



## Climate change and residential real estate: what are the risks for the banking sector?

French residential real estate is already suffering the consequences of weather phenomena, particularly through the direct impact of natural disasters. This vulnerability is set to increase as climate change becomes more pronounced. Residential real estate is also a key sector in strategies for the transition to a low-carbon economy, which, if poorly anticipated or implemented in a sub-optimal way, can be a source of shocks for households or real estate values. Despite the exposure of residential real estate to climate risks, the transmission of these risks to banking institutions is not necessarily direct, notably because of the way credit is granted in France and the existence of risk pooling mechanisms. The purpose of this article is to clarify the exposure of French residential real estate to physical and transition risks and to characterise the channels through which these risks are passed on to the lending activities of the banking sector.

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Banque de France

JEL codes  
G21, G32,  
Q54, R31

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32%

of energy consumption in France concerns housing (Ministry for Ecological Transition, 2021)

×5 to ×6

possible increase in the cost of weather-related claims in certain French *départements* between 2020 and 2050 (ACPR, 2021)

97%

of households have taken out comprehensive home insurance in mainland France (Insee, 2020, 2017 data)

67%

of outstanding housing loans in France are guaranteed by a surety (ACPR, 2022)

### Main channels through which climate-related risks in residential real estate are transmitted to financial institutions

	RISK FACTOR	REAL ECONOMY	FINANCIAL SPHERE		RISK CARRIERS
PHYSICAL RISK	Clay movements	HOUSING Damage: structure, networks	INSURERS Home insurance/natural disasters		INSURERS/ REINSURERS
	Heat	...		Cat Nat guarantee <sup>a)</sup>	
	Flooding	HOUSEHOLDS Costs: repairs, rehousing...	INSURERS/ REINSURERS Compensation Reinsurance	CAISSE CENTRALE DE RÉASSURANCE Reinsures insurers	CAISSE CENTRALE DE RÉASSURANCE
TRANSITION RISK	Carbon tax	HOUSING Low energy performance Far from town centres...	Payment default		SURETIES
	Housing energy renovation obligation	HOUSEHOLDS Energy bill Cost of renovation ↳ Lower disposable income...	Non-mortgage loans	Mortgage loans	
	...		SURETIES Recovery or liquidation of the property	BANKS Recovery by sale of the property Outstanding capital due	BANKS

Sources: I4CE and Banque de France.

a) Natural disasters.



The summer of 2023 was the hottest on record at the global level, with an average temperature of 16.77 °C, i.e. 0.66 °C above the reference level (Copernicus, 2023). In 2022, France had already experienced extreme summer weather conditions, with a proliferation of violent storms, repeated heatwaves and exceptional drought (Météo-France, 2022), all of which contributed to forest fires on an unprecedented scale, both in terms of spread and location. In July 2022, France Assureurs estimated the damage caused to homes alone by the bad weather in June at more than EUR 1 billion (France Assureurs, 2022), and counted more than 930,000 new weather-related home claims over the full year (France Assureurs, 2023).

In addition, the real estate sector accounts for around 32% of energy consumption and 11% of greenhouse gas emissions in France (Ministry of Ecological Transition, 2021; Citepa, 2022). It therefore represents one of the key areas for the French economy's transition to carbon neutrality.

At the same time, French households spend EUR 551 billion on housing (22% of GDP in 2021), which is the largest item of expenditure for the poorest households (Insee, 2022). Finally, real estate accounts for 61% of household wealth and is the largest asset for households in the third to fourth decile (Insee, 2021; Bricongne et al., 2019), while 33% of households repay a mortgage (Insee, 2021).

Climate issues are therefore particularly significant for residential real estate, which is exposed to "physical"<sup>1</sup> and "transition"<sup>2</sup> climate risks. Although these climate-related dynamics and unprecedented developments primarily affect households and their homes, the banking sector cannot ignore them. With outstanding loans of EUR 1,286 billion and an annual amount of new loans of around EUR 218 billion (for 2022, excluding renegotiations), home loans in France account for almost 85% of outstanding loans to households in France, i.e. the bulk of new loans to individuals (Banque de France, 2023a – data as at April 2023).

However, climate risks associated with residential real estate are not necessarily directly transmitted to banking institutions. A number of risk pooling mechanisms exist that can reduce the banking sector's exposure and vulnerability.

