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Johannes Pfeiffer and Karen Pittel

To Adapt or Not to Adapt: Costs, Benefits, and Financing of Adaptation in the EU

For a long time, adaptation was a relatively minor aspect in the public discourse surrounding climate-related challenges. The public debate has, and often still does, focus primarily on climate protection and the reduction of greenhouse gas emissions. However, the growing frequency of climate-related disasters in recent years has led to increased attention to the governance of adaptation and a shift in public perception. A survey conducted by the European Investment Bank (EIB 2024a) reveals that 94 percent of EU respondents recognize the importance of adapting to climate change, with 50 percent indicating that adaptation should be prioritized. Moreover, over 80 percent of participants believe that investing in climate adaptation can create jobs and boost local economies, and that urgent investment is required to prevent even higher costs in the future. Similar trends are observed at the national level in Germany (EIB 2024b).

To better understand the urgency and scale of adaptation, this paper provides an overview of estimates regarding past damages as well as future risks from climate- and weather-related events. It also presents projections on the costs and benefits of climate adaptation in the EU. However, when it comes to costs and financing needs, evidence remains less comprehensive compared to estimates of climate-related damages. Still, given current assessments, the financing available is often found to be insufficient, given the potential risks posed by climate change (ECA 2025). The uncertainty surrounding financing requirements is just one of the barriers that hinder both public and private investment in adaptation. Other contributing factors include the long-term nature of returns on these investments, the lack of information on avoidable impacts, and the question of who is responsible for financing adaptation measures. The paper concludes with a brief discussion of these financing-related challenges and potential solutions.

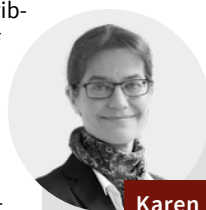
PAST IMPACTS FROM CLIMATE- AND WEATHER-RELATED EVENTS

The European Environmental Agency (EEA) regularly reports (direct) economic losses due to meteorological (e.g., storms), hydrological (e.g., floods), and climatological events (heat-waves, cold waves, droughts, forest fires). The

KEY MESSAGES

- Estimates of climate impacts and of the potential to reduce these impacts through adaptation show the scale of benefits that can arise from investing in climate protection and climate adaptation in the EU
- Assessments also show that the benefits of adaptation measures often exceed their costs, thus providing a strong economic rationale for investing in climate change adaptation
- Current private and public financing levels for climate adaptation often fall short of what could be considered economically efficient
- Challenges in implementing and financing adaptation measures result from uncertainty about future damages, financing restrictions, and lack of information. Also, climate adaptation responsibilities have to be clearly allocated between private and public actors
- To close financing gaps, especially on the local level, access to new financing options that involve private and public actors have to be made available

most current data covers the period from 1980 to 2023. Aggregate economic losses for the EU27 amount to EUR 738,280 million (in 2023 prices). Figure 1 illustrates the distribution of losses over time, differentiated for the three impact categories. It also shows that aggre-



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Figure 1
Aggregate Annual Losses from Climate- and Weather-Related Events in EU27 Countries from 1980 to 2023

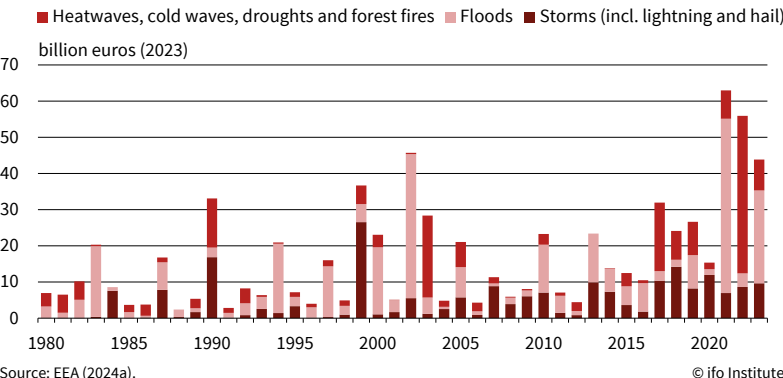
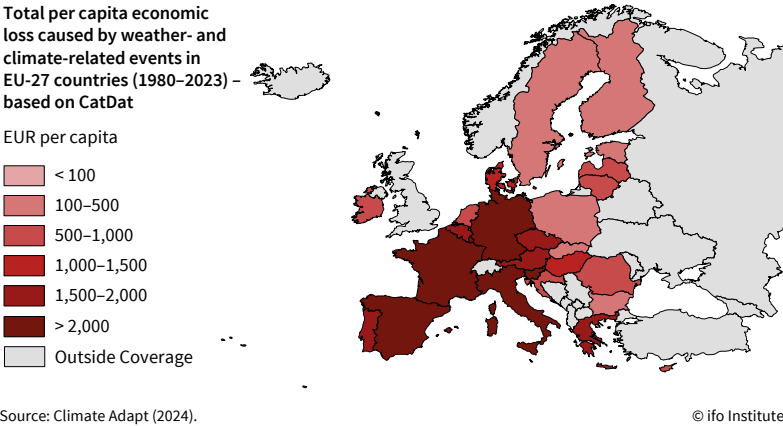


