EFFECTS OF DISCLOSURE OF FLOOD-LIABILITY ON RESIDENTIAL PROPERTY VALUES: AN UPDATE

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Abstract

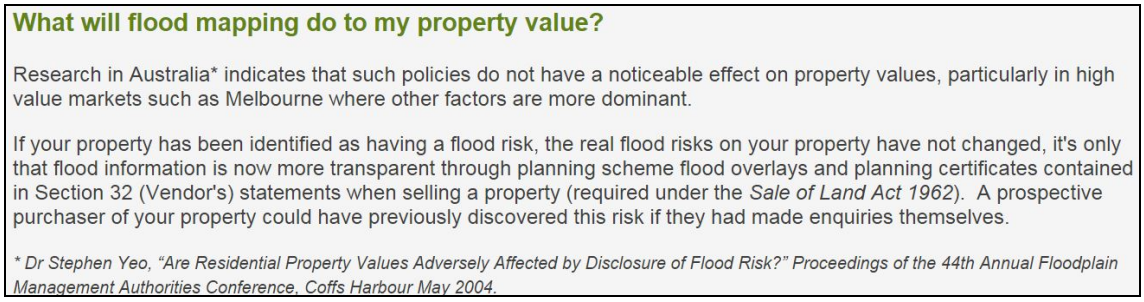
This paper provides a review of the international and local literature assessing the impact of flood risk information on residential property values. We extend the findings of a previous review conducted over a decade ago when flood risk disclosure regimes in Australia were quite different. After a brief discussion of methods typically used for assessing the value of flood risk and their strengths and weaknesses, we examine three questions. On the question of the effect of being located in a floodplain there exists considerable heterogeneity in the empirical results, though flood-prone land is often discounted. The degree of discounting may be associated with the degree of risk, and the discount can often be traced back to a flood event. But sometimes positive attributes of a waterfront or coastal location outweigh any discount. On the question of the effect of an actual flood event on property values, the characteristic effect is discounting in impacted areas, exacerbated by multiple floods in a short time-span and even extending to areas not flooded. Property values typically recover in time. On the question of the effect of floodplain designation and its disclosure, we find it can initiate or increase discounting, or have no effect, or even reduce discounting. This relates to the different forms of disclosure, particularly whether it is mandatory and at what point in the transaction process the flood risk is revealed. We conclude with implications for flood risk managers in Australia.

Introduction

A common complaint against the release of flood information is a presumed adverse effect on housing values. In an attempt to shed some light on this vexed issue in an Australian context, Risk Frontiers reviewed international and local literature (Yeo, 2002; 2003; 2004). The review found the evidence equivocal with some studies, particularly from the United States, finding flood-prone properties discounted compared to equivalent flood-free properties, with others finding no significant difference. Actual flooding of a property was more likely to adversely affect property values than a floodplain designation. The balance of evidence suggested that fear of adverse impacts was over-rated.

It appears that the Risk Frontiers' review has had some influence in helping Australian flood managers respond to a sometimes hostile public concerned about the disclosure of flood risks. Figures 1 and 2 present extracts from two education resources intended to allay residents' fears that the release of flood maps or plans could lead to a loss of property value. The first is from the Flood Victoria website and the second is from a fact sheet developed by the Floodplain Management Association (FMA) in partnership with the Insurance Council of Australia (ICA). Both have drawn either explicitly or implicitly on that research conducted over a decade ago.

Figure 1: Extract from Flood Victoria website



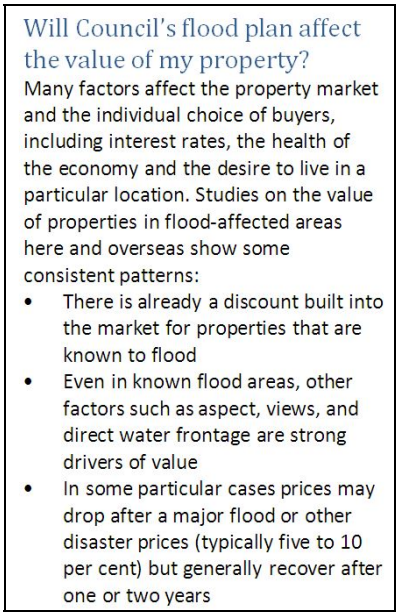
What will flood mapping do to my property value?

Research in Australia* indicates that such policies do not have a noticeable effect on property values, particularly in high value markets such as Melbourne where other factors are more dominant.

If your property has been identified as having a flood risk, the real flood risks on your property have not changed, it's only that flood information is now more transparent through planning scheme flood overlays and planning certificates contained in Section 32 (Vendor's) statements when selling a property (required under the *Sale of Land Act 1962*). A prospective purchaser of your property could have previously discovered this risk if they had made enquiries themselves.

** Dr Stephen Yeo, "Are Residential Property Values Adversely Affected by Disclosure of Flood Risk?" Proceedings of the 44th Annual Floodplain Management Authorities Conference, Coffs Harbour May 2004.*

Figure 2: Extract from 'Flood, Insurance and Your Property' fact sheet (FMA)



Will Council's flood plan affect the value of my property?

