Climate-Informed Real Estate Returns In Europe

JUNE 2021

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TABLE OF CONTENTS

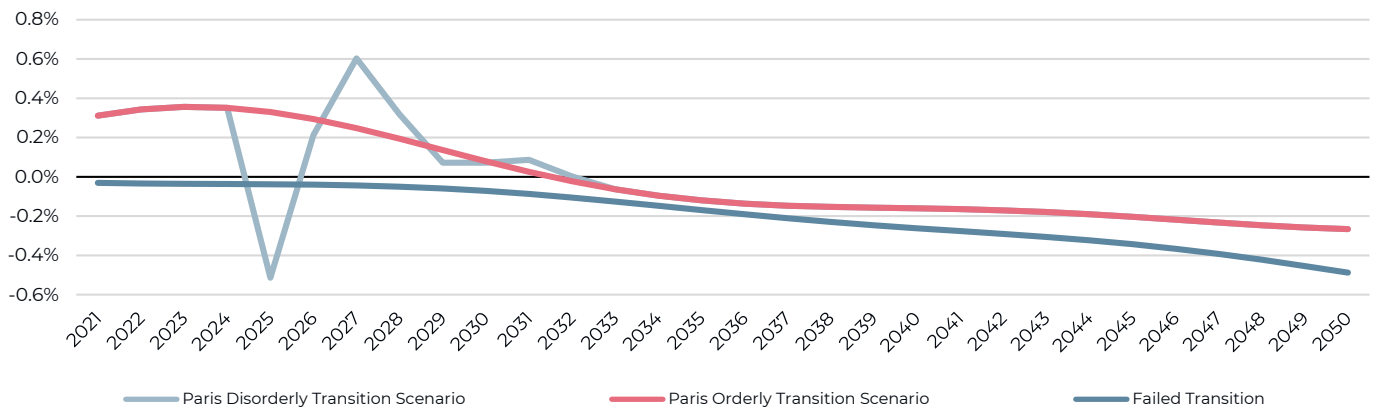
HOW MUCH WILL CLIMATE CHANGE IMPACT EUROPEAN REAL ESTATE RETURNS?

- As Europe has been ramping up its vaccinations, it is also coming to grip with the latest Covid-19 variant. In the meantime, restrictions are slowly being lifted after 15 months of various degrees of lockdowns across the region. Attention has already been shifting to the upcoming UN Climate Change Conference (COP26) planned for early November. During the pandemic, there has been an increasing momentum around net zero carbon commitments. In fact, the UN's Race To Zero now represents over 120 countries, 700 cities, 2,300 businesses, 160 institutional investors and 600 universities committed to achieving net zero carbon emissions by 2050 at the latest. Collectively these actors now cover nearly 25% of global CO2 emissions and over 50% of global GDP.

- In real estate, institutional investors and listed REITs have been leaders in announcing their net zero commitments. These commitments will require retrofit investments and switches to renewable energy sources. Also, new types of reporting for energy use and carbon emission as well as technological innovations would allow us to keep track of meeting these targets. It is encouraging to see progress in other sectors like electric cars and hydrogen-fueled airplanes. However, innovation in a fragmented industry dominated by long lasting legacy assets might require extra efforts after the effects of the pandemic are absorbed.

- Broader action on climate change in European real estate will be forced to step up to the next level when EU and local regulators set more aggressive targets for renewable energy use and carbon emission reductions. This is a topic we already addressed in our February 2020 report titled "Managing & Pricing Climate Risk". In this follow-up report, we will quantify the impact of climate change on European real estate returns over the next 20 years. We expand our scope from the previous transition and physical climate risks to include also a new macroeconomic climate impact. This does require some assumptions along the way, which we will highlight together with the results.

