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# Flood risk insurance, mitigation and commercial property valuation



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## Introduction

The commercial property sector is an important economic engine that suffers loss and disruption as a result of flooding and may be at increased risk in the future (Committee on Climate Change, 2015). Commercial property transactions are an important part of a national investment portfolio (Savills, 2016) and any risk to these asset values can threaten local or even national economic stability. Furthermore, businesses operating within commercial property are a vital part of local economies and are integral to community recovery. Therefore understanding the impact of flooding on commercial property value and the potential to mitigate this impact through risk transfer and loss reduction measures for existing property can support sustainable property markets in areas at risk, as well as the communities they support (Tobin, 1979).

However property investment, and in particular non-domestic property investment form part of global investment markets and investment funds that may be at threat from flood risk (London Climate Change Partnership, 2009), there are also businesses operating trans-nationally with real estate portfolios to match. Investment managers' performance would be enhanced if understanding of risk pricing was developed on a consistent basis internationally.

Research on the value of property at risk of flooding or having been flooded has generally focussed on the residential property market. The majority of empirical studies, spread internationally, are transactional analyses of observed market price for example (Montz, 1993, Eves, 2004, Sirmans *et al*., 2005, Bin *et al*., 2008, Lamond *et al*., 2010, Pryce *et al*., 2011, Beltrán Hernández, 2016, Hirsch and Hahn, 2017). Studies have also used expert consultation to explore the process, rationale and causes of discounted valuation (Eves, 2004). Findings from these studies show large variation in the scale of impact observed on market price. Differences in value estimates for different national markets relate to information and perception of risk fostered through different regulatory and insurance

contexts (Yeo, 2002, Lamond *et al*., 2005). However there are also temporal variations in market price within national and sub-national markets that reflect the point in time value including economic conditions and saliency of risk (Eves, 2002).

Based on rational choice theory, studies in the USA have explored price differentials in relation to the extra cost of insuring against flood damage and loss (Skantz and Strickland, 1987, Bin *et al*., 2006). Theory also predicts impacts on market value proportionate to expected cost of damage repair where insurance is not available or not taken up (Tobin and Newton, 1986). Imperfect information, denial and heightened risk perception are expected to hamper market behaviour (Pryce *et al*., 2011) whereby value is based on perceived rather than actual risk or supported artificially through subsidised insurance. New information such as a flood event can therefore cause large and undesirable temporary adjustments in value that have the potential to become embedded into blight (Pryce *et al*., 2011).

Notwithstanding this, there is far less evidence in the commercial property market. It is not appropriate to assume that findings can be extended directly from the residential sector, although the same concepts are relevant to explore. Commercial property transactions are more likely to be for investment purposes and the proportion of non-domestic buildings that are owner occupied is much smaller (Property Industry Alliance, 2017). Thereby the purchase decision may often be arms-length, influenced by different factors. As pointed out by the Investment Property Forum (2015) valuation points and rental transfers may be more frequent whilst sales transactions are less frequent and transparent. Studies of the value of commercial properties at risk in the UK, in the absence of high quality transactional data, have canvassed expert views and gauged market perception from commercial property owners and occupiers. (Kenney *et al*., 2006, Bhattacharya *et al*., 2013). Kenney *et al*. (2006) noted the importance of insurance and complexity with respect to physical aspects of potential damage given the heterogeneity of non-domestic construction. Bhattacharya-Mis and Lamond (2016)

demonstrated that use class (such as retail vs industrial property), is a key factor in the vulnerability of property utility and value. They both point to a vulnerability in the UK market that is not yet realised in market price but has the potential to cause serious impact in the future if mitigation is not undertaken (Pottinger and Tanton, 2011). Recent work in the USA on hurricane risk by Eichholtz *et al* (2018) suggests a discount due to floodplain location on property price in the aftermath of Sandy around 11% and a study in St. Louis Missouri found similar effects, albeit not statistically significant, due to absence or presence of flood protection levees (Fell and Kousky, 2015). An Australian study also including some commercial property (Rajapaksa *et al*., 2016) found flood events were more important than the release of flood risk maps in changing property value. Authors also highlight the duty of the valuation professional to consider flood risk, thereby avoiding claims of negligence (Cradduck, 2016).

Insurance is seen as important since it provides, amongst other things, reliable compensation and as such supports recovery and reconstruction. Available research also suggests that insurance and regulation regimes influence the uptake of risk mitigation measures (Kreibich *et al*., 2007) and that the regimes vary across different international markets (Lamond and Penning-Rowsell, 2014). In contrast, government compensation independent of prior actions is assumed to discourage individual precaution and preparedness (Keskitalo *et al*., 2014).

