Hot Summer Economics

Economic effects of the hot European summer of 2026

Background document

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The fact that climate change affects long-term economic growth is by now an established consensus in science. Sea-level rise, lower crop yields, reduced dairy production, increasingly less fresh water availability, human health, reduced productivity and rising energy demand are main channels through which climate change hurts the economy. Over time, these channels can add up to substantially lower growth, or even uncontrolled collapse: one recent estimate puts the long-run loss in world GDP at over 20% for every degree of global warming, once the full range of climate variability is priced in.[1] Uncertainty here remains high, though. These estimates are modelled, and models rest on many assumptions.

Yet this year, we are seeing some of the effects of climate change in practice. The extreme heat across Europe this summer is a direct product of climate change, although it's far from the only one. Without global warming, these temperatures would have been virtually impossible; the June heatwave was made roughly a hundred times more likely than it would have been two decades ago.[2] June 2026 was already the hottest June on record for western Europe, 3.05°C above the 1991–2020 average, itself a record set only the year before.[3] Since then, two more heatwaves have followed. Three in six weeks.
Many European countries have this summer already seen a record number of days above 30 degrees, though the exact metric varies by weather service. The Netherlands' KNMI recorded five tropical days in June, a twelve-day heatwave, the earliest of that intensity ever, and a regional "super-heatwave" in Limburg with a peak of 39.4°C.[4] Belgium logged seven tropical days at Ukkel, a new record.[5] Germany's DWD registered a national record of eleven days above 35°C at some stations.[6] France saw five straight days above 40°C, a first, and 72 départements under red alert at once.[7] Spain's AEMET recorded its hottest June on record at 15 of 86 stations. Italy lacks one national body tracking this the way DWD or KNMI do, but Florence saw six straight days above 36°C, a 70-year record.[8] The closest thing to a centralised cross-country figure comes from World Weather Attribution's own finding that 45% of over 800 European cities surveyed broke their own heat-stress records.[9] Water shortages are starting to bite into economic activity too, from transport and energy production to crop yields.

These are the first signs that we should stop treating climate change as something for the future. We are feeling the effects now, in daily life. This background document estimates the economic effects for the European Union this summer, with a focus on GDP growth. We also touch on some severe societal consequences that never show up in the growth figures at all.

Extreme heat & economic activity

There is considerable evidence that extreme heat lowers aggregate production. Above roughly 30°C, sustained over several days, output per hour worked starts falling fast: about 3% for every additional degree, according to Allianz Research.[10] OECD-research more conservatively estimates that for every 10 additional very hot days (>35C) in a year 0.3% of labour productivity is lost.[11] When these days come in a heat wave, another 0.2% of labour productivity is lost. Note that these average labour productivity effects differ across sectors. For the economy as a whole, heat waves in four especially hot years between 2000 and 2020 are estimated to have caused on average 0.4% BBP loss in Europe.[12]

We estimate how much economic activity the EU as a whole and the seven largest economies within it are likely to lose due to excessive hot days in 2026. We do so by estimating how many excessive hot days we can expect. With this number, we review literature to calculate EU-wide estimates for GDP-losses from the agriculture, energy and transport sectors. Next, we estimate how much general labour productivity losses the seven largest economies and the EU as a whole are likely to experience. We then combine these estimates into estimated GDP loss.

Excessive hot days

We start our estimation by estimating the number of hot days we can expect this year more than usual. We do so by counting the average number of days in excess of 30 degrees in the period 1991-2024, or the longest period available, based on data from ECA&D. Next, we extrapolate expected hot days in 2026 based on what we have seen so far. We do so by counting the number of days over 30 degrees in 2026 until the end of July. We then extrapolate this number to the entirety of 2026. We extrapolate by adding the number of days implied by the country-specific mean share of extremely hot days from August onwards over the period for which we have weather records. This varies from 45% in Italy and France to 36% in Germany and Poland. After this extrapolation we obtain our *expected number of hot days.*

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We then substract the average number of hot days in our weather record from our *expected number of hot days*. By doing this we obtain the *excessive number of hot days*. This varies from only 1 excessive extremely hot day for Poland, to 47 excessive hot days for Italy. We can now estimate how much productions losses these excessive hot days should cause across the main economies of the EU. Weighing by GDP, we see an average number of 24 excessive hot days. We will use this estimate to approximate the EU-wide GDP losses from agriculture, energy and transport first, unless more accurate data is available. Next, we will add a country-specific estimate of general labour productivity losses.

Table 1

Country	Hot days in 2026 until July 31st	Historic share of hot days from August onwards	Expected hot days 2026	Historic number of hot days	Excessive number of hot days (for EU weighed by GDP)
Italy	53	45	96	49	47
Spain	61	41	103	70	33
Germany	13	36	20	13	7
Poland	7	36	11	10	1
Belgium	13	42	22	13	14
Netherlands	8	41	14	5	9
France	33	45	60	19	41
EU					24

Source: ECA&D, Triodos Bank

Broadly, but not entirely, the agriculture, energy and transport channels below are driven by water availability, while the labour productivity channel is driven mainly by temperature itself. The split is not perfectly clean: within energy, the solar and thermal-efficiency losses and the legal cooling-water temperature limits are themselves temperature effects rather than water-scarcity effects, and within agriculture, heat-driven fertility loss in maize and heat stress in livestock operate independently of rainfall. These temperature-driven sub-channels sit closer to the mechanism behind the labour productivity estimate than the drought-driven ones do, and we return to what this means for double-counting later in this section.