Climate scenario impact on baseline GDP growth forecast

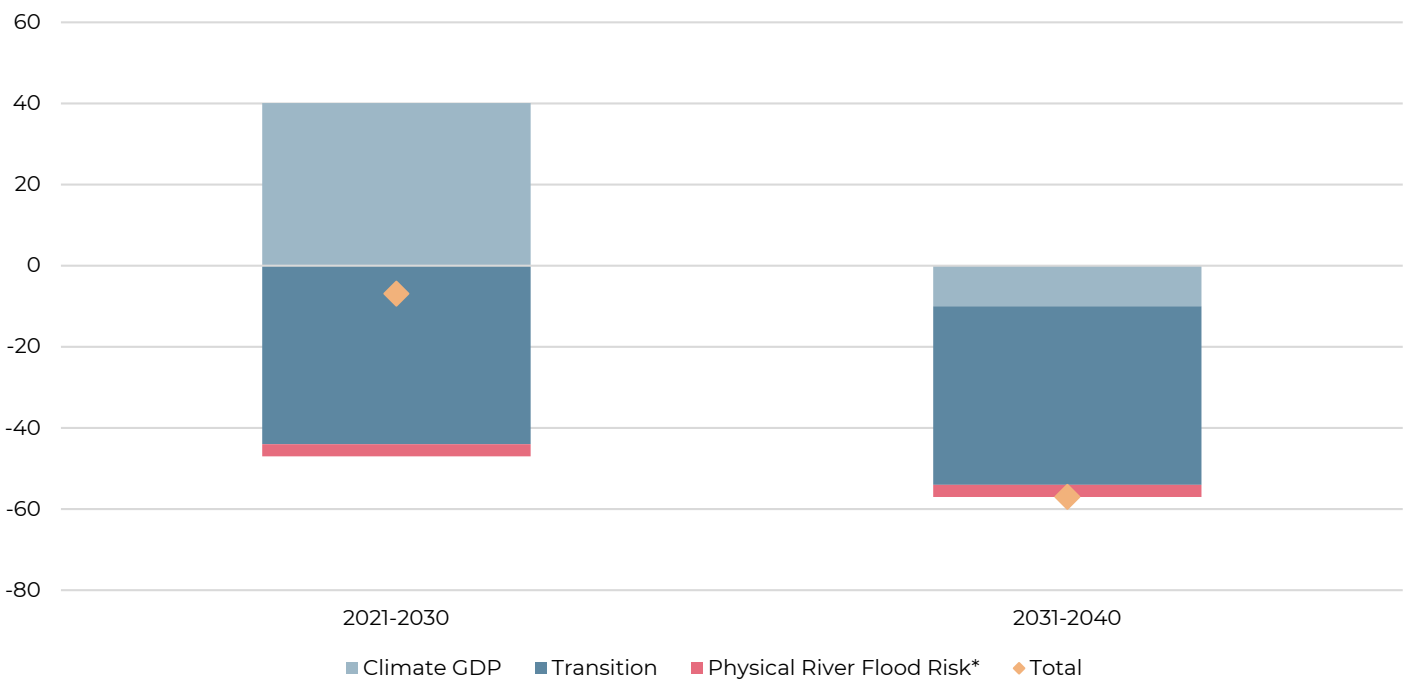


Sources: Ortec Finance, AEW Research & Strategy

EXECUTIVE SUMMARY: NEAR 60 BPS RETURN IMPACT FROM CLIMATE POST 2030

- In this report, we provide our initial estimates of the impact of climate change on European real estate investment returns, as a follow-up from our Feb-20 report on managing and pricing climate risk.
- First the good news, a cumulative +3% GDP 2021-30 growth is projected assuming an orderly transition to implement the Paris-accord climate targets. This lifts 2021-30 real estate returns by 40 bps pa from our climate uninformed base case forecasts.
- Based on Ortec Finance projections under the orderly transition, the positive effects of climate investments reverse to a GDP decline after 2030. As a result, real estate returns are projected to decline by 10 bps over the 2031-40 period.
- Second, a negative 44 bps impact on 2021-30 real estate returns is expected from climate-related transition risks. The same impact is assumed for 2031-40. These estimated risk premiums are based on the projected costs of carbon intensity reductions for existing buildings as specified for each CRREM sector and country.
- Thirdly, physical river flood risk reduces returns by 3 bps pa over the 2021-40 period. This risk premium is based on Munich Re insurance costs from river flooding under the RCP 4.5 scenario for the 20 most liquid markets across five key capital cities.
- Across all three climate impacts we use the same time horizon and similar climate change scenario assumptions. This means that over the next ten years, European real estate investors can expect a net negative climate impact of -7 bps pa. From 2031-40, this negative effect ramps up to -57 bps pa.
- Our approach allows us to quantify more precise impacts on a either a country or city level for each of the three main property types across our coverage universe. This also facilitates the incorporation of climate-related risks in our risk adjusted approach.

CLIMATE CHANGE IMPACT ON EUROPEAN REAL ESTATE RETURNS PER PERIOD (BPS PA) UNDER ORDERLY TRANSITION (RCP 4.5)



*Sources: AEW Research & Strategy, Ortec Finance, CRREM, Munich RE, RCA, DEEP, CBRE, ECC European Construction Costs, RLB Euro Alliance, DEEP retrofit database , BPIE. * Please note that this is reflective only of markets that actually have river flood risk.*

SECTION 1: ECONOMIC IMPACT FROM CLIMATE CHANGE

ORDERLY TRANSITION LIFTS GDP GROWTH IN NEXT 10 YEARS

- To better understand the possible impact of climate change on the economy, we focus on three economic climate change informed projections from Ortec Finance.
- First of all, the Paris orderly transition scenario which shows a positive economic impact on European GDP growth in the next 10 years, relative to the climate un-informed baseline scenario. The baseline is similar to consensus forecast. The positive impact comes mostly from increases in public and private investments needed to meet the Paris accord objectives.
- Secondly, the failed transition scenario which assumes that no further policy initiatives are launched to meet climate targets. Despite little immediate impact, temperatures will rise more and sooner with an immediate negative impact on the economy.
- Finally, the disorderly transition scenario which reflects the real world political difficulties coordinating climate policies globally. Ultimately, the macro economic impact is in line with the orderly transition.

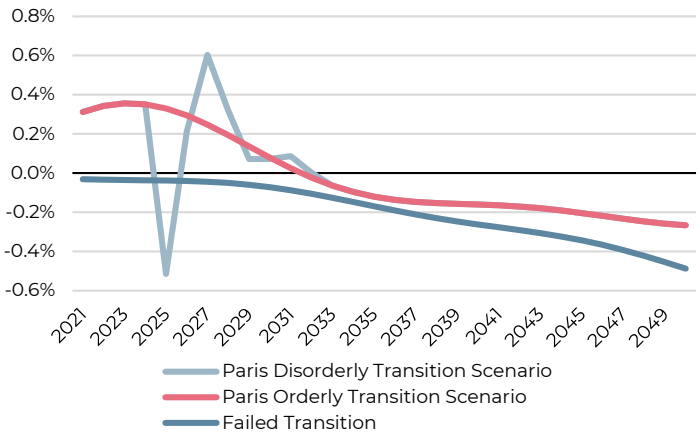
ORDERLY TRANSITION MAKES MOST ECONOMIC SENSE

- Cumulative GDP growth impacts over the next 30 years show that an orderly transition makes good economic sense, as it limits the impact from climate change to less than 1% cumulative in both the orderly and disorderly transition.
- However, doing nothing to meet the Paris accord as shown by the failed transition confirms that it is an economically unattractive option as GDP would be nearly 6% lower over the next 30 years.
- This equates to a staggering amount of US$ 1.7 trillion as the estimated difference in GDP growth over the 2021-50 period between the orderly and failed transition.
- It seems that many companies and governments are already understanding these economic benefits as the number of announcements of (net) zero carbon targets have been accelerating.
- In fact, the EU has tied its eligibility for Covid-19 recovery funding to national governments' green policy initiatives to stimulate renewable and other investments to facilitate an orderly climate transition.

ECONOMIC BENEFITS VARY ACROSS TIME AND COUNTRIES

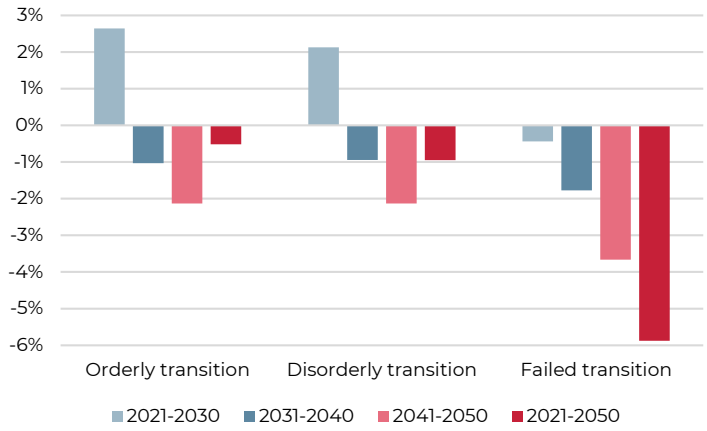
- European averages hide differences in the economic growth benefits from an orderly transition. Apart from the short term boost from investment in 2021-30, later periods show increasingly negative results, as transition-related investments needs to be repaid. The 2041-50 period has more than twice the negative impact as in 2031-40.
- The chart shows countries sorted from best to worst cumulative 2021-50 GDP impact with Norway standing out. Its reliance on oil and gas exports make it the biggest economic loser in all periods.
- Geographically similar Finland is expected to benefit most as climate change will allow for longer growing seasons boosting the economy.
- Thanks to its more developed low carbon energy sector, Spain stands out as having a small positive GDP impact for the next 30 years, especially compared to Italy.
- Italy has a higher initial required investment positively impacting economic growth. But as investment slows down, growth loses its momentum with the debt repayment starting, income and consumption falls.
- Each country's status of already implemented policies determines the needed transition investment and the associated economic boost.