Many factors affect the property market and the individual choice of buyers, including interest rates, the health of the economy and the desire to live in a particular location. Studies on the value of properties in flood-affected areas here and overseas show some consistent patterns:

- There is already a discount built into the market for properties that are known to flood
- Even in known flood areas, other factors such as aspect, views, and direct water frontage are strong drivers of value
- In some particular cases prices may drop after a major flood or other disaster prices (typically five to 10 per cent) but generally recover after one or two years

But do the conclusions reached in the previous studies remain valid? And are the public education messages that draw upon that work, still legitimate? Certainly much has changed in the intervening time. Public outcries after damaging floods—including Wollongong in 1998, Newcastle in 2007 and, particularly, Brisbane in 2011—has led to a marked change in the availability of flood insurance, with (as of March 2014) 93% of home building and insurance policies including flood cover either as a standard inclusion or on an opt-out basis (FMA, 2014). Insurers have become progressively better informed about flood risks through the development of the National Flood Information Database (NFID), since its first release in December 2008 (Leigh et al., 2010). Together with Risk Frontiers' Flood Exclusion Zones, insurers now have a form of flood information for some 93% of Australian addresses. In theory we would expect insurers' use of risk-adjusted premiums to send a clear signal to homeowners, potential purchasers and local councils.

In keeping with the National Strategy for Disaster Resilience (COAG, 2011), there has also been increasing emphasis on communicating information and educating people about flood risks. State and Local governments, for example, are increasingly making flood maps or property level risk data publicly available to consumers on their websites, mostly in respect to the extent of flooding in a design flood with a 1-in-100 ARI (henceforth the ARI 100 extent). The Queensland Government, for example, has recently developed a Floodcheck Map Portal.[1] Brisbane City Council has provided on-line Flood Wise Property Reports since 2008 (Dobes et al., 2013).

Economic theory suggests that if the information is readily available, flood risk should be reflected in property values, as purchasers are willing to pay a premium for flood-free properties. Studies from the USA suggest that the discounted value of flood-prone land is similar to the present value of future insurance premiums, implying that the market has efficiently priced the costs of occupying such land (Bin & Polasky, 2004; Bin & Kruse, 2006).[2] Whether via insurance or the progressively wider availability of flood risk information, a more informed population should translate to the capitalization of flood risk.

This study re-examines issues pertaining to the impact of floods and the disclosure of flood risk on property values in the light of contemporary studies and the recent Australian flood experience mentioned above.

Methods

Three broad methods have been used to assess the impact of flood risk on property values:

1. Hedonic modelling is the most common. This attempts to describe the price of a house statistically using regression variables such as structural attributes (size, number of bedrooms and bathrooms, etc.), neighbourhood characteristics (household income, demographic composition) and accessibility characteristics (proximity to transport and amenities) (Zhang et al., 2010). Flood risk can be included as a subset of the neighbourhood characteristics. Most often location within the ARI 100 extent is used as a proxy for flood risk, although this is not a true risk metric (van den Honert and McAneney, 2010). To adequately explain the variation in house prices from one property to another requires large numbers of causal variables and large numbers of observations (selling prices) (Lamond et al., 2007). Two types of hedonic models are commonly employed: standard hedonic models that assess the implicit price of risk and difference-in-difference (DND) models that assess how the implicit price of risk changes after a flooding event or disclosure of a floodplain designation.

   Two studies merit special mention: the Daniel et al. (2009a) meta-analysis and meta-regression analysis of 19 US hedonic studies, an analysis subsequently expanded by Beltran et al. (2014).[3]

2. Repeat sales analysis. This method assesses repeat sales of the same properties to ascertain the effects of flooding or floodplain designation, provided that a property's structural characteristics remain constant over the period between sales and that the influence of inflation and major changes in locational variables are controlled for (Lamond et al., 2007). An advantage of this approach is the reduced data requirements since most of the variables are constant for the same house.

3. Interpretation of raw sales data over time. Since controlling for the host of factors that influence house values is not easily accomplished, these studies are more susceptible to extraneous and sometimes unknown factors including seasonal trends, which arguably limit their explanatory power. But they may provide a useful first step or enable examination of specific flood events on well understood sub-markets (Lamond et al., 2005).

The results of any study need to be judged according to the robustness of the method employed and data utilised. With much of the literature employing econometric techniques, this is a difficult task for a 'lay' reader. Nevertheless, we can observe three general reasons for caution.

Assumptions and choices shape the results

A study's assumptions and modelling choices self-evidently exert an influence over the result (Rambaldi & Fletcher, 2014). Spatial definition is also important. Most studies adopt the ARI 100 floodplain for their assessments, whereas Lamond et al. (2010) adopted the ARI 1000 floodplain for several iterations. It is possible that the failure of these authors to detect differences in housing prices was due to their defining 'floodplain' so broadly. Temporal definition is also important. Pope (2008) critiqued an earlier study (Bin & Polasky, 2004) for its limited temporal control, which may confound efforts to explain observed differences in housing values.