Therefore the dual aims of the research were to develop an understanding of how different international insurance and regulatory regimes promote effective flood risk mitigation for commercial property; and to explore the consistency of international approaches to the valuation of commercial property at risk from flooding.

## Research Methods

An illustrative case study design was used to develop a cross country comparison whereby

cases are selected to reveal a broad range of experiences rather than be representative of an average example (Thomas, 2009). This approach is useful in order to illustrate different approaches, explore best practice and reveal whether outcomes are dependent on the specifics of the cases. Five countries (Australia, China, Germany, the USA and the UK) were chosen to represent different insurance and regulatory regimes as understood from previous studies of insurance systems (Lamond and Penning-Rowsell, 2014) and regulation (Defra, 2015). The research team included local researchers in each country with expertise in flood risk management and building pathology, and a common approach was adopted across the case studies to allow for cross comparison and synthesis of findings.

A qualitative approach was chosen to illuminate the complexity of the interactions between practice and governance of this rapidly evolving issue (Robson, 1993). The methods employed were: a systematic scoping review of literature and grey literature (Collins *et al*., 2015) to understand the prevailing regimes and opinions at a national level; and interviews with Built Environment professionals operating in the case study countries to understand their experiences and perspectives as practitioners with differing opportunities and constraints.

The quick scoping review used a systematic search of databases of academic literature and industry sources, as well as generic search websites. A PICO search query (Collins *et al*., 2015) was developed on the ISI web of science using terms related to commercial property, flooding, insurance and valuation that was used to search international databases with country delimiters. Websites of specialist organisations and local language journals and databases were also scoped by the country specialists.

A semi-structured interview approach allowed common themes to be explored across case studies, with the necessary flexibility (given different roles and responsibilities of interviewees) within, and across, case studies. A common set of interview questions was developed to explore themes identified through the literature review. Two of these themes

focussed on the role of flood insurance in the mitigation of flooding and the impact of flooding on commercial property value.

Experts with knowledge and experience of advising on flood risk were targeted in order to gain the most informed view from a small sample size (Silverman, 2013). Interviewees were therefore purposively selected through a combination of recruitment methods including social media, known experts, emails from the RICS (a global professional body for surveyors) to their commercial members and snowball techniques. Such a strategy was necessary given the expected diversity of roles and professionals involved and the rarity of individuals with specific flood expertise. A target sample of fifteen (15) semi-structured interviews in each case study was considered to be appropriate in advance as the point of theoretical saturation (Strauss, 1998; Gubrium, 2001). As interviews proceeded, the number of interviewees per country was adjusted as the local researchers judged understanding of the critical context had been achieved. Data were obtained from interviews with 72 Built Environment professionals from the five countries. The roles and division of the experts is shown in table 1.

INSERT TABLE 1 here

The interviews were transcribed, translated as necessary and coded in suitable qualitative analysis software (NVIVO and MAXQDA based on the availability at partner institutions) under a common set of initial and emerging themes. For this process a thematic content approach to analysis was employed (Braun and Clark, 2006), with each country expert creating an initial coding of interviewees statements and views under the initial themes. This was followed by team discussions of preliminary findings and proximal themes through which emergent themes and subthemes emerged. A second round of coding followed in which emergent themes and sub- themes were also coded in the data. This

allowed the data to be drawn together on a cross national basis under the themes and sub-themes.

## Results

The results of the literature review and interviews are combined below to provide a summary of the insurance regime in each country. This is followed by a thematic evaluation of the interview findings in relation to risk mitigation, through insurance and property valuation.

### *Insurance and risk management regimes*

#### *Australia*

Australian insurance policy-making originated from the policies of UK companies, prior to the 1968 'Gentlemen's Agreement' (Huber, 2004). Within a typical policy, 'flood' events were covered, even though the term itself was not defined (Australian Government, 2016). In 1984 the Insurance Council of Australia (ICA) provided a definition of flood[1] that was not covered by default enabling partial, or fuller, add on 'flood' insurance. However the definition is not clear as multiple interpretations have been applied over the three subsequent decades.

Following extensive flooding in Queensland in 2011, the Federal Government considered adopting a system of mandatory flood insurance. A National Disaster Insurance Review (National Disaster Insurance Review Panel, 2011) was undertaken; however, the government decided not to legislate, with the result that the definition of flood is still questioned and debated, and the lack of understanding of the difference between a flood and storm event remains (Australian Government, 2016).