Climate scenario impact on baseline GDP growth forecast



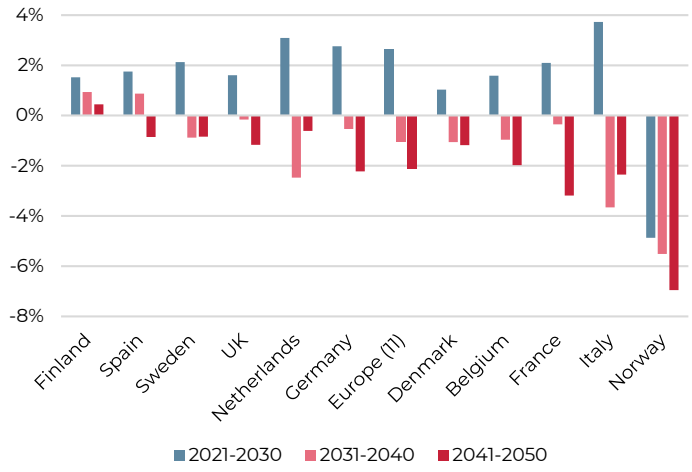
Sources: Ortec Finance, AEW Research & Strategy

Cumulative impact on GDP growth per climate scenario



Sources: Ortec Finance, AEW Research & Strategy

Cum. GDP impact for orderly transition scenario per country *



**The results in the chart are sorted according to the cumulative impact on GDP for the 2021-2050 period, from the smallest to the largest.*

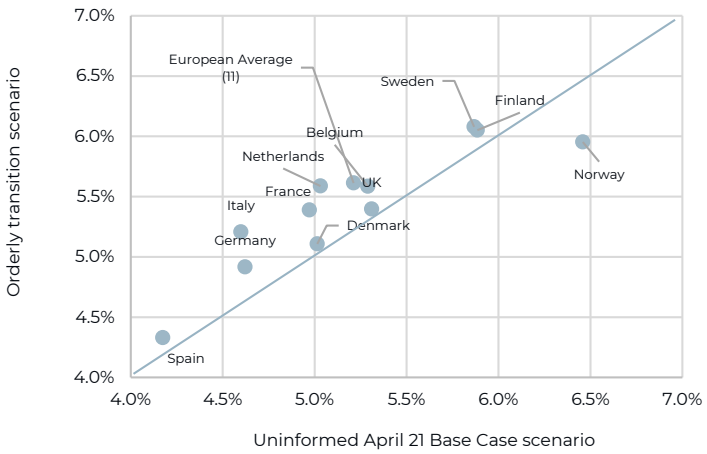
Sources: Ortec Finance, AEW Research & Strategy

CLIMATE CHANGE IMPACT ON RETURNS

40 BPS 2021-30 RETURNS BOOST IN AN ORDERLY TRANSITION

- 2021-30 returns improve by approximately 40 bps pa (from 5.2% to 5.6%) across all European property markets in an orderly transition compared to our climate uninformed Apr-21 base case. As discussed earlier, this is driven by the better GDP growth expected in an orderly transition.
- With the exception of Norway, all national average returns improve as a result of the transition induced stronger economic growth.
- Dutch and Italian markets are forecast to show 60 bps pa improvements in returns, while the UK and Denmark are predicted to have only 10 bps pa additional returns.
- Our impact analyses are based on the same sensitivity of GDP to total returns as implied by the scenario analyses in our mid-year 2020 outlook. There was no difference in bond yields between our Apr-21 base case and the orderly transition scenario.

Total return forecasts for uninformed Apr-21 base case vs orderly transition scenario for 2021-2030

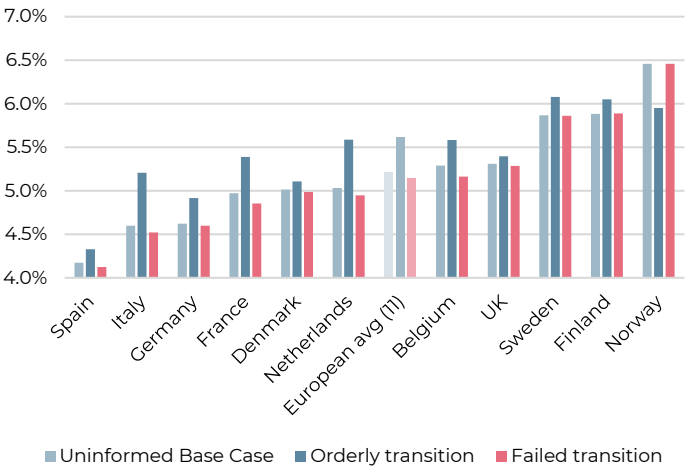


Sources: Ortec Finance, AEW Research & Strategy

2021-30 BOOST BIGGEST FOR ITALY & NETHERLANDS

- European real estate return averages for the next ten years hide national differences in the benefits from an orderly transition.
- With countries now sorted from lowest to highest real estate returns, Italian and Dutch 2021-30 real estate returns are boosted most.
- Due to the significant GDP impact under this climate scenario, Norway's property returns come down. Norway's returns are still in line with Finland and Sweden. All three still showing above average returns at around 6% pa in an orderly transition.
- Spain stands out as having low returns and limited positive impact from the orderly transition, especially compared to Italy. But, this is because Spain has been ahead in meeting the transition pathways. This means that Italy will benefit in the short term, from its delayed start on the transition pathway.
- This also explains the limited return impacts for the UK and Denmark, which see little GDP and return impact between the uniformed base case and the orderly transition. As Spain, they have started already on this work and have less upside going forward.

Total return forecasts per climate scenario and country for 2021-2030

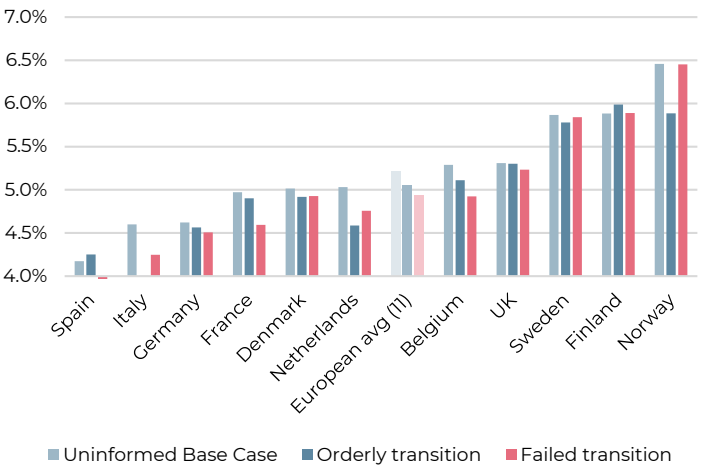


Sources: Ortec Finance, AEW Research & Strategy

ECONOMIC IMPACT ON RETURNS REVERSES AFTER 2030

- As the investment-driven macro economic boom in the 2021-30 period ends, the impacts from debt servicing and other effects are coming to the forefront in the next ten year period.
- Again countries are sorted from lowest to highest real estate returns over the 2031-2040 period. Norway again stands out with an negative impact from an orderly transition.
- Instead of a positive 40 bps positive impact on real estate returns, we see a small negative 10 bps and 20 bps average impact from the expected decline in GDP in an orderly and failed transition scenario, respectively.
- Our results show that Finland and Spain have a positive impact from an orderly transition. The UK has the smallest impact from either an orderly or failed transition.