Attribution is not straight-forward

Attributing an observed difference in housing values to a particular cause is not straight-forward. Bin and Polasky (2004) examined pre-1999 housing sales data for Pitt County in North Carolina and detected a discount for houses located in the ARI 100 extent compared to those that were not. The reason for this discounting was not articulated, but it was loosely connected with low risk perception preceding flooding in 1999. In a subsequent study, Bin and Landry (2013) re-examined the data and found that the discounting was linked to earlier flooding in 1996, with no discount prior to that. The later study made clear that the discounting prior to 1999 was not associated with floodplain maps utilised for the National Flood Insurance Program (NFIP).

Doupé et al. (2014) argued that the prices of Brisbane houses with a flood risk fell by -2.6% as a result of the on-line release of Flood Wise Property Reports (FWPR) in July 2008.[4] Just how confidently the modelled decrease in the value of flood-prone properties for the 2008–2010 period can be identified with easier access to flood risk information is debatable. Another likely explanation for the fall in value of flood-prone properties after mid-2008 is the Global Financial Crisis, which Rambaldi and Fletcher (2014) suggest contributed to a depressed and volatile housing market in nearby Moreton Bay Regional Council in 2008. Given Eves and Wilkinson (2014) found that the greatest impact of the 2011 flood was on high-value flooded suburbs, it is possible that the GFC also had uneven impacts, with higher-value (flood-prone) riverside properties particularly affected. Also, anecdotal evidence from local real estate agents and valuers suggests that very few Brisbane residents would have been aware of flood risk information before the 2011 flood (Dobes et al., 2013). The modelled result may also be exaggerated by the decision to include in the dataset 50 riverside properties sold in June 2008 (prior to the release) at an average of $3.27 million (Dobes et al., 2013). We cannot categorically reject attribution of the observed fall in selling prices of dwellings with a flood risk to the on-line release of FWPR in July 2008, but for the reasons set out above, we suggest that the reason for the decrease is not clear cut.

Beware publication bias

A third reason for caution in interpreting the literature describing the effect of flood risk on housing values is publication bias. Formally, this means that 'published study results may not be an adequate representation of all possible study results because of selection effects' (Daniel et al., 2009a, p.358). Selection effects may include self-censoring of authors with respect to undesirable or implausible results and the

tendency for reviewers and editors to prefer papers consistent with conventional economic theory. Daniel et al. (2009a) guardedly concluded that 'publication bias is likely not entirely absent' from their meta-analysis of hedonic models, while Beltran et al. (2014) detected a tendency for over-reporting of negative impacts of flood risk on property prices.

Results

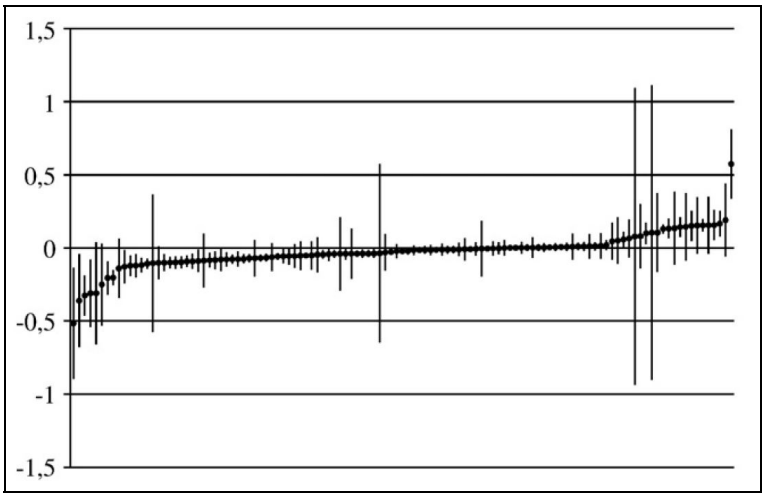
In what follows we extend our earlier literature review of the effect of flood risk on housing values in respect to three questions.

Question 1: What's the effect of being in a floodplain on property values?

Answer 1A: There is considerable heterogeneity

Daniel et al.'s (2009a) meta-analysis found considerable heterogeneity in the results of the 19 US studies summarised, with the implicit price of flood risk varying from –52% to +58% (Figure 3). Similarly, Beltran's (2014) meta-analysis, drawing on 37 studies, found a range from –75% to +61%.

Figure 3: Distribution of the effect on property values of location within a floodplain compared to outside floodplain, with meta-analysis observations ordered along x-axis from discounts to premiums, and showing 95% confidence interval. The vertical axis is percentage differences in prices (source: Daniel et al. (2009a)).