[1] Described as 'the inundation of normally dry land by water escaping from the normal confines of any natural watercourse or lake whether or not altered or modified, or any reservoir, canal or dam'.

Participants noted that insurance terms of coverage vary from state to state, with each having different risk profiles. Insurers in more flood prone areas request that mitigation measures are adopted, or they impose penalties when mitigation measures are not adopted. An interviewee commented: *'Brisbane insurers are likely to be red hot on this, whereas in Sydney they wouldn't be because they've not had a lot of flooding here'.*

*China*

National government in China states that it encourages companies and citizens to participate in natural insurance programs in general according to the 2007 '*Emergency Response Law of the PRC'* Ministry of Housing and Urban-Rural Development, 2016). However, as noted by Shi and Liu (2013) there is no state provision for flood insurance and private companies therefore dominate the market.

Although commercial property owners, landlords or property management companies are required to purchase property insurance (Li *et al*., 2015) that covers a limited set of water damage problems such as rainwater leakage, blocked drainage, escape of water from pipes and surface water flooding. Fluvial and coastal flooding are not included, need to be purchased separately and are not mandatory.

Gaschen *et al*. (1998) stated that around 80% of property flood insurance schemes are purchased by large and medium sized commercial enterprises. According to interviews in the Greater China region, having property insurance is a common practice among land and property owners. However, they confirmed the limitations of coverage:

> *…as far as I know most of commercial properties are required to purchase the property insurance and it is combined with flood disaster, fire and other hazards …..,. So, I understand the property insurance that my clients purchase normally can cover the cost from surface water flooding includes fixing the lifts or escalators or the flood from pipe leakages and seepages, etc.*

Insurance coverage for fluvial, coastal or combined flooding is available from private insurers but is not compulsory. Commentators have noted that the availability of, and demand for, both bundled property insurance and extra flood coverage may be enhanced if urban provincial and local governments support the private insurers with the required risk information and financial support (Wang *et al*., 2012, Li *et al*., 2015).

*Germany*

Severe floods in the Rhine catchment in 1993 and 1995 initiated a change towards more integrated flood risk management in Germany (Bubeck *et al*., 2017). This was strengthened following the 2002 event (Kreibich *et al*., 2011) through the 5-point action programme for improvements in flood risk management, which led to amendments of the Federal Water Act. Private precautionary measures are expected from property owners in a floodplain in accordance with their resources and capabilities (Wasserhaushaltsgesetz (Federal Water Act), 2009).

Flood insurance is provided as commercial property insurance and 'all-risk' policies, covering direct damage to assets as well as losses due to business interruption (Jakli, 2003). Flood insurance penetration in Germany has increased strongly in recent years, but is still low in comparison with other countries such as the UK (Surminski and Thieken, 2017). There are large regional differences due to historical compulsory flood insurance in the former German Democratic Republic and in the federal state of Baden-Wuerttemberg (Schwarze and Wagner, 2004).

Decisions about availability of insurance for small companies (insured value < 2.5 million Euros) depend on the ZÜRS flood zoning system German Insurance Association (GDV) (GDV, 2016). Premiums and deductibles increase from zone 1 to zone 4, with properties in flood zone 4 (with floods expected more frequently than 1 in 10 years)

considered uninsurable (Schwarze and Wagner, 2004). An expert explained that the GDV has developed several non-binding adaptable insurance templates for small businesses. However, interviewees recognised that insurance terms are negotiated on a case by case basis with industrial and large commercial businesses.

In Germany, triggered by the 2002 flood and again by the 2013 flood, political debates took place about a compulsory flood insurance scheme. However, both initiatives failed, mainly due to governmental refusal to provide a guarantee for remaining risks (Schwarze and Wagner, 2004, Surminski and Thieken, 2017). The GDV together with engineers and Build Environment professionals developed the building certificate "flood passport (in German: Hochwasserpass)", launched in 2014 (Thieken *et al*., 2016). The impact in the commercial sector is unknown but there is no evidence of a positive effect on the implementation of precautionary measures for households (Osberghaus and Philippi, 2016).