Total return forecasts per climate scenario and country for 2031-2040



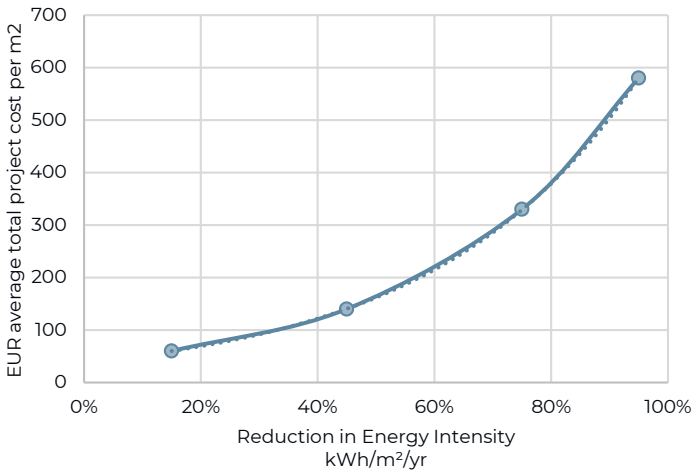
Sources: Ortec Finance, AEW Research & Strategy

SECTION 2: TIMING THE TRANSITION

ENERGY INTENSITY REDUCTION COSTS ARE NON-LINEAR

- As described in our Feb-20 report, the Carbon Risk Real Estate Monitor (CRREM) allows for a top-down market level cost assessment to meet specific Paris-accord informed carbon reduction and energy intensity pathways for commercial and residential real estate properties based on their country and property type.
- Historical building retrofit data identifying their actual costs and achieved energy intensity reductions is the basis for assessing the costs of energy reduction.
- The chart on the right shows that a 15% reduction in energy for a building costs EUR 60 per sqm in 2010. However, the costs do not increase linear, as it becomes more costly and more difficult to reduce energy intensity by 100%.
- The closer to full energy reduction as % of the targeted pathway, the higher the costs. For a 95% reduction, the costs in 2010 were estimated at EUR 580 per sqm based on data from the DEEP retrofit database.

Energy intensity reduction costs in 2010

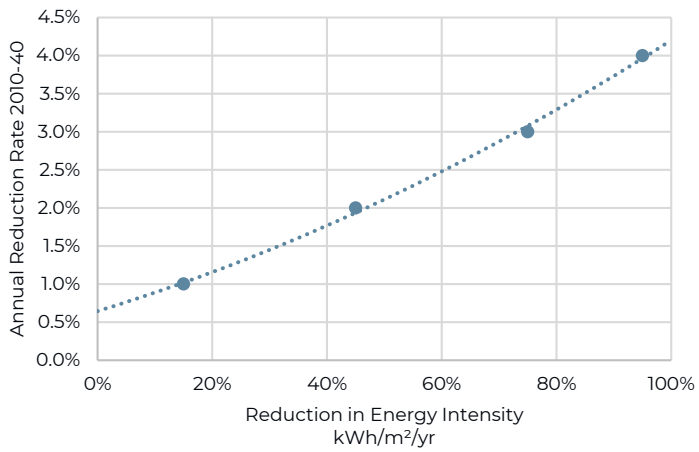


Sources: CRREM, DEEP retrofit database & AEW Research

COSTS ARE COMING DOWN WITH HIGHEST COST MOST QUICKLY

- Consistent with other areas of renewable energy like solar and wind, technological advances have in the past helped reduce costs in many different ways.
- The CRREM assessments assume that cost savings will be realized in the future due to technological innovations when retrofits are needed to reduce the energy intensity of commercial buildings.
- It seems logical that PropTech start-ups will focus on achieving efficiency savings where the incremental costs are currently the highest.
- This is good news for property investors as the future cost savings from technology improvements to achieve near 100% energy intensity are projected to be the highest.
- The highest category of energy intensity to 95% is expected to reduce in costs four times at 4% pa compared to the lowest energy intensity reduction at only 1% pa.
- As a result, the potential cost reductions will be most significant for the largest reductions in energy intensity.

Annual cost reduction % due to improvements in technology

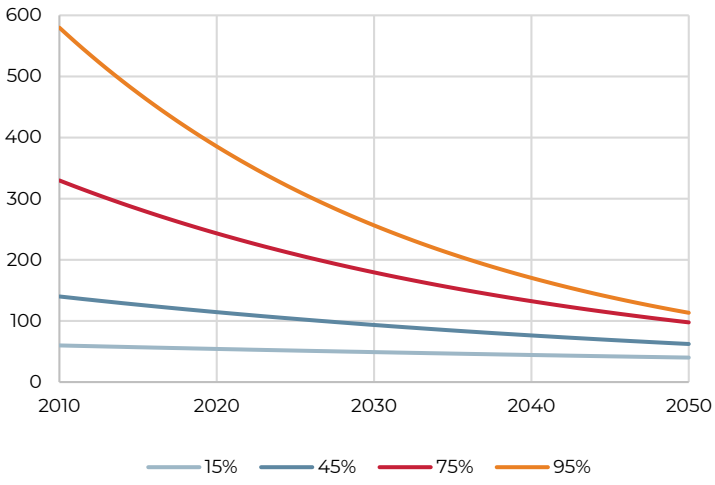


Sources: CRREM, DEEP retrofit database and AEW Research & Strategy

95% REDUCTION TO COME DOWN BY OVER 80% OVER 40 YEARS

- The combination of the non-linear shape of current costs and assumed future costs savings means that investors' costs of required reductions in energy intensity will be in a much narrower range by 2040 and 2050.
- By 2050, a 95% reduction in intensity is projected to cost less than EUR 155 per sqm or about the same as the 45% reduction would cost in 2020. In other words, investors are assumed to get 50% energy reduction in 30 years for the same costs as of today.
- This reduces the economic burden on investors and others in the market to meet these carbon and energy intensity pathways.
- However, it is important to note that it might be unwise to wait till 2050 to make any changes and meet the carbon pathway targets.
- Market prices will likely reflect new policy initiatives, like subsidies or carbon penalties along the way. CRREM allows for these as well.
- In order to assess the impact on real estate returns it is important to note that timing matters, especially with longer term investment horizons of 5-15 years.

Projected annual reduction rate from the average total project cost (EUR/m2) over time per reduction target (xx%)



Sources: BPIE, CRREM, AEW Research & Strategy

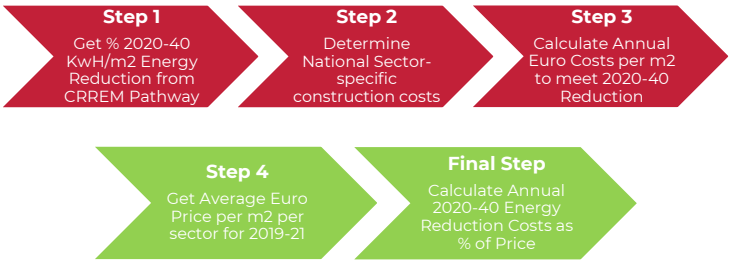
FIVE-STEP APPROACH TO TRANSITION COSTS

RELATIVE ENERGY REDUCTION COSTS REQUIRES FIVE STEPS

- As indicated in the diagram, we apply a five-step approach in order to arrive at a relative cost measure of energy intensity transition:

1. Look up the % energy intensity reduction needed in KwH per sqm from the freely available pre-filled CRREM tool for each country's three property sectors;
2. Determine the national sector specific construction costs index from the same tool;
3. Calculate the annual costs in Euros per sqm to meet the 2020-40 energy intensity reduction (taking into account the % needed (step 1) and the change in costs over time);
4. Determine the average sales price per sqm for each country's property sector over the 2019-2021 period from the RCA data;
5. Calculate the annual energy intensity reduction costs to meet the Paris-accord based CRREM pathways as % of current property price for each country's three sectors.