Figure 2
Distribution of Total Losses (1980–2023) per Capita across EEA Member Countries



gate losses are driven by a couple of extreme years over time but also that the number and severity of impacts increased in the latest years. In fact, 2021 to 2023 are three of the five years with the highest economic losses (EEA 2024a). Considering the distribution across member states, Figure 2 illustrates a large variation for per capita losses across member states. The EEA also reports on insurance coverage. About 19 percent of total losses were covered by insurance. Coverage was largest for losses from storms and lowest for losses from droughts, cold waves, and forest fires (Climate Adapt 2024). The share of insured losses differs substantially across member states with a share of 62 percent in Denmark and just 1 percent in Romania (EEA 2024a). Climate- and weather-related events also caused 241,587 fatalities over the same period. While 44 percent of total economic losses were due to coastal or river flood events, heatwaves caused around 95 percent of total fatalities (Climate Adapt 2024).

The overall economic impact of such extreme events is in many cases not limited to direct losses and therefore even larger. Indirect economic impacts and losses arise, for example, from disruptions to value chains, but typically they are more difficult to identify and quantify. Moreover, impacts are often not restricted to directly monetarized damages, but can

also include non-market/monetarized impacts such as deterioration of human health or the functioning of ecosystems or societal conflicts. Trenczek et al. (2022) study the impacts of extreme weather events in Germany from 2000 to 2021. They find that cumulative damages increase from EUR 114 billion (in 2021) to EUR 139–149 billion when accounting for indirect but directly monetizable damages as far as they have been assessed in the literature.¹

IMPACT PROJECTIONS AND FUTURE ECONOMIC RISKS

Since the 1980s, average temperatures in the EU have been increasing twice as fast as global temperatures, implying that Europe is the fastest warming continent (EEA 2024b). With global temperatures rising further, Europe and Germany are facing an increasing number and more extreme weather- und climate-related events in the future, with four key risks summarized by Bednar-Friedl et al (2022):

1. Heat stress for people and ecosystems lead to increases in mortality and ecosystem disruptions.
2. Heat and droughts pose substantial risks for agricultural production for most European regions, which cannot be compensated by productions gains expected in Northern Europe.
3. Water scarcity is of high concern for Southern Europe even for 1.5°C global warming, and extends also to other European regions for stronger temperature increases.
4. Sea level rise and the increasing number and intensity of flood events due to changing precipitation patterns pose significant risks for people, economies, and infrastructures.

These physical risks are particularly concentrated in Southern and partly also Central European regions (see also EEA 2024b). Moreover, they rise substantially with global warming exceeding 1.5°C or 2°C. In particular, for 3.0°C warming or worse, Bednar-Friedl et al. (2022) point out that geophysical (e.g., water scarcity) and/or technological constraints can limit adaptation options, again particularly for Southern Europe. In recent years, the understanding of the economic risks these impacts of global warming bear has risen notably. In general, studies that aim to quantify economic risks can differ in various dimensions – with respect to the methodological approach they take