The aim of this article is to specify the channels through which the climate risks to which residential real estate in France is exposed are passed on to banks in their lending activities. Examining the issues at stake for the real economy sheds light on the climate risks affecting residential real estate sector (see section 1). Analysing the existing risk management systems then enables us to describe the potential transmission of these risks to banking institutions and identify the end-bearers under current conditions (section 2). Finally, we discuss the sustainability of these systems in the light of increasing climate risks (section 3).

### 1 The growing exposure of residential real estate to climate risks

This section looks at the potential impact of "physical" and "transition" climate risks on residential real estate in France. In particular, it examines how these risks can affect housing and home-owning households, before analysing how they can affect the banking sector.

#### Exposure of housing and home-owning households to physical climate risks

The intense weather phenomena in recent years provide an overview of the climatic risks to which real estate is exposed. The shrinkage and swelling of clay soils, triggered by successive droughts and rains, as well as floods and major fires, have caused considerable damage to buildings. For example, from 1989 to 2018, the Caisse Centrale de Réassurance (CCR) estimated that the cost of compensating claims linked to the

1 Physical climate risks are the potential financial losses resulting from extreme and chronic weather events and their propagation through the economy and the financial sector.

2 Transition climate risks correspond to the potential financial losses resulting from efforts to restructure the economy and the lifestyles people adopt towards a low-carbon system, in order to limit global warming to 1.5-2 °C. These efforts may be based on changes in policies, technologies and behaviour, and may also lead to litigation, for example.



shrinkage and swelling of clay as a result of natural disasters was EUR 12.3 billion (out of EUR 78 billion for all weather events combined) – French Ministry of Ecological Transition and Regional Cohesion (a); see also Fondapol, 2020. Other weather phenomena can also affect real estate, such as erosion of the coastline as a result of rising sea levels, or landslides.

These weather phenomena can have a direct impact on property, causing considerable damage that requires repair work or even rebuilding (or relocation if there is a risk of the damage occurring again). In the current climatic conditions, the whole of France is exposed to these risks, but in an uneven manner, due in particular to the local determinants of the various weather events (Météo-France, 2020).

Weather phenomena in France are likely to worsen over the coming decades, with more frequent and intense weather events. In addition, exposure (concentration of population and assets in areas at risk, etc.) and vulnerability (resistance of buildings) also contribute to increasing damage. The estimated cost of climate-related events could thus double by 2050, to stand at EUR 143 billion (France Assureurs, 2021).

Beyond the loss of property value caused by extreme weather events, climate change could also impact property value more indirectly. Extreme but also chronic weather phenomena in the more or less close vicinity of housing can adversely affect access, use or even attractiveness of the housing (e.g. housing located in an area where outdoor activities are compromised, logistical chains disrupted and household employment impacted). Similarly, a property's unsuitability for new weather conditions can reduce its value, regardless of natural disasters. Its design may simply be ill-suited to heatwaves or new water conditions.

### Exposure of housing and home-owning households to climate transition risk

The structural changes needed to make the transition to a low-carbon economy may give rise to transition risks for residential real estate, particularly if they are poorly planned or occur in an unfavourable context. While an increase in carbon prices and its impact on energy costs

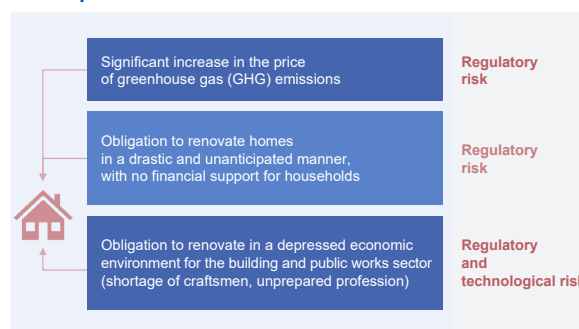
are well-identified risk factors, others could emerge, and even interact, reinforcing their impact on the real economy (see Diagram 1).

For example, the existing stock of housing is subject to energy renovation obligations applied to homes with an Energy Performance Assessment (DPE) score of G, F and E, gradually over time (see Appendix 1). In the future, these policies could go even further by requiring that the entire housing stock be renovated to reach a score of A, B or C. Such obligations could put households in financial difficulty. They would have to bear the financial cost of extensive renovation work in order to be able to rent or sell their property, which would lead to a potential loss of income or (at least relative) depreciation in the value of their assets (I4CE, 2021).