Five Steps to Calculate Energy Intensity Reduction Costs

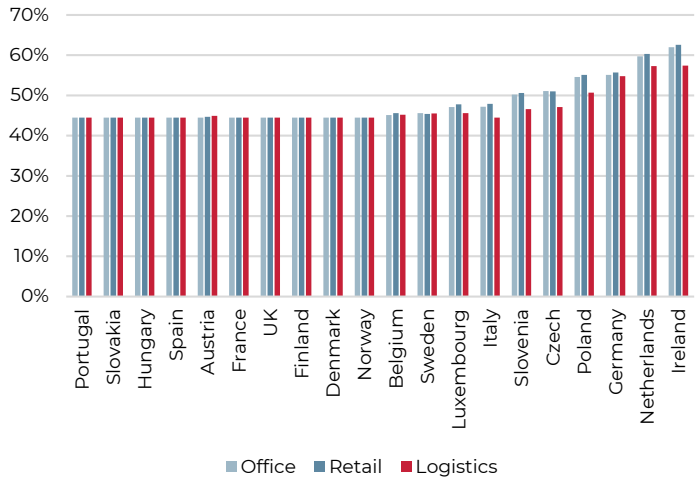


Source: AEW Research & Strategy

2020-40 REDUCTION IN ENERGY INTENSITY MOSTLY AT 45%

- In the first step of our approach, we identify for each country the sector-specific cumulative reduction in energy intensity over the next 20 years, based on our application of the CRREM tool.
- This approach assumes that each property is already at its 2020 energy reduction pathway. Despite the fact that this is unlikely to be the case in reality, it is a necessary assumption for our approach.
- Furthermore, it takes into account the typical 10-year holding term for commercial real estate. Our approach assumes the current owner bears the costs of energy intensity transitions during this 10 year period. But at the end of the holding, it is also assumed that the new owner will deduct the costs of the next 10 years of (lower) transition costs from the price paid to the original investor.
- Based on this, most segments require a 45% reduction in energy intensity, with a few notable exceptions like Germany, Netherlands and Ireland at between 55-60% reductions.
- Please note that these energy intensity reductions are not yet all set out in national legal requirements.

Required % reduction in energy intensity 2020-40 from CRREM pathways

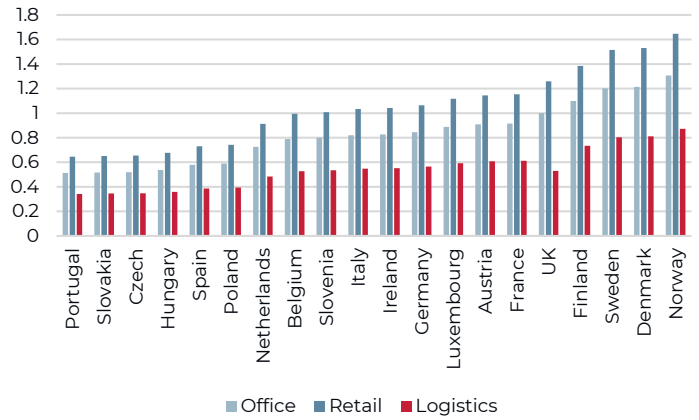


Sources: CRREM, AEW Research & Strategy

CONSTRUCTION COSTS VARY WIDELY ACROSS EUROPE

- To allow for variations in local costs, CRREM uses the European Construction Costs index, or ECC. This is a membership organisation offering an online platform making European construction cost data more accessible to project developers, investors and others.
- The ECC database provides detailed data on a wide range of European construction costs allowing it to provide an up-to-date on-line cost calculator for construction cost management.
- CRREM uses the ECC data by establishing the construction costs of 2018 UK office as the benchmark at 1.0 and using the cost differences for each country's three property sectors to be based on that.
- Our chart shows that based on this methodology, costs in most Scandinavian countries are high, while Portugal, Spain and most CEE countries are on the low end of the range.
- Given the labor intensity of construction work, these results seem logical and reasonable.

Construction cost index (2018 UK office = 1.0)



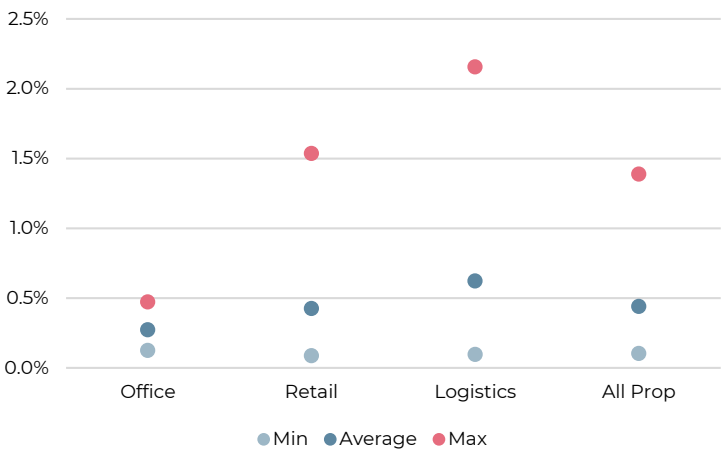
Sources: CRREM, ECC European Construction Costs, RLB Euro Alliance and AEW Research & Strategy

CLIMATE TRANSITION RISK PREMIUM

LOGISTICS TRANSITION COSTS DOUBLE OFFICES AS % OF PRICE

- Based on our five-step approach, our chart shows the aggregated results of the annual costs for energy intensity reduction as % of the average price or capital value per sector for Europe as a whole and a selected number of countries on an all-sector basis.
- European average transition costs for logistics are estimated at over 60 bps pa, which is more than double the near 30 bps for offices.
- This is more driven by the lower average price per sqm for logistics compared to offices than the % of energy intensity that needs to be dealt with over the holding period.
- The spread for individual countries around the European average for the office sector is much smaller than in both logistics and retail. Again this more driven by the difference in the average prices.
- Luxembourg records the lowest logistics and office premium, while France has the lowest retail transition risk premium.
- Sweden stands out as highest in offices and retail while Denmark comes top for logistics' transition risk premium.

Annual 2021-30 Costs of Energy Reduction as % of Price per sqm per property type (European average)

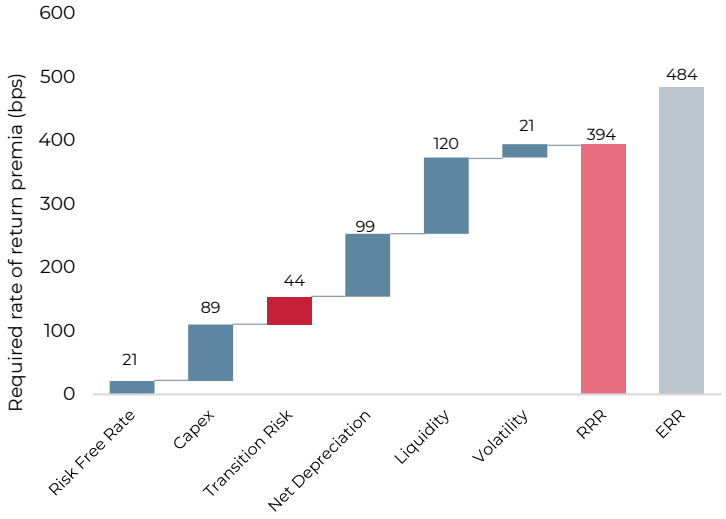


Sources: CRREM, constructioncosts.eu, RCA, AEW Research & Strategy

TRANSITION RISK PREMIUM FITS RISK-ADJUSTED APPROACH

- Given that our estimate for the required energy intensity reduction costs are specified per country-sector and a percentage of current prices, it can also be interpreted as a risk premium.
- Investors will require this premium to be compensated for the climate-related transition costs of energy intensity reduction.
- Over the last three years, we have introduced and expanded our risk-adjusted approach to include a wider range of markets globally.
- At this point, it proves convenient to add the new and separate risk of the climate transition to the required rate of return (RRR).
- In our schedule, we show the magnitude of the European average transition risk premium at 44 bps in relation to the other risk premiums. These were previously presented and updated in our May 2021 mid-year European Outlook.
- In the future, we plan to fully incorporate this climate transition risk premium into our overall European framework.