Agriculture

Hot weather impacts both agricultural output and food prices. Heat stress raises evaporation and crop water demand, dries out topsoil, shortens grain-filling periods and can reduce fertility in maize and other summer crops. In livestock, high temperatures reduce feed intake, lower productivity and increase mortality risk. The result is not just lower farm output, but also lower quality of produce, higher irrigation demand, pressure on water systems, supply-chain disruption and, with a lag, food-price pressure.

Across the EU, crop losses caused by droughts and heatwaves have tripled over the past 50 years, highlighting the growing threat that extreme heat poses to agricultural productivity and food security.[13] Historically, the losses have been large when heat and drought coincide. In 2003, the combination reduced wheat yields by 11% and maize yields by 21% on average across Europe; the 2018 and 2022 heat-droughts again showed that damage can be large, regionally uneven and only partly offset by better conditions elsewhere.[14]

For 2026, the evidence points to an already sizeable but likely still incomplete hit. The July MARS crop bulletin from the European Commission shows the pattern clearly: repeated heatwaves have shortened the grain-filling phase of winter crops and brought the harvest forward. EU yield forecasts for winter crops, which are harvested early summer, have been revised downwards by 1–4%, leaving the outlook for total cereals 1% below the five-year average. For summer crops, which are harvested late summer, exceptional heat and limited rainfall across western and central Europe depleted soil moisture, constrained biomass accumulation and affected flowering. Yield forecasts have been reduced for all summer crops, most notably for grain maize and sunflowers, by 6–7%.[15] On average, the yield forecasts have been revised by 3% compared to the month before, when there were no significant revisions. This fits the country-level picture: heat and low soil moisture reduced winter cereal prospects in parts of Germany, cut Hungarian winter-crop forecasts sharply below the five-year average, and pushed summer-crop forecasts below average in several countries, including France, Italy and Hungary.

France's maize harvest is projected to be its lowest in 50 years.[16] In other words, the main macro channel is certainly not only winter grains. Total output is heavily affected by the summer effects on maize, sunflower, fruit and vegetables, plus livestock stress, and the season is still unfolding.

For livestock, heat stress has for example reduced milk production by up to 10% in Italy's Parmigiano Reggiano region, while broader historical evidence points to average annual milk-yield losses of around 1% from heat stress and larger losses during sustained hot-humid spells.[17] For horticulture, the evidence is less complete but points in the same direction: vegetable production has suffered from leaf curling, sunscald and reduced crop quality, while JRC's crop monitoring shows heat stress has so far reduced yield forecasts for sugar beets and potatoes in especially France, Hungary, and Czech Republic.[18]

EU agriculture accounts for roughly 1.2% of GDP, so even a severe agricultural shock does not translate one-for-one into a large macro number.[19] If we take the currently reported crop yield forecast downgrades and other evidence and extrapolate for the remainder of summer, we foresee a 3-7% loss in EU agricultural output for the year, of which the direct drag on EU GDP is in the order of 0.05–0.10 percentage points. Including first-round spillovers through food processing and animal feed and imports could plausibly lift the total to around 0.1 percentage point of EU GDP.

The more visible effect may come through prices. The lost crops are expected to make Europe more dependent on imports, which could push global commodity prices somewhat higher, although the final price effect will largely depend on the southern hemisphere harvest in late 2026 and early 2027. For now, the shortfall in European grain production comes as global crop supplies are also tightening, with severe drought in southern and western parts of the US affecting grain and meat production.[20] Recent research suggests that heat-related supply shocks have a measurable and persistent effect on inflation.

The estimates by Kotz et al. (2024) provide a useful benchmark for the current episode. They find that the 2022 European summer heat increased food inflation by 0.43–0.93 percentage points and headline inflation by 0.18–0.41 percentage points over the following year. Given that the 2026 heatwave has so far been of comparable or greater intensity across large parts of Europe, and has already resulted in widespread agricultural and energy-sector disruptions, inflationary effects of at least a similar order of magnitude, appear plausible, although still uncertain.[21]

Higher food prices also reduce real household purchasing power and raise input costs for food processing, hospitality and other food-intensive industries. Research shows that heat-related agricultural shocks have persistent effects on food and headline inflation, while macroeconomic studies indicate that inflation shocks reduce real consumption and output through lower real incomes and higher production costs.[22] Assuming that the 2026 heatwave increases food inflation by approximately 0.5–1.0 percentage points over the coming year (consistent with the estimates for the 2022 European heatwave), and knowing that food accounts for 17% of the total headline inflation basket, the resulting reduction in real household purchasing power would likely be 0.08-0.17%. Assuming a little less than half of this translates into actual lower GDP for 2026, EU GDP is impacted by 0.03–0.07 percentage points.[23]

Taken together, the direct (output loss) and indirect (rising prices and spillovers) effects lower GDP by approximately 0.15 percentage points. The estimates remain provisional. Current crop forecasts incorporate observed weather and short-range meteorological forecasts but cannot fully account for conditions during the remainder of the summer. A prolonged August heatwave would disproportionately affect maize, sunflowers, sugar beet, fruit and vegetables, potentially increasing agricultural losses beyond current projections. Conversely, cooler and wetter conditions could stabilise yields in parts of northern and central Europe.