Not all households are equally vulnerable to these different transition risks. For example, a household living in a home heated by fossil fuels could face an increase in costs linked to the price of carbon, while households owning a property known as an "energy sieve" (DPE score of F or G) could be faced with an energy renovation obligation. At 1 January 2022, "energy sieves" accounted for 20% of homes in France (Ministry of Ecological Transition, 2022b), while more than half of French homes were still heated by fossil fuels in 2020 (Ceren, 2022).

Other variables can increase households' vulnerability, notably their level of income. A modest household that owns and/or lives in an "energy sieve" may be less able to respond financially to a rise in energy prices or an obligation to renovate. At 1 January 2022, 1.9 million households belonging to the first two income quintiles lived

### D1 Examples of risk factors that could affect the real estate sector



Source: I4CE (2021).



in an “energy sieve” (Ministry of Ecological Transition, 2022a). Households’ level of income is all the more important as the share of the budget allocated to housing is relatively high: on average 19.7% in 2017, and 32% for households in the first quartile (Insee, 2021).

## 2 The transmission of climate risks to the banking sector is limited by specific pooling mechanisms

Residential real estate and households are exposed to both physical and transition risks. However, these risks are not directly passed on to the banking sector via credit risk, particularly given the existence of risk pooling mechanisms and the attention paid to lending standards in France (priority given to assessing household solvency, control of borrowers’ repayment burden).

### The Cat Nat scheme: extensive cover against physical risks

In France, insurance against damage to property caused by natural (non-agricultural) risks is governed by a standard contractual insurance system for insurable risks, such as storms, and by the natural disaster compensation scheme (“Cat Nat” scheme)<sup>3</sup> for non-insurable risks. Created in 1982, this scheme requires all property damage insurance policies to include a guarantee against natural disasters, offering a cover that significantly reduces their vulnerability to a full range of physical risks. This means that individuals and businesses can choose whether or not to take out comprehensive insurance, knowing that, if they do, this insurance will automatically cover them against natural disasters.

The French government supports the scheme through the Caisse Centrale de Réassurance (CCR), of which it is the sole shareholder and to which it provides an unlimited guarantee. The scheme is financed by a flat premium surcharge equal to a fixed percentage of non-life insurance premiums. The fact that premiums are not risk-specific ensures solidarity at national level, but also prevents the disclosure of the “price of risk” and helps to disconnect real estate prices in France from the real estate’s exposure to physical risks. The impact on real estate prices seems to be all the more limited in that

the properties most exposed to climatic events may also benefit from amenities (for example, the proximity of a river or seafront, which can be valued in prices).

The existence of this Cat Nat scheme has two consequences in terms of passing on to the banking sector the exposure of residential real estate to physical risks. On the one hand, most households are covered against the risks with the heaviest and sharpest financial consequences: the impact of an extreme weather event on banks’ measurement of their credit risk is only indirect. On the other, since the CCR largely covers this risk, the liabilities for insurers (excluding the CCR) are limited to the least significant damage.

### The transmission to credit risk is limited, notably due to guarantee mechanisms

Certain measures designed to promote the transition, such as gradual rental bans based on energy performance classes and exposure to physical risks, will affect real estate prices. However, the impact of these market dynamics on French banks’ credit losses should remain limited for two main reasons.

First, the French system tends to decouple the probability of payment default from real estate price trends, making the loss given default relatively insensitive to the value of the property. This is because a housing loan is granted primarily on the basis of an assessment of the borrower’s ability to repay (rather than on the value of the property). In principle, the borrower is required to repay the entire capital owed. In addition, unlike in other jurisdictions, it is not possible in France to take out an additional loan by taking advantage of the revaluation of one’s property. Similarly, faced with a downturn in the real estate market, there is no incentive for homeowners to strategically default, particularly as housing loans generally carry a full right of recourse.<sup>4</sup>

In addition, when a borrower defaults on a loan, losses for banks are limited thanks to credit guarantee mechanisms. In France, over 67% of outstanding housing loans are guaranteed by a surety. This is a national specificity: if the borrower defaults on payment, the guarantor reimburses

<sup>3</sup> “The effects of natural disasters are considered to be uninsurable direct material damage caused primarily by the abnormal intensity of a natural agent [...], when the usual measures to be taken to prevent such damage could not prevent it from occurring or could not be taken” (article L. 125 1 of the French Insurance Code).