¹ The overall picture in Germany is somewhat similar to the observations for the EU27. There is a huge variation in the damages caused by single events from around EUR 50,000 to over EUR 33 billion for the most severe event in terms of economic losses. Again, there are a few events that largely drive cumulative damages. For Germany, there are six events with direct losses of EUR 5 billion or higher, amounting to EUR 86.5 billion in total. Moreover, nearly half of aggregate economic damages, or over EUR 71 billion, are to due flooding and heavy rain events, while the other half is more evenly distributed between storms and hail and snow events (22 percent or about EUR 32 billion) and heat and drought (29 percent or about EUR 42 billion).

to project future climate damages, with respect to the climate impacts they consider, as well as with respect to the assumptions they make on socioeconomic developments. For the European level, there are, for example, two extensive analyses of future climate risks and losses, PESETA IV (Feyen et al. 2020) and COACCH (2021a). Both similarly consider physical impacts and economic costs for different sectors in detail and then combine and translate these sectoral results into macroeconomic impacts by use of CGE models. They differ, however, with respect to the impacts they consider – PESETA IV considers the increase in heat-related mortality, while COACCH assesses heat-related labor productivity reduction – and for which socioeconomic scenarios they evaluate the physical climate impacts.² Key observations from these studies are:

- Both projects find substantial but somewhat different economic risks. Annual welfare losses of the EU27 countries and the UK together could amount to at least EUR 175 billion or 1.38 percent of GDP if their current economies were hit by 3°C global warming. Limiting warming to 2°C or even 1.5°C would reduce these losses to EUR 83 billion (0.65 percent of GDP) or even EUR 42 billion (0.33 percent of GDP) respectively (Feyen et al. 2020, results for EU27 plus UK). In COACCH (2021a), macroeconomic impacts are even larger with a median loss of 2.2 percent of GDP in 2070 across all European regions and all nine scenario combinations analyzed.
- Both studies point out that these damages should be understood as rather conservative projections since they derive only from a fraction of all potential impacts and especially do not include important non-market impacts (e.g., biodiversity loss) or potential (socioeconomic) tipping points.
- Both studies confirm considerable heterogeneity of economic losses between European regions and member states. Feyen et al. (2020), for example, point to a significant North-South divide. The results from COACCH (2021a) also suggests that around 25 percent of EU regions are projected to suffer losses of 5 percent of regional GDP or larger compared to a baseline without climate change. This diversity, of course, arises from heterogeneous climate impacts, and from already existing differences in infrastructures, socioeconomic structures, and climate and weather conditions (e.g., average temperatures or precipitation patterns). Economic losses are concentrated in Southern Europe and South-Central Europe, while Northern Europe experiences, at least for some sectors like agriculture, even gains from global warming.

² PESETA IV studies the impacts in 2100 for 1.5°C, 2°C, and 3°C global warming and primarily from a static perspective, i.e., holding current economic structures fixed. COACCH considers in total nine combinations of climate change scenarios (represented by RCPs 2.6, 4.6, 6.0, and 8.5) and socioeconomic development pathways (represented by SSPs 1 to 5), particularly for 2050 and 2070.

GDP losses across all regions are driven mainly by sea level rise and/or river floodings. Southern and South-Eastern European regions also strongly suffer from droughts and heat waves affecting the agricultural sector but also labor productivity in general (in COACCH) as well as heat-related mortality (in PESETA IV; Figure 31 in Feyen et al. 2020).³