Answer 1B: There is often a discount for flood-prone land

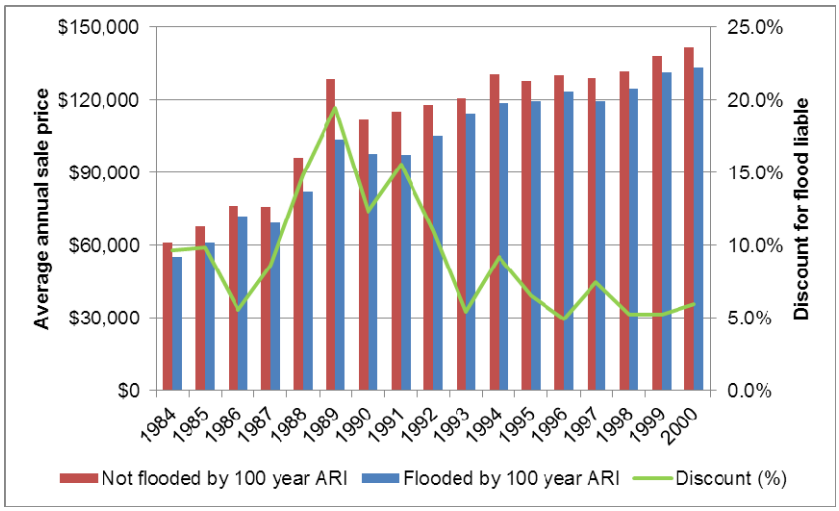
Both Daniel et al. (2009a) and Beltran et al. (2014) found that about 70% of available meta-observations reported a discounting of the value of properties associated with flood risk. Daniel et al. (2009b) found the median discount for being in a floodplain was -7.6%. Beltran et al. (2014) reported a mean difference of about -6%.

In Beltran's meta-analysis, with weights allotted for each study relative to the amount of information they provided, a discount of -2.7% was determined for properties within the floodplain (either ARI 100 or 500 flood extents) compared to equivalent properties outside the floodplain.

Using sales from 1970–2010 for an inner-city suburb of Brisbane subject to minor, tidal floods as well as occasional larger floods from the Brisbane River, Rambaldi et al. (2013) found that properties subject to flooding in an ARI 100 event were discounted by about -1.3% relative to those that were not.

Eves (2002) used raw sales data to estimate a discount for properties in south-west Sydney subject to flooding in an ARI 100 event of between -5% and -19% over the period 1984 to 2000 (Figure 4).

Figure 4: Average annual sale prices for properties in 44 streets in Fairfield LGA, 1984–2000 (based on data presented in Eves (2002))



Answer 1C: The degree of discounting may be associated with the degree of risk

For riverine floodplains, Beltran et al. (2014) found a discount of -5.1% for properties located within ARI 100 extent, and a lesser -2.1% discount for properties impacted by an ARI 500 event.

Rambaldi et al. (2013) calculated an additional discount of -5.5% per metre below the 100-year level.

Answer 1D: The discount can often be traced back to occurrence of a flood

Beltran et al. (2014) found a discount of -3.1% prior to a flood for properties within the ARI 100 extent. This suggests that the discount of -5.1% observed above for the undifferentiated 100-year river floodplain includes a discounting due to actual floods. Similarly, the fact that no discount was detected for properties within the ARI 500 extent before a flood, yet -2.1% for the global ARI 500 grouping, points to the influence of actual flooding.

Rambaldi et al. (2013) attributed the -1.3% discount for properties within the ARI 100 extent to frequent, minor floods in the study area.

Answer 1E: The positive attributes of a waterfront or coastal location may outweigh the discount

Beltran et al. (2014) found that properties exposed to ARI 100 *coastal* flooding enjoyed a +14.1% *premium* over areas outside designated flood-prone coastal regions. One of the studies using data from North Carolina found a premium of +61% for properties at risk to ARI 100 flooding due to wave action. The price premium was attributed to views and boating access (Bin & Kruse, 2006).

Daniel et al. (2009b) found that in a general context of significant discounting following floods in the Netherlands, properties located within 500 metres of the river enjoyed an offsetting positive effect of +2.7%, though this was not sufficient to entirely negate the discount.

After flooding in Rockhampton, Queensland, Small et al. (2013) suggested that the resilience of property values in Park Avenue could be due to its waterfront location.

Question 2: What's the effect of a flood event(s)?

A relatively prolific literature addresses the question of the impact of actual flooding on housing values. In what follows we summarise recent findings.

Answer 2A: Floods may have no effect

Floods may have no effect on property values if the flood risk is already capitalized. Kousky (2010) found that the 1993 flood in Missouri had no impact on property values in the ARI 100 extent but had significant impact on those situated beyond the ARI 100 and within the ARI 500 flood extents where no prior capitalization of flood risk had taken place.