<sup>4</sup> Unlike in other jurisdictions, the framework established by the legislator guarantees that the borrower remains liable for the balance to be repaid, and therefore creates no incentive to deliberately stop debt repayments when the market value of the property falls below the amounts due.



the bank, before recovering the claim by restructuring the loan or seizing the property. This mechanism reduces the direct credit risk for banking institutions by passing it on to all borrowing households in a risk pooling mechanism. When a loan is taken out, each household pays into a mutual guarantee fund that absorbs losses in the event of default, with the provisioned surplus returned to the households once the loan has been repaid. This mechanism makes it possible to decouple losses from real estate prices.

Finally, these mechanisms mitigate the risks borne by credit institutions. The risk to the value of the real estate is structurally limited, while the risk to income is managed as part of the lending decision and borne by sureties. The main vulnerabilities stem from more indirect impacts, notably on economic activity or on the income of future borrowing households. Banks are therefore not the first to be impacted by climate risks in residential real estate, which are shared between several risk carriers: sureties, insurers and reinsurers and, lastly, the CCR, for natural disaster risks (see Diagram 2).

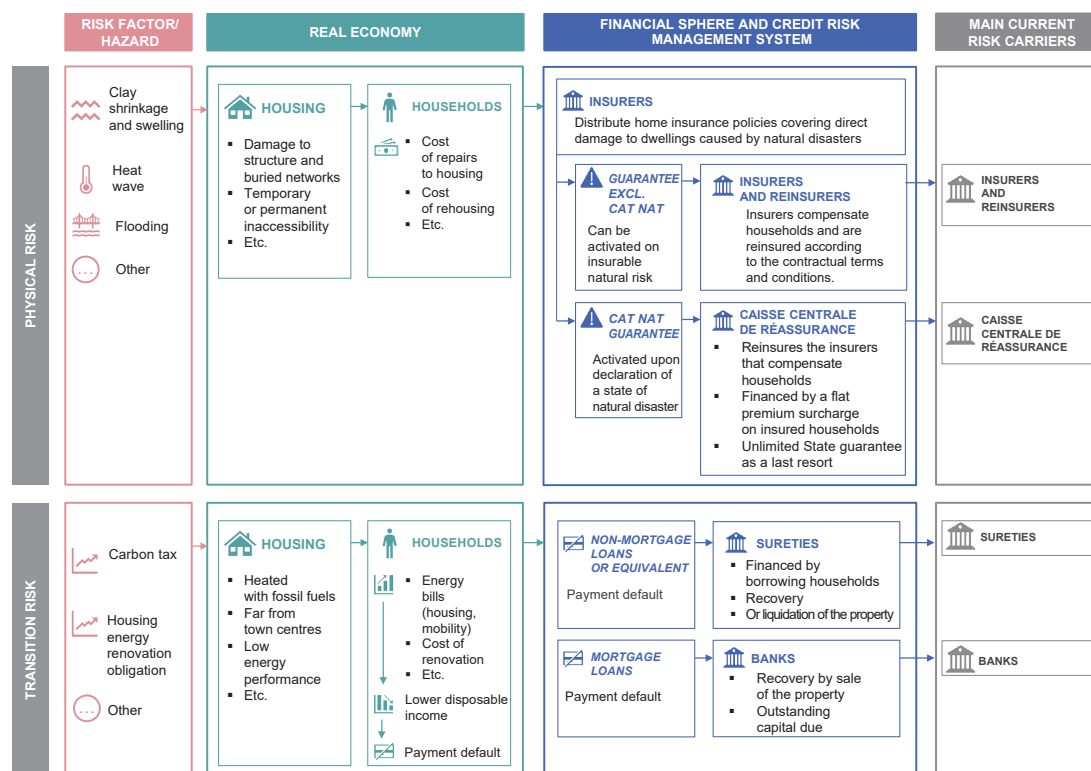
### 3 How sustainable are risk pooling mechanisms in the light of the challenges posed by climate change?