Energy

Extreme heat affects the energy system through simultaneous increases in demand and constraints on supply. On the demand side, households and businesses consume more electricity for cooling, increasing peak loads and raising the cost of balancing electricity systems.[24] On the supply side, high air and river temperatures reduce the efficiency and availability of thermal generation, including nuclear and fossil-fuel power plants that depend on cooling water. Drought reduces hydropower output, while very high temperatures lower the conversion efficiency of solar photovoltaic panels and gas turbines. Heat can also reduce the transmission capacity of electricity networks by increasing the temperature of overhead power lines.[25] These effects reinforce one another when heat, drought and low wind occur simultaneously: electricity demand rises just as parts of the generation and transmission system become less reliable, increasing reliance on imports, electricity storage, demand-side flexibility and dispatchable back-up generation.[26] Exactly this combination of persistent heat and drought has characterised the 2026 European summer so far, with low river levels and water scarcity placing additional pressure on electricity generation and system resilience.[27]

The evidence for 2026 points to a broad tightening of European electricity markets due to the extreme summer heat. The heatwave has so far constrained electricity supply through several channels. High river temperatures reduced the availability of cooling water, forcing output reductions at nuclear power plants in France, Switzerland and Hungary. During the heat in July, around 6.3 GW of French nuclear capacity, which equals roughly one-tenth of installed nuclear capacity, had at times been curtailed because cooling-water temperatures exceeded environmental limits.[28] Additional nuclear reactors and a major gas-fired power station also faced operational restrictions due to regulatory limits to water temperature and the exceptionally warm cooling water reducing plant efficiency. In parallel, persistent drought reduced river flows and reservoir levels across much of Europe, lowering hydropower production and increasing pressure on thermal generation.[29]

On the demand side, successive heatwaves have so far significantly increased electricity demand across Europe as households and businesses relied more heavily on cooling. Rising demand for air conditioning has become an increasingly important driver of summer electricity consumption across Europe, particularly in Southern and Western member states.[30] The increase in cooling demand coincided with weak wind generation in several markets, pushing day-ahead wholesale electricity prices sharply higher. German day-ahead electricity prices, for example, rose by almost 30% during the late-May heatwave as higher cooling demand and lower wind output forced greater reliance on more expensive gas- and coal-fired generation. Similar price spikes were observed during the June and July heatwaves, with analysts warning that persistent high temperatures and constrained supply were likely to keep European wholesale electricity prices elevated.[31]

We estimate that 2026’s hot summer weather inflicts a significant gross reduction of around 60 Terawatt-hours (TWh) in the EU’s total power generation compared to normal seasonal conditions. When measured against the EU's entire electricity production (2750 TWh), this heat penalty translates to a 2.2% loss in total yearly electricity output.[32] Hydropower provides the largest contribution to the estimated electricity shortfall. We assume that the exceptional heat and drought conditions experienced during the summer of 2026 will reduce EU hydropower generation by approximately 50 TWh relative to normal conditions. This estimate is based on the benchmark established by the 2022 European drought, during which EU hydropower generation was 50 TWh below the 2000–2021 average.[33] Given the comparable scale of heat and drought observed across large parts of Europe in 2026, using the 2022 hydropower deficit as a baseline provides a reasonable estimate of the likely reduction in hydroelectric output.

Concurrently, we assume that, averaged over an estimated 25 days of exceptional heat in the summer of 2026, cooling-water (legal) restrictions and reduced thermal efficiency lower effective EU nuclear generation by the equivalent of 10–15% of installed nuclear capacity. This is based upon reported outages so far in 2026 and historical data. This implies a loss of approximately 5–7 TWh of nuclear electricity generation.[34]

High ambient temperatures also reduce the output of fossil-fuel thermal power plants by lowering thermodynamic efficiency, increasing cooling requirements and raising the likelihood of outages.[35] We estimate this effect by combining observed electricity generation with published temperature–performance relationships. Gas-, coal- and oil-fired power plants generate approximately 750 TWh of electricity annually across the EU, equivalent to around 51 TWh during an estimated 24 days of exceptional heat in the summer of 2026. Henry and Pratson (2016) estimate that the efficiency of thermoelectric power plants declines by approximately 0.12–0.45% for every 1°C increase in ambient or cooling-water temperature.[36] Assuming that these 24 days are on average around 8°C warmer than normal, this implies an efficiency loss of roughly 1–4% during those days. This adds up to an estimated reduction of approximately 0.5–2.0 TWh of fossil-fuel electricity generation across those hot days. This estimate is broadly consistent with recent empirical evidence from European power plants, which shows that extreme heat significantly increases the probability of forced outages, by around 3.2 percentage points for coal-fired plants and 1.3 percentage points for gas-fired plants.[37]