*UK*

Commercial property insurance is provided by private companies in the UK and is not compulsory. Standard policies usually include coverage for flooding of all types, and 'business interruption' insurance can also be purchased to cover flood disruption. Evidence on the uptake of insurance among business properties from UK Department for Environment, Food and Rural Affairs (Defra) surveys (Dickman *et al*., 2015) and the Federation of Small Businesses (2015) suggests high level of penetration (95%) among small businesses with few problems of availability. Recent developments, that reduce the commitment of insurers to universal availability of coverage and the introduction of the Flood Re re-insurance pool (April 2016) that specifically excludes commercial property, may lead to large increases in premiums and excesses for small to medium businesses at risk. This may be an important consideration given that the availability of insurance is a material factor in the valuation of commercial assets (Kenney *et al*., 2005).

Bhattacharya-Mis and Lamond (2014) supports these findings, larger companies in their study were more likely to self-insure and they note that even small businesses may avoid claiming against their policy to avoid increases in premium. Large commercial concerns have long been excluded from guaranteed coverage (Huber, 2004).

Interviewees had limited knowledge about the details of insurance conditions. As one expert explained:

> *There is a bit of a gulf really between the technical engineering and property side of the flood problem and the insurance industry. The insurance industry, typically, has been quite black box with regard to flood risk …*

Another interviewee noted:

> *I suppose most commercial people go through a broker, to get their insurance, rather than just going online and getting insurance.*

However, they were aware that some companies that had been flooded were having problems obtaining insurance and that this was a serious issue to them.

*USA*

Under provisions of the US National Flood Insurance Program (NFIP), both commercial and residential properties located in the administratively-defined 100-year floodplain are required to carry flood insurance, with the cost of that insurance dependent on the elevation of the structures relative to the base flood elevation (BFE) and any mitigation that has been implemented (Hartwig and Wilkinson, 2005; Federal Emergency Management Agency, 2017). For commercial properties, rates are capped at $500,000 for both building and personal property (Federal Emergency Management Agency, 2013). While some of those interviewed agreed that the program encourages mitigation, the extent to which this requirement influences mitigation varies depending upon a number of factors including the age of the building, the size of the operation, and ownership characteristics. With respect to

age, it may be the case that the costs of mitigating older buildings and buildings with basements are so high that the offset in premium costs is not seen to make mitigation a good investment. At the same time, new structures must incorporate flood-proofing into their plans in order to obtain a building permit, typically through elevation above BFE.

Size of the business affects the willingness to undertake mitigation in several ways. For larger operations, the NFIP cap on flood insurance is often insufficient so these businesses may be required as a loan condition to carry both an NFIP policy and a private commercial policy. The extent to which this encourages mitigation is variable. As one interviewee put it:

> *my impression is that there is nothing other than a determination to say if you do or do not [need to] buy flood insurance. … It's not really an appraiser/client relationship where they are giving advice, it's more of a "here is what you need for the loan" file.*

Other large operations that are not subject to loan requirements will self-insure, so it is difficult to obtain information on the extent to which mitigation is used to reduce risk. Smaller businesses face different issues. As one professional noted, '*some businesses only have the money to keep the doors open and others have the resources to actually look into making their property safer.'* In many cases, small businesses are renters. Once an appropriate location is found, they typically do not think about flood risk and are not required to carry flood insurance. The owner of the building may have insurance but that does not cover the contents of the businesses, only the building.

***Take up and motivation for risk mitigation***

There was largely a consensus among the interviewees across countries that the insurance industry could have a major influence on the motivation of companies to take active steps to mitigate against flood risk. However, many perceived that this was not currently the situation with regard to all commercial properties in their markets and that insurers could do more.

This was the case despite differences described above in the regimes under which property insurance treats flood risk. Reasons offered to explain the perceived failure included two that were repeated across all five case studies: low take up of insurance policies and lack of a premium incentive to spend resources on mitigation.

*Low take up of insurance*

Low take up of insurance can be a reflection of lack of perceptions that flood risk is a serious threat to property and business:

> *…normally developers and the government are not foolish, they will not put developments into a high (flood risk areas), normally the drainage system is well equipped…(Chinese interviewee).*

Alternatively insurance may be unavailable or unaffordable in a particular flood zone (Germany, Australia). Lack of an insurance policy may be more prevalent in large companies because while smaller companies may be unwilling to bear risks, large companies can self-insure.