At present, the banking sector's exposure to climate risk through residential real estate seems to be under control. However, this situation is likely to change. On the one hand, the systemic dimension of climate change (repeated, increasing shocks occurring simultaneously or close together over time, non-linear impacts) could severely affect the economic system and undermine the current principles of risk pooling. On the other hand, any delays in the adaptation and/or transition process could result in an increase in the vulnerability of residential real estate to climate risks, which would call for a review of the analysis.

#### The Cat Nat scheme: financial sustainability and incentives for adaptation

As regards physical risks, as mentioned above, climate change will increase the frequency and

## D2 Mapping of the main credit risk transmission channels



Sources: I4CE and Banque de France.

Note: Sureties are mainly owned, individually or collectively, by banks.

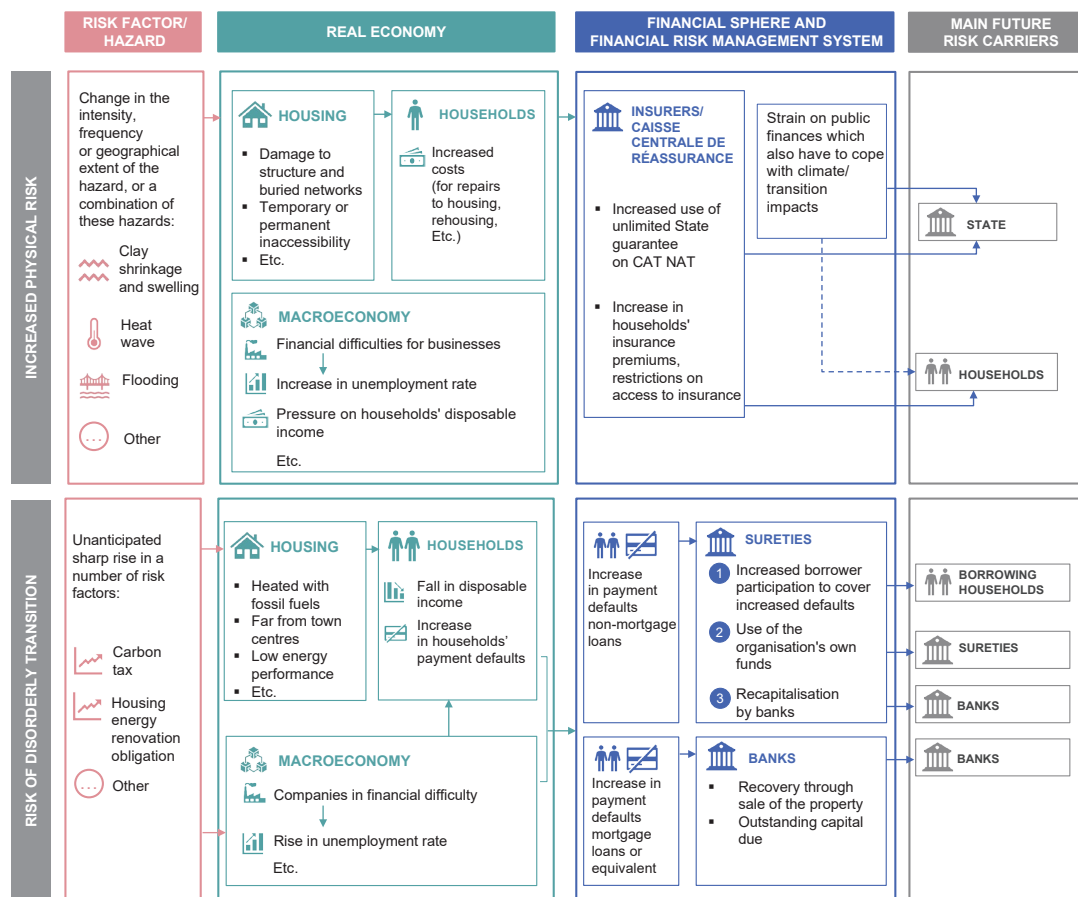




intensity of natural disasters, with the mechanical consequence of heightening the exposure of the French housing stock and raising the claims ratio. According to the *Autorité de contrôle prudentiel et de résolution* (ACPR), the claims ratio could rise by a factor of five or six in the French *départements* most affected (ACPR, 2021). The CCR and Météo-France (2018) estimate that, by 2050, the natural disaster compensation scheme (Cat Nat scheme) will have to cope with a 30% to 50% increase in the cost of these disasters.