Even the EU's solar infrastructure suffers from the heat. Despite cloudless skies driving record gross electricity production, elevated cell temperatures reduce photovoltaic conversion efficiency. Laboratory and field evidence suggests that solar panels lose approximately 0.3–0.5% of their power output for every 1°C increase in cell temperature above 25°C. Because panel temperatures exceed this threshold on many warm summer days and not only during the most extreme heatwaves, we base our estimate on a broader 50 warmer days rather than the 24 days of excessive heat. Given annual EU solar generation of around 350 TWh, this corresponds to approximately 47 TWh of electricity generation during the affected period. Assuming an effective 2–5% reduction in output during these days yields an estimated loss of approximately 1.0–2.5 TWh of electricity generation. Despite this efficiency penalty, overall solar generation during heatwaves generally remains high because increased sunshine largely offsets part of the temperature-induced reduction in panel performance. [38]

The electricity, gas, steam and air conditioning sector (classification by Eurostat) accounts for around 2.5% of EU GDP. Assume the summer heat of 2026 reduced annual output by approximately 2.2%, the direct impact on aggregate EU GDP would be approximately 0.06 percentage points.[39]

The more visible effect may come through rising energy prices, and here we have actual 2026 data rather than only precedent to draw on. According to Ember, the European weekly average day-ahead price rose from below €95/MWh at the start of June to €115/MWh by month-end, roughly 21%, as the late-June heatwave took hold, the highest level since the 2022 energy crisis.[40] Prices remained elevated through July, rising further in several markets, while Italy's gas-dependent market saw prices return to levels last recorded in winter 2025.[41]d prices approximately doubled during the hottest days of the 2025 heatwave.[42] The 2026 rise was more moderate than either precedent, and part of the reason is that gas and oil prices were falling sharply over the same weeks in June, as hopes of a ceasefire in the US-Iran conflict pushed fuel costs down just as the heatwave was pushing electricity demand up.[43] The two effects worked against each other, so the observed 21% increase likely understates the heat-driven component in isolation. When hostilities resumed in July, gas prices rose again, this time reinforcing rather than offsetting the heat effect, which complicates reading the July numbers as a clean heat signal too.[44]
Taking the observed 21% at face value would understate the heat effect, since it is measured against a backdrop of falling gas prices from the Hormuz de-escalation, an offsetting shock with no obvious way to isolate its size from the data available here. As a working adjustment, we take the lower bound of the price increases observed in the two most comparable (but less extreme) precedent heatwaves without a competing geopolitical shock, 40-60% in 2022 and approximately 100% in 2025, and use the more conservative end of that range, ~40%, as a proxy for the price response the 2026 heatwave would likely have produced absent the Hormuz effect. This is a judgement call rather than a derived estimate.

With a sustained ~40% weekly-average rise as the more representative figure and assuming elevated pricing held for roughly six weeks across the three heatwave periods this summer, this implies an average annual electricity price increase of approximately 4-6%. Electricity accounts for roughly half of the HICP energy component, with gas, heating oil and motor fuel making up the rest; we therefore apply our estimated increase only to electricity's share of the basket, implying a narrower increase in the HICP energy component overall. Given that energy accounts for approximately 10% of the HICP basket, this implies the heatwave increases annual headline inflation by approximately 0.2-0.3 percentage points. Drawing on empirical evidence that temporary energy-price shocks reduce economic activity through lower household purchasing power, higher industry production costs and weaker business investment, this inflationary shock is assumed to reduce annual EU GDP by approximately 0.06-0.09 percentage points.

Under these assumptions, a prolonged heatwave similar to that experienced in the summer of 2026 could reduce annual EU GDP by approximately 0.12-0.15%, both through direct losses in energy output and indirect price effects.

Transport & logistics

Extreme heat also affects GDP through transport and logistics channels. Transport and logistics are particularly vulnerable because high temperatures damage rail infrastructure, cause road damage, lower inland waterway navigability, increase port operating constraints, and in general disrupt logistics networks. These disruptions limit transport services, which is the direct impact on GDP, and also affect GDP indirectly through higher transport costs.[45]

The summer 2026 heatwave has already produced substantial disruptions to European transport and logistics networks. Low water levels on the Rhine have forced inland vessels to operate with significantly reduced cargo loads, in some locations as little as 20% of normal capacity, substantially increasing freight rates and transport costs for commodities such as coal, chemicals, fuels and industrial inputs.[46] The Rhine disruptions have begun affecting manufacturing supply chains, and firms have resorted to smaller vessels, additional shipments and stockpiling to maintain production. Economists estimate that if these transport disruptions persist, they could reduce German GDP growth by around 0.2 percentage points.[47] The effects extend beyond Germany. Low water levels on the Danube have disrupted commercial barge traffic and reduced shipping volumes, while cargo throughput at the Port of Rotterdam has also declined because inland waterways can no longer efficiently transport goods to and from the hinterland. The volume of cargo transported to and from Rotterdam to the Rhine has fallen and was around 10% lower than normal end of July.[48] Extreme temperatures have also affected rail transport. Across Europe, rail operators have imposed speed restrictions and increased monitoring because of track expansion, signalling failures and other heat-related infrastructure risks. Infrastructure managers report that extreme weather is becoming an increasingly important source of operational disruption for European rail networks.[49]

Taken together, these developments show that the 2026 heatwave is disrupting multiple freight transport modes simultaneously, thereby reducing transport capacity, increasing logistics costs, and creating bottlenecks in European supply chains.

