Climate Change Risks and Changing Face of Real Estate
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- Contribution of Real estate to climate change
- Targets for reduction of emissions leading to climate change
- Framework: direct and indirect effects of climate change on Real estate
- Changes in Real estate in different countries
- Ranking of different countries. Measurement methodology
- Conclusion
- Extension of Research
- References
- Author information
**REDUCTION REQUIREMENTS**

<table>
<thead>
<tr>
<th>Emission category</th>
<th>Region</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-250 per 10^13 t CO2</td>
<td>Annex I</td>
<td>-20% to -40%</td>
<td>-30% to -60%</td>
</tr>
<tr>
<td>Non-Annex I</td>
<td>Substantial deviation from baseline in Latin America, Middle East, East Asia and Central-Planted Asia</td>
<td>Substantial deviation from baseline in all regions</td>
<td></td>
</tr>
<tr>
<td>5-500 per 10^13 t CO2</td>
<td>Annex I</td>
<td>-40% to -60%</td>
<td>-50% to -70%</td>
</tr>
<tr>
<td>Non-Annex I</td>
<td>Deviation from baseline in Latin America and Middle East, East Asia</td>
<td>Deviation from baseline in most regions, especially in Latin America and Middle East</td>
<td></td>
</tr>
<tr>
<td>5-850 per 10^13 t CO2</td>
<td>Annex I</td>
<td>0% to -25%</td>
<td>-30% to -40%</td>
</tr>
<tr>
<td>Non-Annex I</td>
<td>Elsewhere</td>
<td>Deviation from baseline in Latin America and Middle East, East Asia</td>
<td></td>
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</tbody>
</table>

Regional breakdown and distribution of the actual emission reduction requirements (Source: IPCC 2007b, Fourth Assessment Report: Working Group III, Mitigation of Climate, Box 13.7, p. 776)

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**Managing Risks**

- (a) The Fallacy of Replication: “Properties that currently experience floods are of type x and not type y. Therefore, properties that experience floods in the future will also be of type x, and not type y.”

- (b) The Fallacy of Composition: “Significant financial safety nets are viable if a single area is flooded. Therefore, significant financial safety nets will be viable if all areas are flooded.” With respect to climate change, there are two important fallacies of composition worth highlighting, those with respect to (i) insurance markets, and (ii) state bailouts.

- (c) The Fallacy of Linear Scaling: “The impact of a flood of severity is of magnitude z. Therefore, the impact of a flood twice the severity of y will be twice the magnitude of z.” Labour market effect, Social network effect, Psychological and informational effect.

- (d) The Fallacy of Isolated Impacts: “The price of house A is reduced because it is flooded, house B is not flooded and, therefore, its price will not be reduced, irrespective of its proximity.”
Risks, Opportunities in Real estate

<table>
<thead>
<tr>
<th>Markets to invest</th>
<th>Investors pressure</th>
<th>Extreme weather conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncertainty</td>
<td>Temperature change</td>
<td>International response</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Climate related risks property</th>
<th>Material influence on production/facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain effect or physical risks due to high exposure of physical impacts of climate change</td>
<td></td>
</tr>
</tbody>
</table>
Scenario 1: Regional Divergence
Most likely scenario
Cost of Carbon $110/t CO2 e globally
Relevance to Real estate:
Policy changes and regulatory environment needs strong leadership for execution of emission reduction targets. So Real estate prices might be affected due to new policies, rules and regulations. Property taxes might include carbon tax.

Scenario 2: Delayed action:
Business as usual until 2020
Cost of carbon 15/ t CO2 e to 2020 then dramatic rise to $220 /t CO2 e
Global policy shock most likely.
Relevance to Real estate:
Investors panic and prefer investing only in green buildings. Tenancy agreements will be biased to new constructions rather than existing constructions.

Scenario 3: Stern Action
Market anticipates smooth adjustments and this is planned action to reduce the emissions. Cost of Carbon - 110 / t CO2 e globally.
Relevance to Real estate:
Policy and regulations impact on Real estate is less. Green consumers are aware of climate change. The stress to act under rules for emission reduction is less on property owners. Stern action is a planned action, however implementation has been difficult.

Scenario 4: Climate breakdown
Fossil fuels remain the main source of energy and hence the cost of carbon will be $15/t CO2 e limited to EU ETS.
Relevance to Real estate:
Minimum impact on property owners to take action. The concept of Green building environment will be on a back burner.
Sensitivity to climate change & Global emissions

Real estate sensitivity to climate change

<table>
<thead>
<tr>
<th>Climate Change Risk Factors</th>
<th>Real estate Core Unvisited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>High</td>
</tr>
<tr>
<td>Impacts</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>Policy</td>
<td>High</td>
</tr>
<tr>
<td>Overall climate change sensitivity</td>
<td>High</td>
</tr>
</tbody>
</table>

Real estate investment markets

Leading Real Estate Investment Markets
Scaled by Value of Investible Stock - 2007

Transparency Leads to Transaction Volume

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Conclusion

• Most of the growing economies have crossed the contraction stage
• Tenants are increasingly demanding greener facilities and many new firms are fully integrating their tenancy decisions into their sustainability reporting.

Risk quantification

\[ R_{it} - RFR = \beta_1 + \sum \beta_{ij} \times F_{jt} + \epsilon_{it} \]

- \( R_{it} \): the return for asset \( i \) at time \( t \) (synchronised for private equity / real estate)
- \( RFR \): the risk free rate (nominal 3 month treasury bills)
- \( \beta_1 \): the return factor \( j \) at time \( t \)
- \( \beta_{ij} \): the asset class specific premium (roll-yield, alpha or liquidity). A full multivariate model yells \( j \) into a set of different beta
- \( \epsilon_{it} \): sensitivity to unexpected inflation premium ("real asset" premium)
- \( \beta_3 \): sensitivity to equity premiums (\$S & P 500 – 3 month t.bills)
- \( \beta_4 \): sensitivity to small cap premium (Russell 2000 – \$S & P 500)
- \( \beta_5 \): sensitivity to term premium (Barclays Government bond index – 3 month t.bills)
- \( \beta_6 \): sensitivity to credit spread premium (Barclays high yield - Government)
- \( \epsilon_{it} \): the unexplained portion (error term, or residual)

Source: Mercer et al 2011
References

2. Bettina Furrer, Volker Hoffmann, Marion Swoboda, “Banking and climate change opportunities and risks: An analysis of climate strategies in more than 100 banks worldwide,” 2009
3. Diane Jeffreys, “Climate change: Risks & opportunities in the Canadian commercial real estate market,” KPMG LLP 2008

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