MEDIUM-TERM RISKS AND ECONOMIC COMMITMENT OF PAST EMISSIONS

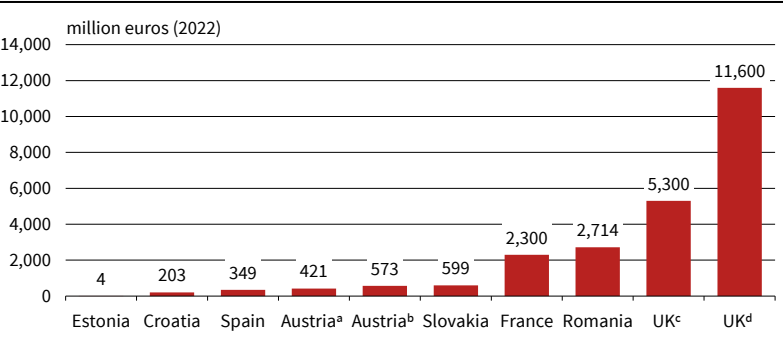
Europe already faces substantial climate risks in the medium term due to historic emissions. Losses in many European regions can amount to 1–2 percent of regional GDP, with some (Southern) European regions suffering from even more severe losses of 5 percent or more of regional GDP (Bosello et al. 2020). Scenario comparisons in COACCH (2021a) illustrate that these losses do not strongly depend on the global warming scenario, which, however, is crucial for long-term economic risks. Thus, historical emissions already “commit” Europe to significant losses and risks over the next two decades – using the terminology of Kotz et al. (2024), who more recently analyzed the global economic commitment of historical emissions and socioeconomic inertia. For Europe, Kotz et al. (2024) find a median (permanent) income loss of 11 percent compared to a scenario without climate change. From a policy perspective, this economic commitment points to a strong role for adaptation and in particular early adaptation measures, which, in contrast to climate mitigation, can address medium-term losses. Adaptation in this sense directly complements but cannot substitute climate mitigation, which is still key to avoid even more severe risks and potential limits of adaptation after 2050.

COSTS OF ADAPTATION AND INVESTMENT NEEDS

While there is an increasingly detailed understanding of future climate risks and potential economic losses, there is much less information available on adaptation costs and investment needs, both for the European level as well as for the national or regional level. The knowledge gap with respect to adaptation costs/investment needs is therefore still considerable (World Bank 2024). At the same time, it is widely noted that adaptation investments still fall short of what is needed to better prepare for future climate impacts for developing countries (CPI 2024) as well as for developed countries and European countries, in particular (EEA 2024b).

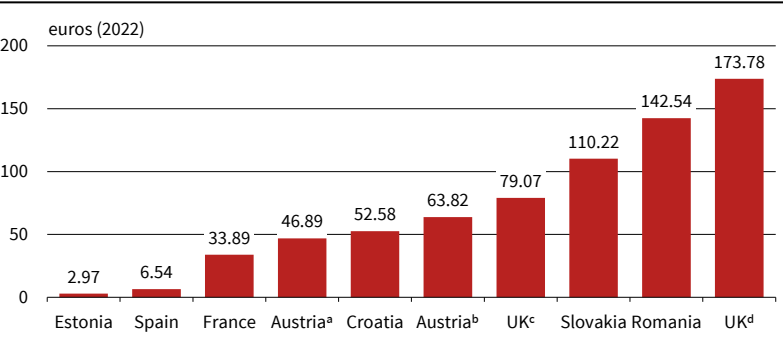
³ Shortages in water supply can also impact the energy system by reducing hydropower potentials but also cooling options for power plants (nuclear), while energy demand increases primarily due to higher cooling needs. There are also notable differences with regard to energy system impacts between socioeconomic scenarios, since energy systems in Southern European regions tend to be more vulnerable with higher shares of renewables, in particular hydropower (Bosello et al. 2020).

Figure 3
Annual Adaptation Costs for Adaptation Measures in the Short Term (until 2030) from National Adaptation Assessments



^a Bottom-up approach. ^b Top-down approach. ^c Minimum action. ^d Maximum action.
Source: World Bank (2024), Figure 16. © ifo Institute

Figure 4
Annual Adaptation Costs *per Capita* from National Assessments for the Short-Term (up to 2030)



^a Bottom-up approach. ^b Top-down approach. ^c Minimum action. ^d Maximum action.
Source: World Bank (2024), Figure 17. © ifo Institute

On the EU level, there is no recent comprehensive estimate of adaptation costs available. Extrapolating from national assessment studies, the World Bank (2024) estimates a range of EUR 15 billion to EUR 64 billion for the annual aggregate adaptation costs for the EU27 countries until 2030. National assessments of adaptation costs/investment needs, as far as they are available at all, differ widely even in the short term until 2030. This is illustrated by Figures 3 and 4 taken from the recent World Bank survey for both absolute and per capita annual investment needs. For Germany, recent estimates of investment needs for adaptation at the local level range from EUR 5.8 billion (Brand et al. 2023) to around EUR 8 billion (DStGB 2024) for the short term.⁴ Heilmann et al. (2024) estimate a minimum investment need of EUR 38 billion from 2025 to 2030 at the local and “Länder” level in Germany. Similar to the EU level, a consistent assessment of the overall investment needs for climate adaptation in Germany, including also the federal level, is missing so far.