Transport and storage represent approximately 5% of EU gross value added.[50] Based on the evidence from the 2026 summer so far, we deem it plausible that there is a 5% reduction in transport and storage sector output during an affected summer period of two months. This implies an annual output loss of 0.8%, which translates into approximately 0.04 percentage points annual EU GDP reduction. Additional spillovers through higher logistics costs, delayed deliveries and disrupted supply chains could increase the total transport- and trade-related impact to around 0.15% of GDP.[51]

Labour hours & labour productivity

General labour production losses arise through two main channels. Firstly, extreme heat makes people work less. The chance of people working falls, and therewith the actual labour force. A study in an Australian panel found that the chance of working drops by 1 percentage point on extremely hot days.[52] Heat during the commute likely contributes significantly to this effect. Even employees who make it to work, will work less hours during a heatwave. In Australia the number of hours worked dropped by 2.2% on average, while an American time use survey also evidence reduced working time during hot days. [53]

The largest loss in labour productivity is not in the number of hours worked, but the labour productivity during those hours. Multiple channels contribute to this effect. People in physical and heat-exposed professions, such as in agriculture, construction, factories with poor insulation or climate control and transport workers are all examples of these professions. On extremely hot days, their labour productivity drops simply because more breaks and a slower pace are necessary to prevent overheating.[54] Yet the labour productivity of people with cognitive professions is affected as well. In hot rooms, people perform less on all kinds of cognitive tasks. In a controlled experiment in 30°C, people performed about 9% less at typical office tasks.[55] These types of productivity losses are plausible for people working at home or in an office without air conditioning on hot days. Even for people who do have air conditioning at their place of work will likely perform less on hot days. Exposure to heat during the commute can lower cognitive performance too, and heat during the night will affect sleep quality negatively, further reducing cognitive performance.[56]

Acclimatisation to extreme heat leads to some adaptation, albeit only partial. Multiple studies evidence that regions more exposed to heat historically suffer less productivity losses on a hot day.[57]

Estimating labour productivity loss per country

We estimate an expected level of output loss due to extreme heat in Europe based on the number of extremely hot days more than usual. We do so by combining our EU-wide estimates for GDP-losses (-0.5% of GDP) due to agriculture, energy and transport sectoral effects which are associated mostly with drought, with a country-specific estimation of labour productivity effects. We do this for seven EU economies: Germany, France, Spain, Italy, Netherlands, Belgium and Poland.

These general productivity effects in turn are driven by absenteeism and lower productivity while at work. Based on the more conservative empirical effect sizes reported by Da Costa *et al*, we expect an average labour productivity loss for EU countries of about -0.6% of GDP based on our 24 excessive hot days, weighed by GDP.

This channel and the sectoral estimates above measure different mechanisms rather than the same loss twice. The agriculture, energy and transport channels capture disruptions to physical output, water for irrigation and cooling, river levels for shipping, crop yield, driven predominantly by drought and low water availability. The labour productivity channel captures a separate effect: the reduced output per hour worked on hot days, driven by temperature itself rather than rainfall deficit, and grounded in a distinct literature (time-use and absenteeism studies, cognitive-performance experiments) that contains no precipitation or water-availability term. A construction worker's productivity falls on a 35°C day regardless of whether the region is in drought; a farmer's yield falls in a dry season regardless of how hard the farm works. Because the underlying literatures were built independently and respond to different physical variables, we do not view this as double-counting, though we note one partial exception below in the energy section.

To estimate how this aggregate number is spread across countries, we evaluate how we can expect labour productivity losses to manifest in each countries. We identified four key factors that can make a country more sensitive to heat. We use these four factors to construct an *extreme weather sensitivity proxy*. We then multiply this sensitivity proxy by the expected number of above average hot days this year to obtain an estimate of the *relative production losses per country*. We then calibrate these relative production losses per country by rebasing them, to obtain an estimated weighed productivity loss of -0.6%, aligning with our expected macro-productivity loss.

The four factors we use to construct our *extreme weather sensitivity proxy (EHS)* are:

1. *The share of a country's economic activity in physical professions exposed to heat (EXP).* This is concentrated in the sectors agriculture and construction, but involves parts of the manufacturing and transport industry as well. To estimate each country's vulnerability we relied on Eurostat's Gross value added and income by main industry (NACE Rev.2) – annual data, using 2025 values. We summed up the share of GVA from the NACE sectors A to F. This includes all industry, but excludes transport. Since both of these sectors should ideally be partially included, we believe this provides a reasonable estimate of how exposed countries are on this indicator.

2. *The penetration of air conditioning in a country (AIR).* Airconditioning demands energy, which can exacerbate energy effects on GDP. Yet, from a labour productivity perspective, air conditioning helps. People achieve higher sleep quality in cooled rooms during episodes of extreme heat, and people perform better cognitively in airconditioned environments during such period. As a proxy for the share of air conditioning penetration we rely on Carbon Brief's analysis which evidences the share of household energy consumption for cooling. We notice relatively high penetration in Italy and Spain, modest penetration in France, and low penetration in Belgium, the Netherlands, Germany and Poland.