Required rate of return (RRR) vs expected rate of return (ERR) including the transition risk premium

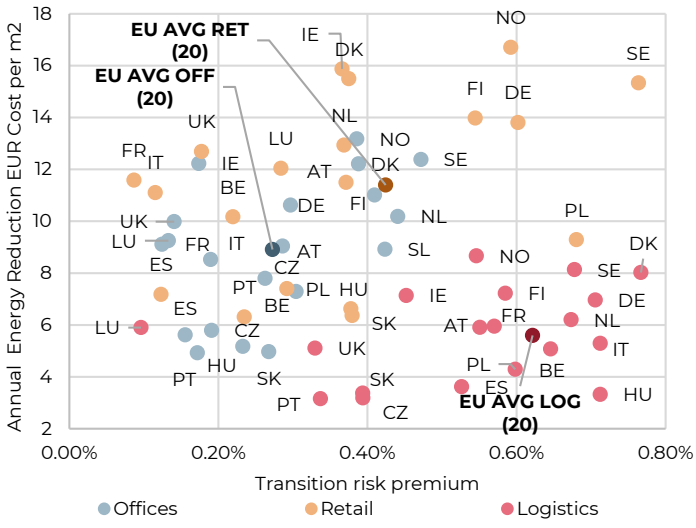


Sources: CBRE, RCA, INREV, Oxford Economics, OECD, CRREM, AEW Research & Strategy

TRANSITION PREMIUM NOT DIRECTLY LINKED TO COSTS

- Our scatter diagram shows both the absolute level of the annual energy reduction costs per sqm and the transition risk premium for each country-sector segment.
- The chart confirms that there is no strong positive correlation between the two variables. This is mostly due to the lower prices for logistics property, which increases the annual costs as a share of the capital value.
- Also, the chart clearly shows that the high construction costs pushes the transition premiums for the Nordic countries up significantly.
- Some data limitations might still be driving our results, as Luxembourg (LU) also shows low transition premiums for logistics and offices – likely caused by the limited number of high priced transactions.
- Please note that Slovenia was removed from this final chart for the lack of transactions and very low implied prices, which results in very high transition premiums as shown above.

Transition risk premium & energy intensity reduction costs per country property sector



Sources: CRREM, constructioncosts.eu, RCA, AEW Research & Strategy

SECTION 3: ACUTE & CHRONIC CLIMATE HAZARDS

MARKET SPECIFIC CLIMATE HAZARD MEASUREMENT

- As highlighted in our Feb-20 report, Munich Re prices risks on a wide range of different reinsurance policies for their clients.
- Based on their natural catastrophe risk models and historical claims experience, Munich Re quantifies future climate hazards under various RCP scenarios, as shown in the table.
- Since Europe is not subject to tropical cyclones, this acute climate hazard is measured but has a zero probability of occurrence.
- Sea level rise measurements are already in place, but since data on man-made defenses against sea level rises are not yet uniformly available across Europe full projections are not yet available.
- Data for five key European cities (Paris, London, Berlin, Madrid and Amsterdam) for both RCP 4.5 and RCP 8.5 scenarios for all four chronic hazards and the acute river flood risk was made available.
- To increase our accuracy, only the most actively traded and highest average priced office, retail and logistics investment markets were identified in each city.

MOST ACTIVELY TRADED MARKETS DEFINED

- To capture the climate impact for the most actively traded commercial real estate markets in Europe, we defined 20 property type specific clusters using the full history of investment transactions.
- In the absence of any useful independent sub-market boundary files, we defined the polygons of the sub-markets for each of the five cities in the table based on the proximity of the individual sales, the total trading activity and the average price per square meter. This was done using DBSCAN, a machine learning cluster algorithm.
- In some cases, we selected two sub-markets for a property type in a single city, like Berlin and Paris offices or Amsterdam and Madrid logistics.
- As a limitation to our accuracy, it should be noted that even though our polygons are defined on the basis of a single property type's sales, the climate hazard risks are estimated for all properties (regardless of property types) in that area.

CLIMATE RISK SCENARIOS LINKED TO LOCAL MARKETS

- RCP 4.5 and RCP 8.5 refer to two specific representative concentration pathways (RCP) or climate scenarios, as published by the UN Intergovernmental Panel on Climate Change (IPCC)
- RCPs reflect different greenhouse gas (GHG) concentration trajectories for the future assuming different scenarios for the timing and effectiveness of policy initiatives and how they impact on GHG emissions.
- RCP 8.5 is the worst case and assumes that only currently announced policy initiatives are implemented without any further actions, this would increase GHG emissions and temperatures by 3.7°C by 2100.
- RCP 4.5 is closely aligned with governments meeting the Paris-accord policy commitments and the temperature target of below 2.0°C degrees.
- Munich Re river flood data can be mapped for specific areas, like the Berlin Tempelhof area: prime logistics market outlined in red.
- The increased dark blue coverage on the map clearly confirms that under RCP 8.5 scenario a larger percentage of the area (as well as outside) will experience an increased probability of river flood.

Overview of physical climate change hazards

	Climate related Hazard	Type of Hazard	RCP Precision
1	Tropical cyclones	Acute	Yes
2	River flood	Acute	Yes
3	Sea level rise index	Chronic	No
4	Fire Weather Index	Chronic	Yes
5	Drought Index	Chronic	Yes
6	Heat stress index	Chronic	Yes
7	Precipitation Stress Index	Chronic	Yes

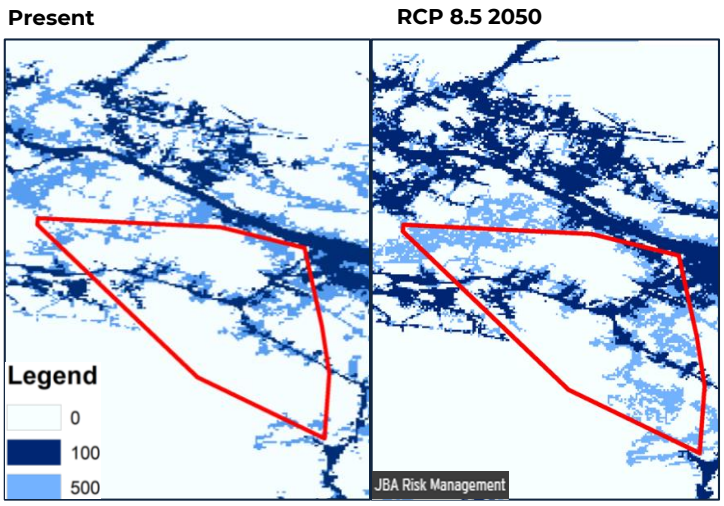
Sources: Munich Re, AEW Research & Strategy

Overview of 20 sub-markets per property type

	City	Offices	Retail	Logistics
1	Amsterdam	Centre	Kalverstraat	Harbour
				Hoofddorp
2	Berlin	City East	Tauentzien-Strasse	Tempelhof
		Postdamer Platz		
3	London	West End	New Bond Street	Heathrow
		City		
4	Madrid	CBD	Sol-Preciados	Las Castellanas
				San Fernando
5	Paris	CBD	Avenue de Montaigne	Orly
		La Défense		

Sources: RCA, AEW Research & Strategy.