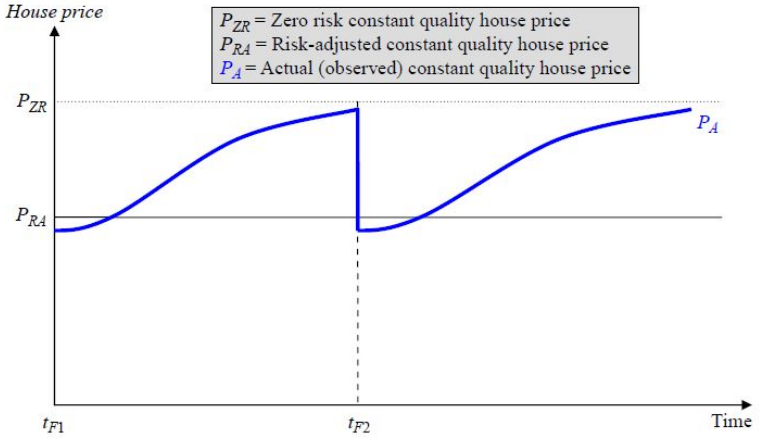
Answer 2B: Floods often discount property values in affected areas

One of the main findings in the literature is the discounting effect of actual flooding and how this changes with time since the last flood. Pryce et al. (2011) relate this to people's tendency for *amnesia*—forgetting past floods—and *myopia*—disregarding future risks that may be perceived with scepticism. Figure 5 presents a model of this pattern in which a flood causes prices to fall to about a true risk-adjusted price. This implies pre-flood 'imperfect capitalisation due to imperfect risk assessment' (p.261), which is then corrected as the flood teaches the market. But in time, amnesia and myopia recommence and prices return above their true risk value.

Beltran et al. (2014) calculated that floods triggered an *additional* discounting of -3.8% for houses located within the ARI 100 extent (such that the after-flood discount totalled -6.9%) and a discounting of -6.2% for houses located within the ARI 500 extent. This result incorporates the findings of Kousky (2010) mentioned earlier.

Hurricane Katrina increased the discounting in Greater New Orleans based on ground elevation. Prior to Katrina, each additional foot below sea level in flood-prone areas resulted in a discount of -0.9%. After Katrina, this increased to a discount of -4.5% as the value of elevation was recognised (McKenzie & Levendis, 2010).

Figure 5: House prices influenced by amnesia and myopia: the case of infrequent floods (source: Pryce et al. (2011))



In the UK, Lamond and Proverbs (2006) found that the price of flooded properties in Barlby, North Yorkshire, did not fall but failed to keep up with the growth in value of the rest of the market. Lamond et al.'s (2010) investigation of price effects in 13 locations showed that the impact of the year 2000 flood on growth was highly variable, from no impact to -30% immediately after the event. But some locations saw floodplain property outperform the rest of the market.

In Brisbane, where major flooding had not been experienced since 1974, the 2011 flood caused an average -6.2% fall in property prices for flood-affected properties (Dobes et al., 2013). Using repeated sales, Doupé et al. (2014) found a decline of -18.9% for the first year after the flood and -7.1% for the first two years after the flood. Eves and Wilkinson (2014) examined trends in the median sales prices of houses in Brisbane suburbs grouped according to their socio-economic status. In the year following the flood, the greatest fall in median price was -15.9% for flooded high-value suburbs, compared to -8.1% for flooded low-value suburbs.

Answer 2C: Multiple floods in a short timespan may exacerbate discounting

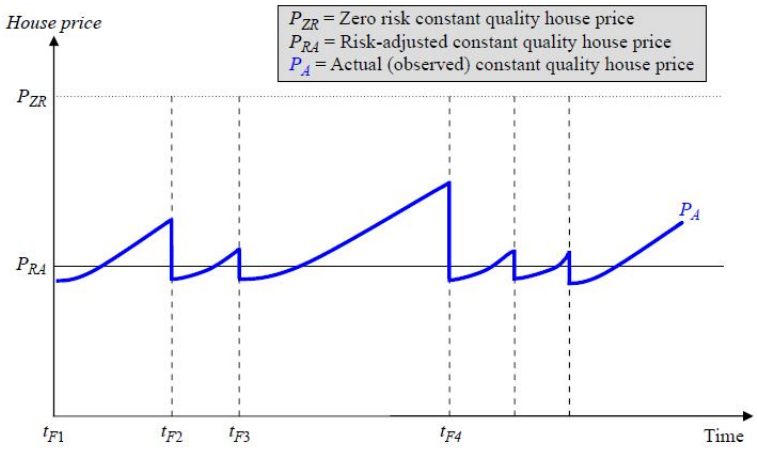
Frequent floods may remind the market of the risk, limiting the influence of amnesia and myopia. The actual price might then be expected to follow more closely the risk-adjusted price, with deviations based on the length of time between floods (Figure 6) (Pryce et al., 2011).

Lamond et al. (2010) found *multiple* floods over a few years did have an effect on property markets in the UK, particularly for properties in the 'significant' risk category.

Daniel et al. (2009b) found that the 1993 Meuse River flood (Netherlands) led to a decrease in house value in the flooded areas of -4.6%. This discounting, when compared to non-flooded houses, increased to -9.1% after a second flood in 1995. The authors posit that:

> *the second flood underscored the necessity for people to account permanently for the risks associated with river flooding. The subjective perception of floods merely constituting a once-in-a lifetime event was corrected and probably brought much closer to the objective level of risk, which implies that a flood can happen several times in a row* (p.574).