3. *Acclimatisation to extreme heat (ACC).* Countries more exposed to extreme heat show limited adaptation. We use historic hot days to approximate this adaptation. We obtain historic hot days from the ECA&D dataset on daily maximum temperatures.

4. *Commute time (COM).* Longer commutes mean more exposure to extreme heat, leading to cognition effects, and a higher chance of delays which increases absenteeism. We use

average commute times from the Eurostat labour survey in 2019 to approximate this influence on productivity.

We then adapt these four data sources into a *sensitivity proxy* that approaches what literature implies. In the literature we find strong evidence for productivity losses in exposed sectors. We also find strong evidence that adaptation is possible, but only to a certain extent. This means we can expect the effect of adaptation to be non-linear; countries that hardly experience heat will be significantly less adapted than countries that experience extreme heat regularly. Yet, the difference between countries that experience extreme heat regularly and countries that experience extreme heat often will likely be relatively limited. We find strong evidence that higher air conditioning penetration helps contain productivity losses, both in the office and at home. Lastly, commute time matters, but likely slightly less than the other factors.

Based on these literature insights, we adapt our data into *sensitivity proxy components.* Our air conditioning penetration component is a score distributed between -1 (low) and -2 (high). We scale the other components to the same order of magnitude, while ensuring that the ensuing range of outcomes does justice to the relative importance of each component. Since the exposed share of gross value added (in percentage) and commute time (in minutes) are an order of magnitude larger than the scores awarded for air conditioning penetration, we divide both by 10. This leaves us with a range of 1.54 for the exposed share of gross value added, and a range of 0.7 for commute time. Lastly, to incorporate adaptation, we use the negative log of the number of historic hot days. This results in values in the right order of magnitude, whilst simultaneously incorporating the notion that the marginal effect of adaptation diminishes. This leaves us a range of 1.14 for adaptation.

Overall, these transformations mean that the exposed share of gross value added is the factor that determines the overall proxy most strongly, followed by acclimatisation, air conditioning penetration and then commute time. We sum up these components as follows:

$$EHS = EXP + COM + AIR + ACC$$

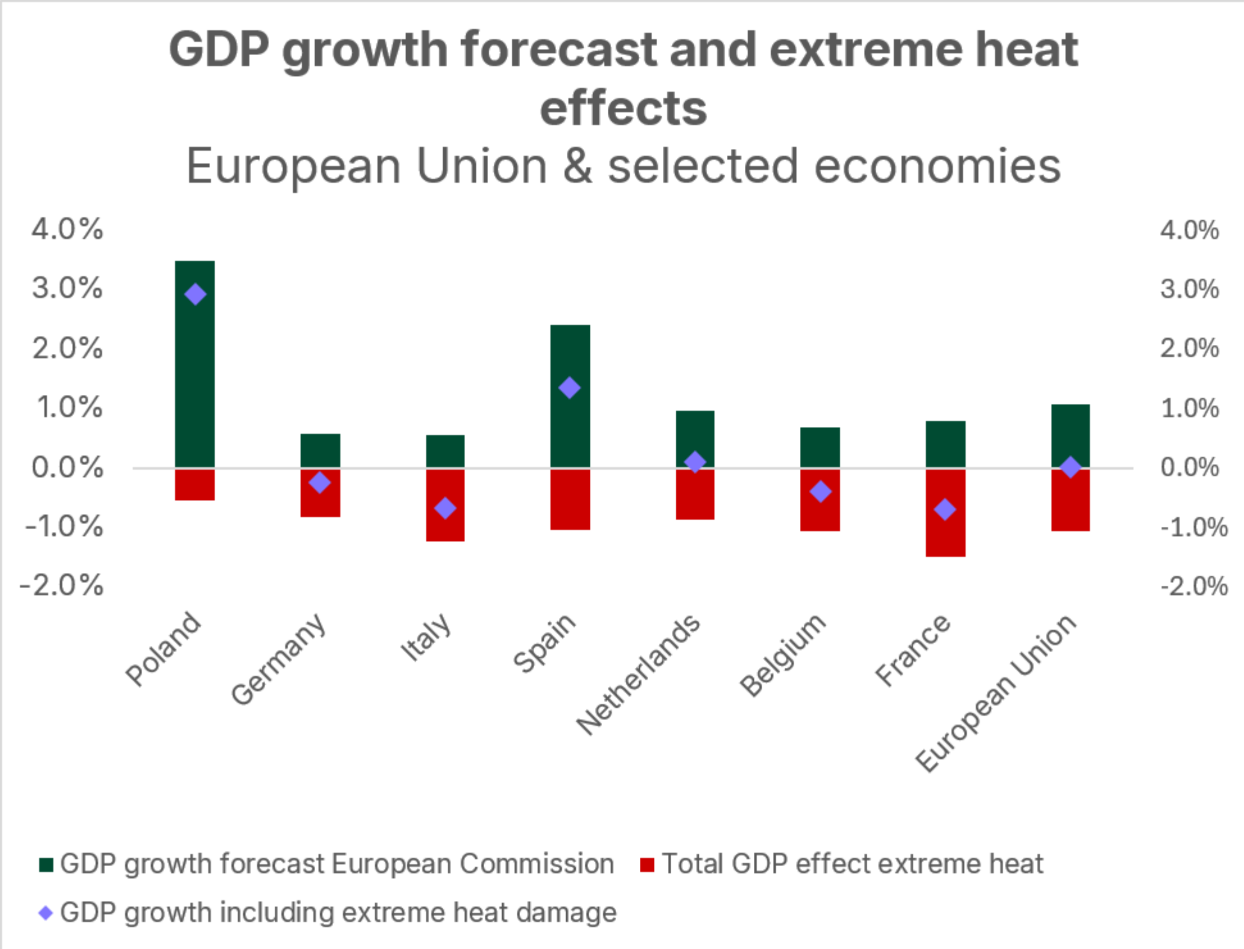
We conclude that Italy is the country least sensitive to extreme heat. With a high air conditioning penetration, a high number of historic hot days resulting in high acclimatisation, and the lowest commuting time in our sample, this makes sense. The fact that they have a slightly above average share of their population working outdoors is outweighed by the 'good' scores on the other three factors. Poland, on the other hand, is most sensitive to extreme heat. They have the highest share of people working in exposed professions in our sample and, although they have an average commute time, have little air conditioning and hardly any acclimatisation. Our metric implies that Poland suffers about 3.4 times as much productivity loss due to a hot day as Italy does. The full country scores relative to Italy can be seen below.