Berlin Tempelhof (Ber – log) River flood risk



Sources: Munich RE, RCA, AEW Research & Strategy.

Probability of occurrence: 100 means once every 100 years, 500 means once every 500 years.

DEEP DIVE INTO RIVERFLOOD RISK

BERLIN & MADRID EXPECT BIGGEST INCREASE IN RIVER FLOOD

- The area weighted probability of annual flood occurrence is calculated using the estimated return period (0, 100 and 500 where 100 means once every 100 years) and the share of each polygon covered by each return period.
- The current average annual probability of river flood across our five cities is around 0.19%. This means that 0.19% of the covered market areas is flooded once a year. This is expected to increase by 2050 to 0.20% and 0.22% in the RCP 4.5 and RCP 8.5 scenarios, respectively.
- The increase in the annual probability over the next 30 years is largest in Berlin and Madrid due to local climate circumstances.
- Despite showing the highest current annual probability of the river flood in Paris, it is not expected to increase further.
- On the other extreme, the annual probability of river flood in London is lowest and not projected to change much.
- Despite its below sea level location, its advanced flood management systems leave Amsterdam with low and virtually no increase in river flood annual probability, irrespective of RCP.

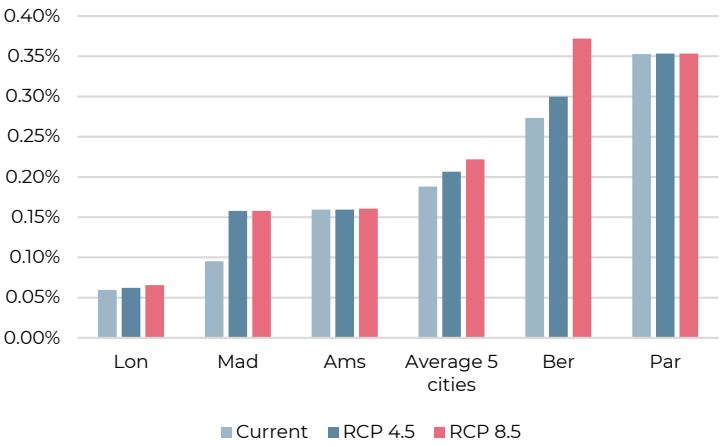
HIGHEST PROBABILTY OF WET FEET IN RETAIL

- When switching from the city to property type level, the results indicate that retail has the highest annual probability of river flood. This is partly explained by the Avenue Montaigne sub-market that we use for the prime retail market in Paris.
- Also, based on the RCP 4.5 and RCP 8.5 scenarios, the increase from an absolute perspective is highest for retail. But, from a relative point of view, the increase in logistics is higher as it comes from a lower starting point.
- In the RCP 4.5 and RCP 8.5 scenarios, we observe that prime office locations are the most stable as the increase in the probability of river flooding is not increasing to the extent as that for the other sectors.
- Finally, the annual probability of a river flood happening ranges from just above 0.30% for retail to around 0.22% for Logistics and 0.16% offices according to the RCP 8.5 scenario by 2050.

INCREASE IN INSURANCE COSTS TIED TO HIGHER RISK

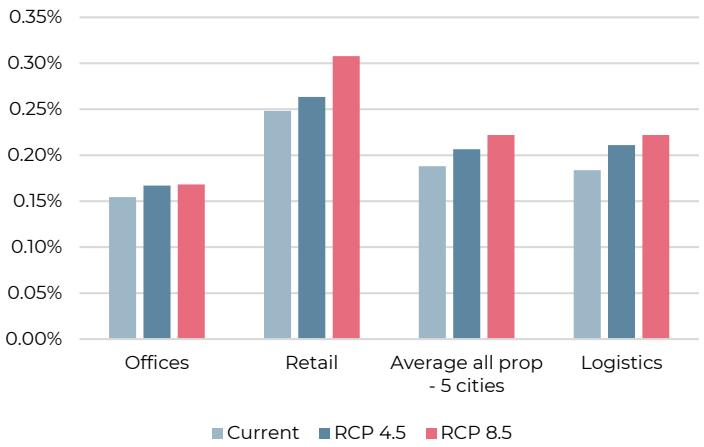
- Our scatter diagram shows both the estimated increase in river flood insurance cost and the change in probability of river flood occurring for each of our 20 sub-markets in our five city test sample.
- The best fitted line shows a strong positive correlation between the two variables, as indicated by the high R2 value. In other words, when risk steps up the insurance costs are also expected to increase.
- If a building is worth EUR 60mn and would be subject to a climate-induced increase of insurance cost of EUR 0.6mn over the investors' assumed 10-year holding period, the increased cost in insurance for the holding period would be one percent of the replacement cost. Please note that the replacement costs might not be similar to the market value.
- As highlighted above, most of the 20 market segments are near the zero marks – showing no change in river flood risk or insurance costs, especially in Paris, London and Amsterdam.
- Berlin retail and Madrid logistics and offices are the outliers showing large increases in insurance costs – not always fully explained by the changes in risks.

Area weighted probability of annual flood occurrence by city (average) and RCP 4.5/8.5 2050 scenario vs current (%)



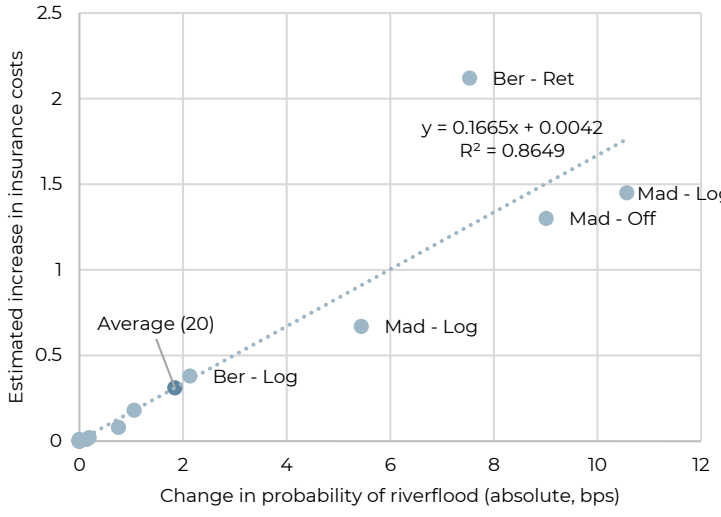
Sources: Munich Re, RCA, AEW Research & Strategy

