-Scale Diagnosis of Indoor Overheating and Adaptation Strategies for Residential Buildings

[11] Atlantic Council (2021), Extreme Heat – the Economic and Social Consequences for the United States, www.atlanticcouncil.org/wp-content/uploads/2021/08/Extreme-Heat-Report-2021.pdf

[12] Heal, G. & Park, J. (2014), Feeling the Heat: Temperature, Physiology & the Wealth of Nations, NBER WP 19725.

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