Country	Multiplication factor of damage compared to Italy
Spain	1.1
France	1.6
Belgium	2.6
Netherlands	2.8
Germany	2.9
Poland	3.4

We multiply our vulnerability metric with our estimated hot days this year in excess of the historical norm to obtain what we expect in production losses through lower productivity. Next, we calibrate these relative production losses per country by rebasing them, to obtain an estimated weighed productivity loss of -0.6%, aligning with our expected macro productivity loss.

Adding in the EU-wide GDP effects of agriculture, energy and transport, we derive the national and aggregate EU GDP losses visible in figure 1. The average effect on the European Union GDP is expected to amount to ~1% of GDP. We estimate that France will suffer the largest economic impact of extreme heat this year. A large jump in hot days relative to what its workforce and infrastructure are used to, combined with only moderate acclimatisation and below average air conditioning penetration mean that France could see its GDP growth reduced by 1.4 percentage points due to extreme heat. Since the GDP forecast for France was quite low to beginwith, this could well result in economic contraction for France of about -0.6% in 2026 compared to last year. Poland, on the other end of the spectrum, is forecasted to have only a few more hot days than usual. Some of the EU-wide transport and energy effects of the extreme heat will still spillover to the Polish economy, but, in combination with its already high GDP-growth forecast, we still expect about 2.9% economic growth this year. The Netherlands can expect about 0.8 percentage points of GDP growth loss due to extreme heat this year. Combined with the pre-existing 1% forecasted GDP growth, this leaves the economy in 2026 about stagnant.

Figure 1



Source: European Commission, Triodos Bank

Uncertainty and benchmarking against other studies

These kind of partial estimations are quite difficult to make. A few things that might be different in reality. First, we expect both in some sectors labour productivity effects and damage effects. They can coincide, and might be less. Second, labour productivity effects can be smaller, because it is summer and economic activity is lower, but can also be higher in some countries given the length and prolonged effects of sleep deprivation (heat fatigue) and cumulative effects in production. Third, we the longer term effects are unknown. In some sectors and some activities, we might see catch-up effects later this year; in other definitely not (like agriculture). Fourth, we did not look at consumption behaviour, while there is some evidence, at least for the Netherlands, that people spend less on extreme hot days.[58] Fifth, we did not take macro-economic second round effects into consideration: extreme weather events, especially when they seem to occur more structurally, can have structural effects on investments and consumptions, as well as government finances. The net effect of all these limitations is hard to estimate. A partial economic effect of about 1% annually is, however, not unlikely.

This estimate is difficult to place directly alongside other recent analyses, since the methodologies diverge sharply. Usman, Parker and Vallat calculated a regional welfare loss of 43 billion euros for the summer of 2025, 0.26% of EU output, for floods, drought and heat combined, rising to 126 billion euros by 2029 if historical lagged effects repeat themselves.[59] That figure covers only the hardest-hit NUTS3 regions, and the three hazards are in fact reported separately. Heatwaves alone account for just 6.8 billion euros of the 2025 total, 0.04% of EU output, rising to 30 billion euros, 0.19%, by 2029. Drought does most of the damage, 29.4 billion euros, 0.18% of EU output, in 2025, rising to 75.6 billion euros, 0.47%, by 2029. Heat and drought combined, the two channels closest to what this report models, since we do not attempt a flood or wildfire estimate, come to 36.1 billion euros in 2025, 0.22% of EU output, rising to 105.7 billion euros, 0.66%, by 2029.