Figure 6: House prices influenced by amnesia and myopia: the case of frequent floods (source: Pryce et al. (2011))



In Sydney, Eves (2002) linked the increased discounting of flood-prone property in Fairfield LGA in the late 1980s and early 1990s to a series of damaging Georges River floods (Figure 4).

Answer 2D: Areas not flooded can also experience a downturn

Kousky (2010) reported that *all* property prices in municipalities located along the Missouri and Mississippi Rivers fell after the 1993 flood by -6% to -10%, even those that weren't inundated, a result that was attributed to damaged infrastructure and stigmatization of the area.

Doupé et al. (2014) described a weakly significant result in which property values in areas of Brisbane that were *not* flooded in that particular event, but were still considered as flood-prone, fell by -9.6% in the first year after the 2011 flood, but that this effect disappeared after two years. Eves and Wilkinson (2014) found that the median price of properties in high value suburbs that were not flooded fell by -7.1% in the year after the flood: this less than in the flooded areas but still significant.

Hallstrom and Smith (2005) investigated how a 'near miss' can update risk perception and thereby influence property values within ARI 100 extent. They estimated that Hurricane Andrew's near miss reduced the rate of appreciation by -19.8% in Lee County, Florida.

Answer 2E: Property values often recover in time

Atreya et al. (2013) found that the flood risk discount caused by the 1994 flood in Dougherty County, Georgia, disappeared between four and nine years after the flood.

The impact of the Barlby, Bewdley and Mold (UK) floods on house prices lasted less than three years at all sites (Lamond & Proverbs, 2006; Lamond et al., 2010).

Although the Brisbane post-flood datasets are not long enough for a full assessment, there was evidence of a recovery in sectors of the market one year after the 2011 flood (Eves & Wilkinson, 2014). Doupé et al. (2014) found that the discounts taken for the two years after the flood were much less pronounced than for the first year.

Possible reasons for only temporary impacts include turnover of the population, strong demand, prospects of improved flood defences, optimism and a lack of any restriction on purchase (mortgages and insurance available) that overrides lingering memory of the flood (Lamond & Proverbs, 2006).

Question 3: What's the effect of disclosure of floodplain designation?

One way in which flood risk could conceivably be capitalized, overcoming tendencies towards amnesia following actual flooding, is through clear and permanent disclosure of flood risk via insurance, regulation and/or mapping. This section explores the recent literature examining the impact of floodplain designation on housing values.

Answer 3A: Floodplain designation can initiate or increase discounting

For Alachua County, Florida, Harrison et al. (2001) found a weakly significant result that, under the disclosure mechanisms of the National Flood Insurance Program (NFIP) prior to 1994, properties in the ARI 100 extent were priced nearly $1000 less than equivalent housing units located beyond this demarcation.

Pope (2008) estimated that the introduction of North Carolina's Residential Property Disclosure Act in 1996, which required sellers to disclose statutory flood risk, led to a discounting of between -3.5% and -4.5% for houses in the ARI 100 flood extent. Similarly, Troy and Romm (2004) estimated a discounting of -4.2% for houses in the ARI 100 extent compared to equivalent houses outside following the introduction of the California's Natural Hazard Disclosure Law (AB 1195) in 1998.

Doupé et al. (2014) argue that the on-line introduction of Brisbane's Flood Wise Property Reports reduced a flood-prone property's sale price on average by -2.6% over the two years after the release of the Reports but this interpretation is contestable (see earlier discussion).

Answer 3B: Floodplain designation may have no effect

Before the introduction of the disclosure laws in North Carolina and California, buyers could still learn about flood risks via the floodplain maps used for the NFIP, but in both cases, there was no significant difference in selling price between comparable properties on or beyond the floodplain (Pope, 2008; Troy & Romm, 2004).

Lamond et al. (2010) assessed property values over a period that included the launch of the UK Environment Agency's maps (2004) as well as flooding. They concluded that 'the impact of flood risk designation on growth in residential property price is … non-existent in the absence of flood events' (pp.348-9).

A change to the official 100 year ARI flood level at Penrith in western Sydney in 1994 might have had a short-term impact on affected properties, but an examination of sales prices in 1999–2000 detected little variation (Egan National Valuers, 2000). The authors conclude, 'The market has seemingly absorbed the information about the potential flood problem and has decided that the flood risk is not considered high enough to be reflected in changes in property value' (p.30).

Answer 3C: Floodplain designation can reduce discounting

In an interesting study from North Shore City, New Zealand, Samarasinghe and Sharp (2010) found that the discount for houses in the ARI 100 flood extent *reduced* from -6.2% to -2.3% after floodplain maps became available to the public in mid-2006. Prior to this, only a binary 'in' or 'out' of flood zone was available. Samarasinghe (pers. comm.) argues that the maps enabled buyers to see more clearly the risk of flooding to a property in a flood zone, giving them opportunity to make more informed decisions.