> *Supposing they've got, a thousand supermarkets, it'll cost them A$10 million a year to get .. insurance, they just don't insure, they do a self-insure…. if they lose a supermarket through a flood, they just rebuild/repair it. Each supermarket costs probably less than A$10 million to rebuild. As long as you don't have more than one flood in your portfolio in a year, you're ahead. (Australian interviewee)*

Even in the USA where taking up insurance is encouraged by the NFIP and mandatory in some circumstances, larger concerns may be underinsured. Commercial coverage through the NFIP is seen to be too low for many commercial entities, resulting in underinsurance. As respondents remarked

> *a lot of deals we do blow past the 500,000 dollar statutory max per building (US interviewee)*

> *We calculate the amount of insurance a business needs to comply with federal law. Example…$200,000 loan but building worth $500,000 – bank only requires $200,000 …. Can get more but typically only get what is required. No one has ever asked what can I do to lessen my risk. (US interviewee)*

Regardless of underlying causes, from a practical perspective, low levels of uptake subvert the influencing potential of the insurance mechanism. Consequently, some professionals called for more regulation that includes mandatory flood insurance.

*Lack of premium incentives*

There was a perception in countries where insurance is widely available that property owners and occupiers would regard insurance as an alternative to other mitigating action unless they were able to offset the cost of other mitigation via lower insurance costs. There are market specific considerations about the practicality of introducing premium incentives. In some markets, such as the UK, where premium for flood risk is concealed within an all risks policy, insurers may not be accurately or transparently pricing flood risk. In other countries, for example the USA, premiums have historically been subsidised, though there is some movement aimed at reducing or eliminating subsidies.

> *The pricing of flood insurance sends a signal to do mitigation and if you have a subsidized pricing structure then you aren't sending the mitigation message but if you have more actuarially rated policies then you are sending the message that if you mitigate it can reduce your insurance premium. (US interviewee).*

Interviewees recognised that this might be challenging to achieve given the level of understanding of the impact of mitigation on risk. Although there are several initiatives that exist or are emerging that could help in the process, currently no professional could identify such a neutral body and interviewees reflected on a lack of guidance available that insurers could use to price mitigation efforts.

*Flood experience and reinstatement*

A commonly mentioned route to influence mitigation occurs during the reinstatement of a property following flood. The reinstatement period is seen as a cost effective opportunity to install mitigation that is also linked to the widely acknowledged effect of flood experience on mitigation. One valuation expert in the US pointed out that a number of commercial entities are retrofitting types of mitigation after Hurricane Sandy. Similarly, following significant flooding in South Carolina in 2015, According to an interviewee:

> *I think that is why a lot of people are doing this [mitigation] right now, not so much the insurance side but more the disruption and the down time associated with it. (US interviewee).*

In such circumstances insurers may influence mitigation through information or encouragement of resilient reinstatement. However they may or may not have a role in planning and implementing recovery, particularly within commercial insurance markets where there may be a high degree of financial settlement: *'when I did work in Hull in 2007, people got a flood and never bothered doing any work, they just took the cash'* (UK interviewee).

In any case the costs of risk mitigation are not generally borne by insurers, because terms in insurance generally preclude "betterment", which is defined as the enhanced value of real property arising from local improvements.

> *They won't pay for risk mitigation, no. You'll find, with insurance companies, they'll repair what's already there, but if you want to put an improvement scheme in, they won't pay for it. (UK interviewee)*

Insurers may still have the potential to inform policyholders about resilience or to insist on physical resilience measures being installed as a condition of future coverage.

> *They push back on us saying; "Well what are you doing about mitigating the risk?" Premiums go up, deductibles increase. There's a big focus on what we're doing; to mitigate the cost to the insurer. (Australian interviewee).*

With the property owner paying for mitigation an increased interest in undertaking benefit cost analyses with respect to mitigation of flood risk and insurance has taken place following flood events in the USA, with an emphasis on how best to reduce future risk. Requirements for flood insurance have been influential in encouraging mitigation, but the results have been very context-specific with respect to different business characteristics.

***Impact on property value***

Interviewees generally concurred that the value of commercial property should be affected by the level of flood risk. As one commented: *'there has to be a difference in value between a property that floods and one that doesn't'* (UK interviewee). UK valuers also recognised it was part of their due diligence obligation to consider flood risk:

> *..So yeah, it is a key consideration for investors and therefore, as valuers, we need to put ourselves in the shoes of those investors and to consider the situation as we would expect them to consider the situation*. (UK interviewee).

However, interviewees from all countries felt that the realisation of this discount in market value is inconsistent due to: lack of awareness or low perception of flood risk; the perception among multiple stakeholders that flood risk is less important than other property characteristics; and a lack of guidelines or common practices that allow valuers to factor flood risk into property value, as described below.