In general, assessing adaptation costs tends to be even more challenging than identifying the costs for climate change mitigation. Adaptation addresses multiple risks, which are often region-specific and typically change over time depending on future global warm-

ing or also socioeconomic developments, e.g., with people continuing to build houses in high-risk areas, thereby putting even more assets at risk.⁵ Also, climate change adaptation measures often cannot be easily and directly compared with each other, in contrast to climate mitigation measures that all target a common environmental problem or external effect, i.e., greenhouse gas emissions. Moreover, adaptation costs are also highly dependent on the policy objective. There is no common or uniform adaptation objective but a variety of possible objectives. These objectives directly reflect societal attitudes toward the residual risks from climate change, that remain even after precautionary adaptation measures are implemented. Objectives could, for example, be to (World Bank 2024)

- ... keep the level of residual damages/risks constant. With ongoing climate change, this would imply that adaptation investment needs are likely to increase over time.
- ... reduce residual risks to a very low level (“protecting to a risk-intolerant level”). However, insuring against extreme but low-probability events, can lead to potentially very high costs.
- ... achieve the economically optimal level of adaptation derived from cost-benefit considerations. Typically, this implies rather high residual damages. However, characterizing the “optimal” adaptation level is challenging due to the wide range of potential climate impacts and possible fat tails in the distribution.

Unfortunately, it is often not clearly stated by politics which of these objectives is adopted when decisions about adaptation measures are made. Beyond the question of objectives, the large variation in the above cited national assessments in World Bank (2024) is, however, also due to differences in the underlying studies. Cost assessments can substantially differ with respect to the methodologies applied (e.g., top-down vs. bottom-up approaches), the time horizons considered (until 2030 vs. more long-term until 2050 or even longer), and the sectors and impact categories included. In Figure 3, the EUR 2.3 billion adaptation costs for France, for example, comprise only “no- and low-regret” measures (World Bank 2024), which could be immediately implemented independently of future climate and socioeconomic scenario realizations. When extrapolating national assessments to estimate aggregate annual adaptation costs for the EU27 (EUR 15 to 64 billion), the World Bank therefore takes the French case study as a lower bound. In contrast, the more comprehensive bottom-up assessments for Aus-

⁴ Currently, spending at the local level amounts to EUR 2.9 billion according to Brand et al. (2023), which illustrates the adaptation financing gap for Germany.

⁵ Assessing costs and even current spending is also complicated because adaptation measures are often not clearly separated from already existing activities and policy fields, but are extensions of existing activities (e.g., investments) and mainstreamed into many existing policies and budgets. So far, there is no uniform standard to report adaptation expenditures in Europe. For Germany, a very recent study newly developed a methodology to identify adaptation expenditures in the federal budget (Hölscher et al. 2025).

Table 1

Overview over Cost and Benefits of Adaptation Measures to Reduce Economic Risks of River Flood Events over the Period 2020–2100 for the EU incl. the UK and for Different Global Warming Scenarios

EU + UK	Costs (2015 EUR mio / year)			Reduction of expected damages			Benefit-to-cost ratio		
	1.5°C	2°C	3°C	1.5°C	2°C	3°C	1.5°C	2°C	3°C
Expected damages (base economy)	12,449	16,843	24,775	-	-	-	-	-	-
Strengthening of dike systems	1,592	2,089	2,896	41 %	50 %	68 %	2.0	2.4	2.9
Retention areas	1,855	2,458	3,320	64 %	71 %	82 %	2.9	3.3	3.5
Damage reduction measures for buildings	711	954	1,400	50 %	50 %	50 %	5.2	5.3	5.1
Relocation	961	1,282	1,860	19 %	20 %	19 %	1.2	1.2	1.2

Notes: Annual costs are the average of undiscounted total costs over 2020–2100. Benefits are calculated by assuming that current economic structures are otherwise unchanged ("Base Economy"). Relocation costs include demolishing of buildings, acquisition of new land, and construction of new buildings and infrastructure. Note that consider the optimal implementation of adaptation measures is considered separately and therefore does not take into account interactions between these measures. This also implies that expected damage reductions have to be considered separately and cannot be summed up.