Answer 3D: Not all forms of disclosure are equal

A key to understanding the variable impact of non-natural disclosure of flood risk on housing values is the variable nature of forms of disclosure.

Much has been written about deficiencies of the United States' NFIP (e.g. Burby (2001); McAneney et al. (2013)), which may explain the mixed results for studies exploring the relationship between location within statutory ARI 100 flood extents (as specified on NFIP maps) and housing values. These deficiencies include:

- Flood maps may be old and relate poorly to the true flood hazard (Kousky, 2010);
- Assessment methodologies struggle to accurately gauge the valuation consequence of floodplain location (Harrison et al., 2001);
- Premiums are subsidized and relate poorly to true actuarial risk (Bagstad et al., 2007);
- Participation rates in NFIP have been relatively low. While there have been amendments to legislation to increase participation including to require maintenance of insurance for the life of a federally-funded or backed mortgage, less than one-half of all structures located in ARI 100 flood extents are insured against flooding (Harrison et al., 2001). Of course, not all properties have mortgages, and so often only the most at risk properties take out insurance;
- People's risk perception and risk preferences exert important influences on participation in the NFIP, irrespective of requirements (Petrolia et al., 2013);
- Buyers often learn of a property's flood risk and the required insurance premium very late in the purchasing process (Chivers & Flores, 2002).

Harrison et al. (2001) found that following passage of the National Flood Insurance Reform Act in 1994, there was increased participation in the NFIP and the price differential for houses located in the ARI 100 flood extent increased.

Pope (2008) found that North Carolina's Residential Property Disclosure Act was a more effective mechanism for informing potential buyers of flood risk than the NFIP, and detected a significant discounting of house prices within the floodplain under the Act. Troy and Romm (2004) found something similar upon passage of California's Natural Hazard Disclosure Law, especially for Hispanic communities. It is understood that both of these State Acts require sellers to disclose a property's statutory flood risk earlier in the sales process.

An investigation of the price impact of floodplain designation for condominiums and standalone properties in Boulder, Colorado, found a strong impact for condominiums (-14%) but none for standalone properties (Meldrum, 2012, 2015). This was attributed to information asymmetries, with better pre-transaction provision of flood insurance cost information for condominiums.

In the UK, Lamond et al. (2005) described the normal disclosure regime as 'ad-hoc discovery of flood risk' (p.634). There, buyers are said to behave in an entirely reactive manner, evaluating risks based on recent experience (Lamond et al., 2010). In the

absence of mandatory disclosure of flood risk, Lamond found that floodplain designation alone produced no impact.

Implications for Australia

Empirical evidence for the effect of flooding or floodplain designation on housing values from the Australian market remains limited. Several researchers have investigated the effects of flooding around Brisbane, yielding findings that are congruent with the wider international literature showing that floods often have a short-lived discounting effect. One study argues that the public release of flood risk information in Brisbane led to a small discounting effect.

Since our last review (Yeo, 2003) there has been considerably more work undertaken in the USA, Europe and the UK, plus an interesting study from New Zealand. The results must not be applied unthinkingly to the Australian scene, since there may be considerable differences in hydrological regimes, and particularly, disclosure regimes. But it does provide a context in which we can make some inferences about the effect of flooding or other forms of flood risk disclosure on housing markets in Australia. Just as there are variations within the United States (e.g. Troy and Romm, 2004, cite different styles of flooding in California for the inefficiency of the NFIP in capitalizing flood risk into property values prior to 1998), there are likely variations within Australia, which lie outside our current scope.

The human attributes of amnesia and myopia are likely to be fairly prevalent here in Australia as elsewhere, with the result that housing values for flood-prone locations may typically ride well above their true risk-adjusted price.

At least for Australian capital cities, local supply and demand equations may be akin to some of the energetic UK markets described by Lamond, which will tend to suppress any flood risk effect. There is also evidence for an increasing proportion of auctions to total sales, led by the Melbourne and Sydney markets,[5] which could trump buyers' consideration of flood risk in that especially competitive and even emotional environment.

Considering whether the changes in the availability of domestic flood insurance may capitalize flood risk into housing values, the evidence is equivocal. Insofar as premiums in Australia may be more truly risk-based than under the NFIP, there is potential for greater impact. And current participation rates sound high (93% according to FMA, 2014), despite flood insurance generally not being mandatory. But what we do not know is how participation rates vary for different degrees of risk: for instance, what is the participation rate for properties located within the ARI 100 flood extent? Many other questions remain to be answered including are there communities where no insurers offer cover? And what is the proportion of policy-holders who *know* they have (or don't have) flood cover, or have made a conscious decision about the appropriate cost of insuring flood risk? Plus, to what degree do prospective buyers investigate the cost of flood insurance *prior to making an offer of purchase*, and shape their decision accordingly? Flood insurance has potential to increase the capitalization of flood risk into property values, but at least in Australia it is too early to assess whether this has begun to be realised.