A related ECB working paper, using a different methodology, machine-learning models trained on a simulated 2022-style heat and drought scenario, arrives at sectoral growth losses rather than a GDP percentage: 4.5 percentage points lower real value added per capita in agriculture, 0.75 percentage points in industry.[60]

Moody's Analytics separately puts heatwaves at around 1% of global GDP at present, rising to 3% by 2050 without additional policy action, though it builds that figure from catastrophe modelling and itself acknowledges that tourism, healthcare and labour productivity are not fully captured, making it more a lower bound than a complete estimate.[61]

Allianz Research's cumulative, multi-year projection offers a further reference point: a 5–7% loss in cumulative economic growth for France, Germany, Italy and Spain over 2026–2030, if that period matches each country's five hottest years between 2014 and 2024. Spread evenly, that averages to roughly 1–1.4% a year, close to our own single-year estimate, though the two are not strictly comparable, since Allianz's figure is a multi-year cumulative projection under a specific repeated-heat scenario, not a single-summer estimate.[62]

Against this range, our estimate of roughly 1% GDP loss for the EU as a whole sits above Usman, Parker and Vallat's heat-and-drought figure by a factor of roughly 1.5 to 4.5 depending on the comparison year, but close to both Moody's and Allianz. The gap with Usman, Parker and Vallat likely reflects methodology as much as substance: their coefficients capture the average historical relationship between heat and drought exposure and regional output, drawn mostly from more moderate past summers, while our bottom-up approach explicitly models the physical channels of an unusually intense season. Two further caveats apply across all of these comparisons. First, like Usman, Parker and Vallat, this report captures only first-round, direct effects within each channel. Neither estimate incorporates supply-chain, demand, or financial-sector spillovers, so both may understate the eventual macroeconomic footprint once losses propagate beyond the directly affected sectors and regions. Second, the academic literature finds that heat and drought losses tend to compound over several years rather than reverse the following season: regional output in the Usman, Parker and Vallat and related ECB work remains measurably lower up to four years after a major drought event. This report presents a single-year 2026 figure without taking a position on how much of the estimated loss is transitory, recoverable through delayed harvests, deferred investment, or catch-up production once conditions normalise, and how much represents lasting damage. That distinction materially affects how the headline figure should be read, and is not resolved here.

Non-GDP impacts

We have focused on the quantifiable impacts on GDP above, but many of the most severe damages of extreme heat can't be quantified cleanly into a GDP figure. Two of the most pressing examples are wildfires and health effects.

Wildfires

The same heat and drought that hit crops and rivers has also fed one of the worst wildfire seasons on record. EFFIS, the EU's Copernicus-based monitoring system, had recorded 321,121 hectares burned across the EU by 22 July, more than twice the 20-year average for that date, though still below 2025, the worst year on record.[63] Spain accounts for the largest share (139,809 ha), followed by Italy (65,588 ha) and France (57,966 ha). As with the other channels, the season is far from over, so these totals will keep rising, and none of it has yet been translated into a euro figure either.

Health

This is the channel with the hardest numbers, and the grimmest. A statistical model by Christopher Callahan puts the death toll from the 22–28 June heatwave alone at around 20,390 across Europe: 5,210 in France, 4,543 in Germany, 3,163 in Spain, 2,709 in Italy.[64] That remains a model estimate for most countries, official tallies lag by weeks or months. France's own health agency has since published an official, non-modelled figure for the fuller 17 June–2 July episode: 5,764 excess deaths, higher in intensity than August 2003.[65] Tellingly, more than half of those deaths fell in just three of the sixteen days, 25–27 June, the peak. Germany's Robert Koch Institute separately reports around 5,120 heat deaths so far this summer.[66] Belgium recorded 1,747 excess deaths between 18 June and 1 July, 48% above the seasonal average, its deadliest heatwave since record-keeping began in 2000.[67] The

Netherlands' RIVM counts roughly 1,323 excess deaths over three weeks, including a lagged effect that continued after temperatures had already dropped.[68] In England and Wales, a joint rapid analysis by the Met Office, UKHSA and Imperial College London put the toll from the May and June heatwaves combined at more than 2,700 excess deaths, with about 42% attributed directly to human-caused climate change.[69]

Given how concentrated the deaths were in the hottest few days, it's tempting to divide a total death count by the number of heatwave days to get a rough "deaths per hot day" rate, then apply that to the day-counts above for a rest-of-summer estimate. That would be misleading. The epidemiological literature is clear that the temperature-mortality relationship is sharply non-linear rather than a flat daily rate: a large multi-country study covering 13 countries found the mortality burden concentrates in the true extremes, not spread evenly across days above a threshold.[70] That's exactly why researchers like Callahan build a full response curve calibrated to each country's climate and demographics rather than a single multiplier, and why we don't attempt our own back-of-envelope version here.

A methodological caveat worth stating plainly: these counts capture direct mortality only. They miss the indirect toll that heat is known to worsen: suicide rates rise with monthly temperature (0.7% per 1°C in the US, 2.1% in Mexico, in one widely cited study), a Spanish study found the risk of intimate-partner femicide rises in the days after a heatwave, and a growing clinical literature links heat stress to acute kidney injury.[71] And heatwaves early in the summer tend to be deadlier than later ones: a 43-city US study found the first heatwave of the season carried a measurably higher mortality risk than later ones, consistent with a smaller pool of the most vulnerable people remaining exposed as the summer wears on, a dynamic worth keeping in mind when comparing this year's early, intense heat to past summers.[72]

None of this has yet been translated into an economic figure, a value-of-statistical-life estimate, sick-leave costs, healthcare spending. That remains one of the biggest gaps in putting a euro number on this summer.

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