*Risk awareness and perception*

Interviewees noted that businesses at risk, but not recently flooded, can have low spontaneous awareness of risk or perceive that the risk is not something they need to be concerned about. They pointed out that lack of awareness of risk is reinforced if property searches do not result

in disclosure and insurance is available regardless of risk. For investment and for business occupation, valuers' due diligence should result in risk discovery, however a lack of hazard maps (in China) and shortcomings of accessible hazard information (low resolution and lack of depth information in UK) as well as difficulties in interpretation (Germany) mean that this is not always meaningful discovery. In the USA one respondent remarked:

> *Real estate disclosure laws do more harm than good. People put too much faith in them. Hugely unreliable – usually tailored that only the previous owners' experience has to be disclosed*

*Other demand factors*

Other demand factors were highlighted by interviewees particularly for the case of central business districts where locational desirability is the dominant consideration.

> *...I have to mention one thing, because the current office and commercial property are very demanding in Chinese cities like Hong Kong and Shanghai, you can see the commercial property offices emptiness rate is very low especially the grade A and B offices, I believe even if the landlord were to increase the rent because of the insurance and other costs. This will not affect the situation (rental) too much.* (Chinese interviewee).

In high risk, high reward locations, no matter what the country, the demand for property remains strong:

> *You could have a property that does have an elevated level of risk, but if every other factor is a big tick and there's very few, other options in the vicinity, well you're gonna find a deal that gets done despite the flood risk issue.* (UK interviewee).

Similarly in Germany

> *In Germany there are companies located next to a large river. Despite this, the topic of flooding only plays only a minor role (also for the economic valuation). This is because the markets are so strong, that they consider these risks as unimportant.* (German interviewee)

Locational factors cited in the USA included water dependent businesses and the high

amenity associated with some areas at risk such as coastal areas. As one professional said: '*coastal development is already so rampant here so it's not like they are going shy away from a project because they are in a flood zone.'* (US interviewee).

However interviewees also noted that where choices were available between properties with high and low risk, the higher flood risk property would be less popular and valued lower: '*This means demand for properties in a flood zone is lower than for those behind a flood protection wall, with an appropriate reduction in price.'* (German interviewee).

Different sectors were also regarded as more or less vulnerable to flooding:

> *The government reclaim some land, they create sort of data centre area, where allocated land for data centre operator, now, that's interesting because if those data centres are at risk of the coastal foundation of water, … reducing its value … massively, because the one you want for the data centre is a safe secure location. If it so close to the water, I think it's a major major issue.* (Chinese interviewee)

*Temporal variability*

Lack of a structured way to price risk was reflected in the disproportionate reaction to an actual flood event and the impact of experiencing a flood. For example, one German interviewee noted that after floods in Germany, "*suddenly disproportionately high value markdowns occur, which are probably not risk appropriate*". Similarly in Australia after the 2011 Brisbane floods, one interviewee observed that; *"commercial investment slowed in Brisbane after floods, focus was on getting buildings back into operation not sale and acquisition, but people tend to 'forget".*

A flood event raises general awareness and, more importantly, perception that the risk is "real" and that the impacts can be severe. This effect was also seen in New York following superstorm Sandy;

> *If market participants believe there is a risk then it affects value. For example a shopping centre could be in a flood zone since say 1973 but has never flooded no matter what the risk* is, so value isn't affected but one flood can change that. (US interviewee)

Professionals interviewed also indicated that such overreactions can be driven by sharp increases in property insurance premiums after flooding, especially if some relatively expensive facilities or equipment are damaged causing unexpectedly high claims:

> *As far as I know in many cases, if it is needed to repair or fixing a lift/escalator in a commercial building (with 30th to 40th floors/levels - common height in the Greater China region) will approximately cost at least with $1 million (or more) Hong Kong Dollars (HKD) (equivalent to £100,000)*....(Chinese interviewee)

Disproportionate reaction causes volatility and could potentially lead to blight in less desirable locations. However, in general the market will return to equilibrium as was reported in Queensland where a rebound effect occurred, with an economic boost from rebuilding of 0.5% GDP, and also in Germany:

> *The evaluator will compare the property with comparable transactions in the surrounding area. If there has been a flooding event in the wider area, then the prices will be accordingly low. But if there has not been a flooding event for a longer period, then the prices will go up.* (German interviewee)

The consensus is that valuers base their market valuations on the available market intelligence and that may not reflect actual flood risk.