The intensification of climatic shocks raises the question of the financial sustainability of the Cat Nat scheme in its current configuration and could require a change in insurance coverage (cf. scope of natural risks covered,<sup>5</sup> notion of “exceptional”<sup>6</sup> state of natural disaster – Senate, 2023) and/or an increase in premiums.<sup>7</sup> Irrespective of this increase, the insurance gap is already high in certain areas that are particularly exposed to climatic risks. For example, overseas territories, which are highly exposed to tropical perils such as cyclones and storms, have a much lower rate of insurance cover than mainland France (see Appendix 2).

### D3 Main risk carriers in a context of disorderly transition and/or increased physical risks



Sources: I4CE and Banque de France.

<sup>5</sup> Natural risks that are deemed insurable are not covered by the Cat Nat scheme. Storms, hail and snow, for example, are covered by a specific scheme (TGN, “garantie tempête, grêle et neige”).

<sup>6</sup> The Cat Nat scheme is based on the prior recognition (by interministerial decree) of an “exceptional” state of natural disaster, which is assessed in particular on the basis of the intensity and frequency of the phenomena compared with observed regularities.

<sup>7</sup> According to the *Autorité de contrôle prudentiel et de résolution* (ACPR) in its physical risk scenario, an increase of between 130% and 200% over 30 years in France. Discussions are also being held on the possibility of raising the natural disaster premium surcharge from 12% to 18% of premiums in non-life insurance policies, i.e. an increase of 50% (in practice, a few euros a month on average) – see Senate, 2019.



While a wide range of extreme weather events remain covered by the Cat Nat scheme, the State – and therefore public finances – will have to bear a large part of the risks brought about by climate change for the housing sector (see Diagram 3 above). For European countries, the impact of weather events on the budget balance is still considered to be limited (-0.74% of GDP), but it could rise as climate change worsens (Avgousti et al., 2023). Households are also likely to be affected by increases in home insurance premiums (and indirectly through the impact of the Cat Nat scheme on public finances). These dynamics heighten the need to monitor and anticipate these new risks, in order to contribute to the implementation of adaptation policies that encourage players to adjust their decisions and prepare for the changes to come.

### A gradual increase in vulnerability to climate risks?

At present, the exposure of residential real estate to climate risks appears to be under control overall. However, this observation needs to be qualified on two counts: (i) adaptation and transition may prove insufficient or inappropriate, and (ii) transition may also be significantly delayed. In both of these cases, the vulnerability of residential real estate to climate change would persist and its ability to transition would be greatly reduced, with a greater repercussion on the real estate market.

The first scenario corresponds to a situation in which homeowners make poor choices in their retrofit investments in response to climate imperatives. One of the difficulties in this area stems from an approach to transition that does not consider the possibility of significant technological changes.<sup>8</sup> These inadequate adjustments commit resources in the short term for little benefit in the future (and even lead to the destruction of capital if they are reconsidered).

The second scenario relates to the dynamics of adaptation and transition of the housing stock. The current large pool of profitable energy-efficiency renovation work (Camilier et al., 2018) that has not been carried out suggests that there is a real risk of a very (too) gradual transformation. This risk is due to poor anticipation of the effects of climate change and/or transition policies, a lack of information among home-owning households about the investments to

be made, difficulties in finding qualified contractors and/or the necessary skills, and coordination problems that may involve or be compounded by financing problems.

At this stage, there seems to be an implicit preference for a gradual transition, particularly when it comes to acquisitions. If the pace of transformation of the housing stock is too slow (whether the number of renovations is insufficient and/or the work undertaken is incomplete – Ministry of Ecological Transition, 2022a), the necessary adjustment will be all the more drastic later on. This adjustment will carry risks in its implementation, in particular costs for households (which could result in an increase in their credit risk or a devaluation of their real estate assets) and/or for public finances.

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As a key sector in transition strategies, a factor of exposure to physical risks, the main asset in households' wealth and a source of systemic risk for the financial system, the real estate sector lies at the junction of climate and financial risks. However, despite the importance of real estate to financial institutions, the climate risks specific to this sector are not passed on directly to credit institutions. Various guarantee and insurance schemes currently protect them from the effects of climate risks. The main channel of transmission to the banking sector is therefore through households' income and repayment capacity, which could be affected by the rise in energy prices and its impact on economic activity.