For the most part, reference to flood risk information is at the behest of the individual buyer. The disclosure regimes at work in Australia appear to be broadly similar to the ad-hoc discovery of flood risk Lamond describes for the UK, where floodplain designation was found to have no impact.[6] As Pope (2008, p.570) observed, 'simply placing environmental information in the public domain does not guarantee that the

information will be noticed and used'. Zhang et al. (2010) emphasised the need not just to make information available but to ensure it is understood.

In a way the uncertain impacts of flood risk disclosure may make interactions with the public more palatable for a Council flood engineer. The advice included on the FMA's information sheet (Figure 2) is still more or less appropriate. It could be amended to be a little more even-handed by adding an acknowledgment that Council's flood mapping *could* have an impact on property values, allied to the important message that the real risks of flooding on the site have not changed (after Figure 1). The New Zealand study finding that better flood risk information can *reduce* impacts on housing values is also worthy of further consideration. The availability of more up-to-date flood information in NFID for some communities has also reduced the number of properties believed to be at risk.

But from a broader perspective of building a flood-resilient Australia, floodplain managers need to consider whether the lack of a clear market signal for flood risk in property transactions is desirable. Clear market signals can promote real flood risk reduction. An example of this was when Suncorp, the primary insurer in Queensland, placed an embargo on new polices following three floods in the town of Roma in quick succession from 2010 to 2012. Existing policyholders were offered renewals with vastly increased premiums. Following community pressure and efforts from all levels of Government, the Maranoa Regional Council began building a levee in September 2013. Suncorp announced that its embargo on new business would ease. Initial estimates indicated an average reduction in household premiums for a $300K home of about 30% and as high as 80% in some of the most flood prone areas as soon as the levee was completed.

In time, risk-based pricing of insurance premiums may show through more clearly in house prices, particularly for high-risk areas. *Mandatory* requirements to disclose plain-English, readily understood, property-level flood risk information *early* in the property transaction process would also promote market signals of risk.

Conclusion

Much has changed and is changing in the Australian market. We anticipated seeing more evidence of discounting of housing values as a result of changes in disclosure regimes including the availability of flood insurance and expanded delivery of flood information. But as yet, there remains scant evidence for a sustained decrease in the value (or in growth rate) of houses with a flood risk. There is scope for considerably more empirically-based, robust research of this issue in an Australian context. Acting against capitalization of flood risk may be the tendency for people to soon forget previous flood events and be over-confident about the impact of future floods. This is suggested by the pronounced but short-lived discounting after the Brisbane flood. Strong housing markets will also tend to diminish any impact. From a broader disaster resilience perspective, one might wish for a stronger market signal of a property's flood risk, which could trigger mitigation interventions to actually reduce the risk by building a levee, raising floor levels or removing an uninsurable house. This could happen as risk-based premiums incrementally influence prices. Requiring the disclosure of transparent flood risk information to prospective purchasers early in the transaction process would also promote market signals.

Acknowledgements

This research has been partly funded by Risk Frontiers. We are grateful for information from Patrick Doupé and Alicia Rambaldi.

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[1] https://www.dnrm.qld.gov.au/mapping-data/maps/flood-mapping-program/floodcheck-map (accessed 8/5/2015).

[2] A number of studies found that the discounted value of flood-prone property is *greater than* the capitalized insurance premiums, which is often explained by non-insurable costs of flooding on housing such as disruption (Macdonald et al., 1987; Donnelly, 1989; Speyrer & Ragas, 1991). One study shows the opposite—the discounted value of flood-prone property is *less than* the capitalized insurance premiums (Harrison et al., 2001). Here, the author draws attention to the non-mandatory nature of participation in the NFIP.

[3] While to our knowledge Beltran's work has yet to be formally published, our current paper draws upon draft results presented at the Meta-Analysis of Economics Research Network 8th Annual Colloquium held at the University of Athens, Greece, in September 2014 (Beltran et al., 2014).

[4] Doupé et al. (2014) updated a previous assessment by Dobes et al. (2013), confining the dataset to two years after the release of the FWPR in July 2008, so that it wouldn't be compromised by also picking up the effect of the major January 2011 Brisbane flood.

[5] Tim Lawless, 'How important are auction clearance rates in the housing market?', *Property Observer*, 25/8/2014, http://www.propertyobserver.com.au/forward-planning/advice-and-hot-topics/34858-how-important-are-auction-clearance-rates-in-the-housing-market.html (accessed 8/5/2015).

[6] In NSW, one mechanism that could alert a potential purchaser to a property's flood risk is a Section 149(2) Certificate, which is required to be attached to a contract for sale and describes whether any flood-related development controls apply to a property. Egan National Valuers (2000) used a small sample of sales data to investigate the impact of S149 notifications on housing values in western Sydney. They detected 'isolated' incidences of variations in property values up to 5% for properties affected by a recently-instituted increase to the 100 year ARI flood level in South Windsor. No impact of Probable Maximum Flood notifications was detected. They comment that 'a purchaser unfamiliar with the workings of property will often see [a Section 149 Certificate] as pure legalese with the prevalent point of view being that such a document is only decipherable by a solicitor or a conveyancer' (p.11).