Area weighted probability of annual flood occurrence by property type and RCP 4.5/8.5 2050 scenario vs current for the 5 cities (%)



Sources: Munich Re, RCA, AEW Research & Strategy

Increased insurance costs vs River flood probability by segment (%) – current vs RCP 4.5 2050 scenario



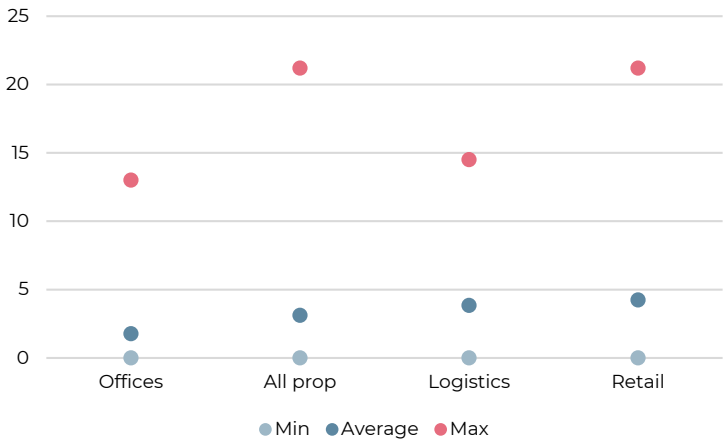
Sources: Munich Re, RCA, AEW Research & Strategy

DERIVING A PHYSICAL CLIMATE RISK PREMIUM

RIVER FLOOD RISK PREMIUM AT 3 BPS PA

- Our river flood physical risk premium for each market is calculated based on Munich RE's climate induced increase of insurance costs, as explained above.
- As shown, the results indicate that the premium varies widely across sectors and cities for our 20 market segments.
- 10 of our 20 segments show a zero risk premium with no increase in risk of river flooding, with another 4 segments at below 15bp increase.
- When looking across the sectors we observe that for the office sector the range is smaller than for the other sectors. For the retail sector the risk premium ranges from o to 21bps per annum.
- Please note that river flood risk is directly tied to location and the definition of the sub-market, not the property type.
- In fact, across our universe the average increase insurance cost is calculated as 31 bps for a 10-year holding period. This means that across our sample a 3 bps annual river flood risk premium applies.

River-flood risk premium per property types (bps)

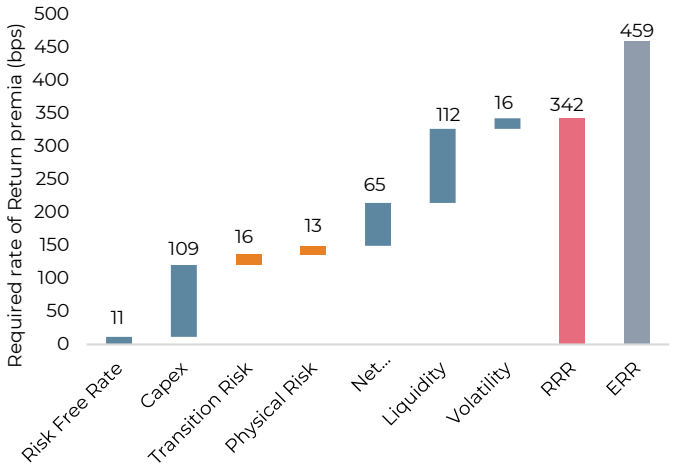


Sources: Munich Re, RCA, AEW Research & Strategy.

PHYSICAL CLIMATE RISK ADDED TO REQUIRED RETURN

- In the next step, we add the physical risk (of river flood) to the transition risk and develop a climate change risk premium that indicates the premium that investors would want to be compensated for in the future.
- To put this in context, we use the Madrid office market as an example for our risk-adjusted return framework. The results show a physical risk premium of 13bps per annum.
- When taking both climate change risk premia together, we observe a 29bps premium for the Madrid office market. To put this in context, our required of rate of return for the Madrid office market including climate risk will be 342bps up from 313bps originally.
- This is only a small increase compared to other markets but especially driven by Madrid's low transition risk of 16bps versus the European average of 44 on page 8.

Required (RRR) vs expected rate of return (ERR) including the transition and physical climate risk premiums – Madrid Office

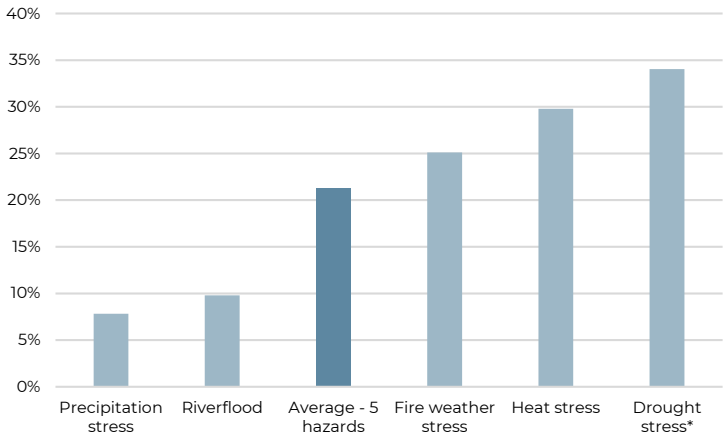


Sources: CBRE, RCA, INREV, Oxford Economics, OECD, CRREM, Munich RE, AEW Research & Strategy

OTHER PHYISCAL HAZARD COSTS NOT YET QUANTIFIABLE

- In our last step, we investigate the impact of chronic climate risk hazards occurring based the RCP 4.5 scenario to 2050. We do this by comparing the change in the underlying scores of the hazards.
- On average, the score across all the hazards increased 21% to 2050 from its current level.
- The drought stress is expected, based on the RCP 4.5 scenario, to see the largest increase in the score at just below 35%. On the other hand, precipitation stress is expected to see lowest increase at around 8% from its current level.
- However, based on Munich Re's experience, they are not seeing the same degree of potential damage on buildings from these other climate-linked hazards when compared with river flooding. This also limits their ability to incorporate the non-river flood hazard effects into increases in insurance costs.
- In the next phase, we would like to incorporate these chronic hazards into our risk-adjusted return framework. However, the current data doesn't allow this yet.

Change in probability * from current to 2050 per hazard for the RCP 4.5 climate scenario



*Sources: Munich Re, RCA, AEW Research & Strategy. *2030 vs 2050 for drought stress index.*

ABOUT AEW

AEW is one of the world's largest real estate asset managers, with €72.8bn of assets under management as at 31 March 2021. AEW has over 700 employees, with its main offices located in Boston, London, Paris and Hong Kong and offers a wide range of real estate investment products including comingled funds, separate accounts and securities mandates across the full spectrum of investment strategies. AEW represents the real estate asset management platform of Natixis Investment Managers, one of the largest asset managers in the world.

As at 31 March 2021, AEW managed €35.7bn of real estate assets in Europe on behalf of a number of funds and separate accounts. AEW has over 400 employees based in 9 offices across Europe and has a long track record of successfully implementing core, value-add and opportunistic investment strategies on behalf of its clients. In the last five years, AEW has invested and divested a total volume of over €21bn of real estate across European markets.

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