However, given the possible concentration of these risks among a few players, both sureties and the Caisse Centrale de Réassurance, as well as the complex and unprecedented nature of climate change, this first assessment needs to be put into perspective. This assessment focuses solely on the credit risk associated with residential real estate, but the transmission to market risk should also be considered as real estate is also a major investment vehicle.<sup>9</sup> The ability of banks and insurers to devise and implement financing and insurance schemes that help to transform the French housing stock with a view to mitigating, preventing and adapting to climate change remains the best way of controlling climate risks.

<sup>9</sup> At end-2022, real estate held for yield purposes by financial investors ("commercial real estate") amounted to EUR 482 billion. In reality, commercial real estate only marginally covers the residential real estate examined in this article; see Banque de France (2023b) for an analysis of the financial stability issues related to commercial real estate.



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## Appendix 1

### Main climate-related regulations on existing housing in France

#### Main regulations in force at 1 January 2023

Life cycle of real estate investment	Nature of the obligation (reformulated)	Deadline		Legal reference Climate and Resilience Act <sup>a)</sup>
		Metropolitan France	Overseas départements	
Change in owner	When the property is sold, an energy audit must be carried out on the property if the initial Energy Performance assessment ( <i>diagnostic de performance énergétique</i> – DPE) score is: F or G E D	01/01/2022 2025 2034	2024 2028 2034	Article 158
Property rental	Rent increases prohibited in “energy sieves” (DPE levels F and G)	25/08/2022	01/07/2024	Article 159
Property rental	Rental prohibited for homes labelled: G F E	2025 2028 2034	2028 2034	Article 160
All buildings	Regional prefects may ban the installation and use of polluting heating appliances in their <i>département</i>	01/01/2023	01/01/2023	Article 186

a) Act No. 2021-1104 of 22 August 2021 on the fight against climate change and resilience building: <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043956924>

## Appendix 2

### Insurance cover in the French overseas *départements*

Overseas, where the Caisse Centrale de Réassurance (CCR) forecasts a 20% growth in claims due to the increased frequency of cyclones and rising sea levels by 2050 (CCR, 2020), far fewer households are insured (see table). According to Grislain-Létrémy (2018), the low rate of insurance take-up in the overseas *départements* is not mainly due to the price of insurance. It is due, on the one hand, to the fact that housing is of poor quality and therefore uninsurable, and on the other, to the expectation of aid (overseas relief funds, local authorities, non-governmental organisations, etc.) that replaces insurance.

#### Comprehensive home insurance take-up rate in France (%)

Mainland France	97
Guadeloupe	59
French Guiana	49
Reunion	68
Martinique	62
Mayotte	6

Note: Comprehensive home insurance includes a natural disaster cover.

Source: Insee, enquête Budget de famille (2020, 2017 data).



## Appendix 3 Institute for Climate Economics



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“The Institute for Climate Economics (I4CE) is a non-profit research organisation that provides independent policy analysis on climate change mitigation and adaptation.

We promote effective, efficient and socially-fair policies. Our 40 experts engage with national and local

governments, the European Union, international financial institutions, civil society organisations and the media. Our work covers three transitions – energy, agriculture and forestry – and addresses six economic challenges – investment, public financing, development finance, financial regulation, carbon pricing and carbon certification.

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### About Finance ClimAct

The Finance ClimAct project contributes to the implementation of France’s National Low Carbon Strategy and the European Union’s Sustainable Finance Action Plan. It aims to develop new tools, methods and knowledge to enable (i) retail investors to integrate environmental targets into their investment choices, and (ii) financial institutions and their supervisors to integrate climate issues into their decision-making processes and align financial flows with climate-energy objectives.

The consortium, coordinated by the French Agency for Ecological Transition (ADEME), also includes the French Ministry of Ecological Transition and Solidarity, the Autorité des marchés financiers (AMF), the Autorité de contrôle prudentiel et de résolution (ACPR), the 2° Investing Initiative (2DII), the Institute for Climate Economics (I4CE), the Institut de la finance durable (formerly Finance for Tomorrow) and GreenFlex.

Finance ClimAct is a first-of-its-kind programme with a total budget of EUR 18 million and EUR 10 million in funding from the European Commission (under the LIFE programme). It will run from 2019 to 2024.”



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