> *Appraisers reading the market. Putting together all the data and making judgment of the situation. Not appraiser judging, it is market judging. .... If market not concerned, won't be reflected in appraisal. .... No stigma, no impact* (US Interviewee)

*Risk information and interpretation*

From the investment valuation perspective, a more risk based approach to valuation of property at risk would be preferred but is dependent on the ability to assess risk accurately. As one valuer described it '*I think the cost of flood insurance in additional costs (affects value), so capitalized insurance costs gets factored into property value'.* (US Interviewee).

Availability and cost of insurance are important risk signals but, although insurance is important in order to facilitate sales and support property value (Kenney *et al*., 2006), it is not always rigorously evaluated during property transactions. Evaluation of risk by other means can be dependent on the impact of regulation and the provision of information about flood risk, for example in the form of flood zone maps. However, there may be lack of trust in the maps.

> *I just ran into a situation where one flood service said the property was not in a special flood hazard zone and another service said it was located in a special flood hazard zone. Data not consistent. And flood zones change.* (US interviewee)

Future risk is also important in valuation for investment, however significant uncertainties surround such estimates. Without reliable and accurate data and projections of risk, some interviewees are reluctant to disclose flood risk to buyers through concerns of prejudicing sales. Flood hazard maps have the potential to depress values in areas at risk as in Germany where one participant observed such an effect after the first round of flood risk management plans was produced towards the end of 2015 (European Flood Directive 2007/60/EC) .

The impact of risk mitigation on value is also unknown with some interviewees believing a flood event may even have a positive effect on the value of commercial property if mitigation measures are put in place after the flood:

> *So if a business, or a commercial property ..could demonstrate that significant flood resistance measures have been adopted. ...., then I'm sure that would have a positive effect on the valuation of the business, or the property itself.* (UK interviewee).

However they recognised that the scale and detail of such an uplift are problematic to estimate in the absence of consensus among the professions or recognition in the form of insurance discounts. Thus owners and occupiers may be deterred by mixed messages from different Built Environment professionals, government officials and insurers, and the real moral hazard where positive action is not recognised by lowering of premiums and inaction is

rewarded through compensation.

**Discussion**

The findings from the study of commercial property value at risk from flooding and mitigation through insurance broadly confirms many of the findings previously observed in the residential property market. These findings relate to a general lack of awareness of risk (Kreibich, 2011), lack of incentives to mitigate risk through insurance (Kreibich *et al*., 2007), lack of understanding of the impact of mitigation and lack of consistency in the reflection of risk in property value (Hirsch and Hahn, 2017). However there are some significant differences in the commercial market that require careful consideration.

The lack of risk awareness is not only on the part of property owners and occupiers but includes many professionals that may advise them. Shared understanding of risk is a pre-requisite for shared understanding of impact and routes to mitigation. Provision of this information is generally considered to be the role of governments, eg the European directive (European Flood Directive 2007/60/EC). Raising awareness and generating common risk perception is also often a governmental goal often delegated to governmental or non-governmental agencies. Maintaining this awareness is an acknowledged challenge, however annual reminders through insurance renewal has been proposed as one potential way to increase saliency. This has significant policy relevance such as opportunities for strengthening the link between insurance and risk reduction measures (Hudson *et al*., 2017).

Findings emphasised the importance of insurance, in keeping with theoretical stances of insurance as a societal good that covers residual risks and enables recovery (Association of British Insurers, 2005, Lo *et al*., 2015). Insurance is also a pre-requisite for due diligence and therefore a material factor in investment valuations. Interviewees also called for insurers to do more to incentivise mitigation and this has been discussed in the literature as a way to avoid increase in societal risk from moral hazard (Kunreuther, 2006). However, while

anecdotal evidence of moral hazard exists in the UK recent empirical results from Germany and the US question the prevalence of such attitudes in the residential sector (Hudson *et al*., 2017).

Interviews indicated that in comparison to the residential sector, penetration of insurance is lower and commercial property is less likely to have comprehensive coverage for flood risk, and is more likely to self-insure. This concurs with recent observations in Missouri (Fell and Kousky, 2015), it follows that the tendency for moral hazard is lower but also that adverse risk selection may be more likely in commercial premises. Therefore the relevance of calls for incentives for mitigation through insurance mechanisms in the commercial property market may currently be seen to be lower than that in the residential sector. Yet, in the USA, mandatory flood insurance has been seen by some interviewed to have a positive impact on implementation of mitigation measures despite some limitations in the specific types of risk mitigation they incentivise. Institutional investors and lenders could have a strong influence where they are involved (Ball *et al*., 2002, Teicher, 2018). Therefore while there is evidence that insurance can play a significant role in encouraging anticipatory flood risk management, more research is needed in context to understand the way this might provide incentives for commercial property owners and investors.