Source: Dottori et al. (2020), Tables A3, A5, A6, A7, A8.

tria and Romania are taken as middle case and upper bound, respectively. The underlying study for Austria assessed bottom-up the costs of all measures in the (federal) Austrian adaptation strategy.⁶

BENEFITS OF ADAPTATION

There is a broad consensus in the literature that adaptation measures already available today can effectively reduce climate impacts and (expected) economic losses. In many cases, adaptation measures are also found to be economically beneficial, with benefit-to-cost ratios significantly above unity (e.g., Feyen et al. 2020; Watkiss and Preinfalk 2022). This is for example illustrated by Dottori et al. (2020), who analyze the economics of adaptation measures for risks of river flood events.⁷ They find high benefit-to-cost ratios ranging from 2 to 2.9, for example, if dike systems are strengthened economically optimal for different warming scenarios (see Table 1). The creation of more retention areas could be even more effective, with a benefit-to-cost ratio of 3.3.

For Germany, Flaute et al. (2022) project cumulative economic damages of EUR 280 to 910 billion from 2022 to 2050 for eight impact categories like damages to buildings and infrastructure (floodings, heavy rain events), agricultural yields, disruptions of supply chains, or effects on the healthcare system (heat-related increases in hospitalizations). Investing in adaptation measures can strongly reduce these losses to EUR 110 billion instead of EUR 530 billion with no adaptation for medium climate impacts, and to EUR 350 billion instead of EUR 910 billion for strong climate impacts. In their study, positive economic effects on GDP from additional investments in adaptation meas-

ures and positive labor market effects even lead to slight increases in aggregate income for the moderate impact case (instead of losses of EUR 280 billion).

Van der Wijst et al. (2022) analyze the macroeconomic and budgetary implications of adaptation policies in three European member states, Austria, Spain, and the Netherlands. For Austria and Spain, the study considers a broader set of adaptation policies; for the Netherlands, it focuses on the Dutch flood protection program, which aims to prepare for high impact, low probability flood events (i.e. for flood events expected at most once in 100 years).

The Austrian and Spanish adaptation programs are found to be highly effective and economically beneficial. They reduce the overall macroeconomic effects of climate change by over 50 percent for pessimistic scenario assumptions in 2050 even when accounting for the policy costs of adaptation measures. Van der Wijst et al. (2022) also point out that the gains in tax revenues resulting from lower climate impacts and thereby increased economic activity even outweigh the costs from increasing public expenditures for adaptation. Public investment in effective adaptation measures therefore not only comes with economy-wide benefits but also has net-positive effects for the fiscal budget. However, the study also illustrates that benefit-to-cost ratios and budgetary implications of adaptation programs depend on the adaptation objective pursued (see above). The Dutch flood protection program is designed to protect against the losses of a 100-year flood event. Its benefit-cost-ratio is positive when considering losses from such an extreme flooding event. However, the program does not appear beneficial when its costs are assessed against the expected damages from all potential flood events.

THE ADAPTATION FINANCE CHALLENGE

The previous sections have clearly shown the potential damages from climate change as well as the po-

⁶ The Austrian case study also directly illustrates the role of methodological differences by also applying a top-down approach. For the top-down cost estimate the study considered current/actual spending on adaptation in the federal budget.

⁷ See also Voudoukas et al. (2020) for the corresponding analysis of adaptation measures for coastal floodings.

tential gains from adaptation. However, despite the high benefit-to-cost ratios estimated for many adaptation projects, the required financial means still have to be raised. According to the World Bank (2024), “a major scale-up is needed of public, private, and blended adaptation finance, involving new actors, new models, and new financial instruments.” The World Bank, however, also stresses the challenges posed in this scale-up. These include incomplete information as well as lack of bankability, regulatory and policy constraints, and social/cultural aspects that affect risk aversion and the perception of trade-offs.