Lack of consistency is evidenced in valuation of properties at risk within and across countries and over time. In this respect the commercial property market is similar to the findings within the residential sector in the UK and Australia (Eves, 2004). The findings also support studies in the UK regarding commercial property (Bhattacharya-Mis and Lamond, 2015, Bhattacharya-Mis and Lamond, 2016). While the quality of risk information available to valuers varies, the difficulties previously reported in the UK appear across all countries studied in terms of understanding how to interpret risk information in order to apply flood discounts. Sector specific considerations are highlighted with risk largely ignored in the high

demand for premium commercial real estate. Different locational factors are offsetting risk in the commercial sector (eg high street position) than in the residential sector (waterfront location), although waterfront location is important, indeed vital, for some commercial sectors. Heterogeneity in the commercial sector adds to the complications in valuation and mitigation advice. Many interviewees recognised the need to explore mitigation for commercial property, perhaps as an alternative to insurance or as a means to keep insurance costs low. This finding sets commercial property apart from studies of the residential market where insurance or compensation is the more expected approach. The potential to treat properties on a case by case basis, scale of investment, increased involvement of advisers and property professionals in the commercial property world may explain this difference.

There were differences in the attitudes expressed in regard to valuation for sale or for investment, more pragmatism is seen on the ground where specific locational or operational advantages offset risk. The study therefore reveals heterogeneity in the approach to valuation due to purpose of the valuation and client goals, as well as in sector and scale of business that the limitations of this study do not allow us to unpick. However the study points to the need to harmonise approaches and increase consistency in order to incentivise mitigation.

**Conclusions**

The research has highlighted that understanding the link between flood risk, insurance, flood mitigation and property value is important in the maintenance of commercial property value and business prosperity. This is therefore of value to businesses and economies that are threatened by flood risk. It is also of value to investors and their support network of Built Environment professionals in managing sustainable investment portfolios.

While discounting due to flooding, or flood risk, is sometimes observed it is far from universally applied and is often time limited as market value relies on risk perception that varies due to saliency of recent flood experience. Heterogeneity in the commercial property

sector and the primacy of business location in certain sectors adds to the difficulties faced by Built Environment professionals in taking a unified view of risk. There is no consistent approach that valuation professionals use to reflect flood risk within or across national markets and therefore investors may need to recognise volatility associated with such valuations. The use of a cost based approach (estimated damage and loss/cost of insurance/cost of compliance with codes) may be appropriate, but guidance is needed and caution needs to be observed in the application of valuation based on rapidly changing risk designations. The adoption of such guidance may need to be supported by changes in government regulations on risk disclosure and transparency in insurance regimes.

Uptake of flood mitigation measures by property owners and occupiers could limit the loss and disruption caused by flooding. Furthermore, flood insurance conditions in some markets were found to be effective in incentivising prescribed measures. However across the five countries studied, no example was found that provided sufficient incentive for a coherent programme of risk mitigation for all properties at risk. Government regulations that increase the uptake of flood insurance or other appropriate risk transfer mechanisms could help to maintain property value through ensuring adequate funds during recovery and incentivising mitigation.

Lack of risk awareness of professionals and lack of appropriately detailed information on risk are two further critical barriers that need to be addressed. There are large differences in the amount and level of detail of risk information available across the countries studied. Government investment in improved provision and precision of hazard maps would not only benefit commercial property markets but also flood risk management as a whole. However Built Environment professionals will need to invest in their own professional development to interpret and advise on risk.

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Table 1. Profile of Respondents

| Country | Valuation and investment | Risk mitigation (property management) | Reinstatement | Risk mitigation (Property adaptation) | Other | Tot |
|---|---|---|---|---|---|---|
| Australia | 2 | 1 | 0 | 0 | 3 | 6 |
| China | 4 | 7 | 0 | 2 | 1 | 14 |
| Germany | 3 | 8 | 2 | 2 | 0 | 15 |
| UK | 5 | 3 | 4 | 3 | 0 | 15 |
| US | 4 | 5 | 5 | 3 | 0 | 17 |
| Overview | 2 | 0 | 1 | 1 | 1 | 5 |
| Total | 20 | 24 | 12 | 11 | 5 | 72 |