The question is also which projects and measures should be financed privately and which publicly. Room for public intervention arises for example in case of externalities from adaptation, or in the case of public goods or natural monopolies (as in flood protection, health care systems, the improvement of transport infrastructure, or early warning systems). Also, distributional concerns, and equity considerations can play a role (Carleton et al. 2024). This concerns especially vulnerable groups or countries unable to adapt to climate change without financial assistance. However, there is also considerable room for private adaptation financing when it comes to households as well as firms (e.g., switching to climate resistant crops, installing cooling devices, or individual disaster preparedness).

PUBLIC ADAPTATION FINANCING

Given the more local nature of the benefits from climate adaptation compared to emission mitigation, the subsidiarity principle should play a more important role in the decision about public adaptation measures and thus financing. However, local and regional institutions often lack financial means, such that either they have to be channeled vertically to the required level, or local and regional institutions have to be provided with the tools to raise the means themselves. Of course, using these public resources for adaptation might reduce financing room for other public policies (Watkiss and Preinfalk 2022). However, as pointed out before, studies have found not only positive benefit-to-cost ratios from a societal perspective but even the potential for adaptation investment to increase long-term public revenues sufficiently to cover the upfront costs (van der Wijst et al. 2021). Still, policymakers might be reluctant to invest, as the impact on public revenues is uncertain and arises only in the long run.

Public Adaptation Financing in the EU

In the EU, adaptation financing is already integrated into different channels and programs. Overall, the EU aims at a strategy of budgetary mainstreaming, which seeks to incorporate climate-related aspects into every phase of the budgetary process. This spans from the design and preparation stages to implementation and evaluation across all spending programs (Darvas and

Sekut 2025). For this, at least 25 percent of the financial resources of the Multiannual Financial Framework 2021–2027 are to be allocated to climate-related expenditures. This includes adaptation investment, for example in the context of the Recovery and Resilience Facility, the LIFE Programme, the European Regional Development Fund, and the Cohesion Fund – to name a few (Climate Adapt 2025). However, given the sheer number of programs involved but also due to the European Commission’s tracking methods rarely differentiating between climate mitigation and adaptation, it is hard to trace EU funding for adaptation (EEA 2024b). Darvas and Sekut (2025) therefore call for a consolidation of the mainstreaming architecture and better tracking of activities, also ex post.

Beyond providing financing, the EU adopted the EU Adaptation Strategy in 2013 and updated it in 2021 as an overarching regulatory framework for EU adaptation actions. The EU Adaptation Strategy also helps member states develop and implement national adaptation plans and strategies, such that almost all member states by now have developed at least a national adaptation plan or strategy (EPA 2024) that serves as a guide for local and regional adaptation efforts. However, despite recognizing that the EU has a “sound framework for addressing the impact of climate change,” the European Court of Auditors (ECA) stresses that “adaptation policies experience issues when put into practice” (ECA 2023). It warns that the EU might risk falling behind with respect to climate adaptation not only due to outdated scientific data but also due to underestimation of the required financial means.

Adaptation Financing in Germany

Looking at Germany, as an example of one EU member state, similar patterns can be observed as in the EU. Although the federal government has taken steps toward a more systematic and consistent approach to climate adaptation with the Climate Adaptation Law in 2023 and the updated Federal Climate Adaptation Strategy in 2024, the sources of required public finances remain unclear to a large extent. While recently a special fund for investing EUR 500 billion was set up for infrastructure investment, of which EUR 100 billion is to be transferred to the so-called climate-transition fund (*Klima- und Transformationsfonds*) and EUR 100 billion will go to the German states, it remains unclear if and how much is going to be used for adaptation investment, especially at the local level.

Despite the previously discussed high financing needs for adaptation on the local level, according to a survey by the German Environmental Protection Agency (UBA), many of the smaller municipalities do not even have or are not yet preparing climate adaptation concepts (UBA 2024). This aligns with the finding of the ECA (2024) for municipalities across EU member states. The ECA especially stresses the difficulties in transposing EU and national adaptation policies into

local rules. According to UBA, municipalities especially cited the lack of personnel and financial resources as obstacles to better preparation and implementation of climate adaptation.

Financing Instruments for the Local Level

Regarding new instruments to vertically allocate financial resources to the regional and local level, the main instrument discussed so far in Germany is the introduction of a so-called “Gemeinschaftsaufgabe” (“joint task”), which refers to a task or responsibility that is shared between the federal government and the federal states. For this, however, a change in the German constitutional law would be required.

Further instruments for local funding have been proposed in the literature. However, these instruments have to be specifically suited to address the challenges local communities might face (e.g., lack of expertise and financing restrictions) and might also have to be adapted to the individual regulatory environment. Especially if funds are to be raised through debt, e.g., green bonds or social impact bonds, the question arises as to how these funds are to be repaid over time. Some adaptation projects might increase public revenues to the municipalities, e.g., by making them more attractive to investors through increased climate resilience. But repayment of other loans might require either increased contributions from the federal level or raising local tax revenues through, for example, environmental taxes, other local taxes (like local business taxes in Germany), or the collection of fees for adaptation services from households and businesses (such as flood protection, stormwater management, or coastal defense). However, the implementation of such taxes and fees can be politically challenging and might reduce the attractiveness for firms to invest. Insurance against climate risks for municipalities might be available and affordable to some communities but not all, especially in the face of increasing climate risks. For other projects, public-private partnerships (PPPs) might be a way to raise funds, especially if revenues arise from the projects, as for example in the case of municipal water management in the form of water levies. PPPs, however, require careful design to ensure that risks and rewards are adequately shared.

PRIVATE ADAPTATION FINANCING

The need for public adaptation financing can be reduced if at least some of the adaptation measures are carried out and financed by private actors. This can encompass, for example, the PPPs just mentioned but also entirely privately financed measures. It is natural for private financing to focus on projects where there are clear financial incentives, such as infrastructure that improves profitability for businesses. These projects can be financially attractive because they offer the potential for cost savings, increased property

values, or long-term revenue generation. Similarly, private firms have an incentive to invest in research and development of climate-resilient products and services, such as drought-resistant crops or water-efficient technologies.

It is, however, essential to create a regulatory environment that fosters private adaptation measures and removes disincentives (Fankhauser 2017). This also includes a credible delineation of costs that are to be borne by the private sector and those that fall under the responsibility of public entities.

Especially in the context of private actors, the role of insurances against climate-related events could be extended given the low coverage rates in many EU countries. Insurance solutions provide not only coverage in case of climate shocks like extreme weather events and mobilize contributions for damage management. They can also provide economic incentives to invest in adaptation to climate change in order to, e.g., reduce insurance premiums.

In Germany, the introduction of mandatory insurance for natural hazards concerning buildings was, for example, recommended by the Advisory Council for Consumer Affairs (SVRV 2024) and the Council of Federal States (Bundesrat 2023). While this would represent a significant intervention, it could help address the moral hazard or “Good Samaritan” problem (Ragwitz and Thum 2023): the more building owners expect the state to compensate for damages, the lower their incentives will be to take out insurance or avoid building land in risk areas. Various design issues would need to be addressed, such as whether the mandatory insurance should be implemented within the insurance market or as a state-run compulsory insurance, and what weight the solidarity principle should have compared to risk-equivalent incentives (Becker and Osli 2022).

The desired steering effect, such as avoiding flood-prone areas, could primarily be realized through a risk-based design of insurance policies. In contrast, uniform or subsidized premiums would lead to distorted incentives (e.g., Garbarino et al. 2024). However, risk-adjusted premiums carry the risk of overburdening households financially. Therefore, for the existing building stock, it would be worth considering, at least for a transitional period, moderately risk-adjusted premiums. For the European level, such a mixed system combining private insurance solutions with a public component to cover the most extreme risks and to limit risk-adjusted premiums is, for example, found to reduce macroeconomic risks of future flooding risks more strongly than pure private insurance systems or a completely public system with uniform premiums (COACC 2021b).

TAKEAWAYS

This paper has clearly demonstrated the economic rationale for investing in climate change adaptation

within the EU. However, it has also outlined the reasons why current financing levels often fall short of what would be considered economically efficient. A range of challenges remains in implementing and financing adaptation measures by both private and public actors. While effective communication and scientific data are crucial in this context, access to financing – or the lack thereof – also plays a significant role. This is particularly true with regard to regional disparities both across and within EU member states, which could not be explored in detail in this paper.

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