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Have Real Estate Markets Joined the 'Extinction Rebellion' Yet?

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the cost of building construction fall, amidst a drive to provide better housing for the working classes. New housing types were being favoured. The *Postwar* (1950-1980) era continued on this path, with an embrace of high-rise as well as low rise housing. Facades vary greatly between brick, tiling, pebbledash and render. Our cut-off year for our *Contemporary* era to begin is 1980. *Revival* are contemporary buildings trying to emulate historical architecture. It should be self-evident, that the sheer amount of details and variations defies a simplistic classification approach.

We suggest a transfer learning approach in which the images are first translated into high-dimensional feature vectors using an existing CV model (*Inception V3*<sup>3</sup>). A classifier is then trained to categorise the buildings into vintages, based on the feature vectors (*Softmax*). A true innovation of our approach is that we include information on neighbouring buildings into the classification, exploiting spatial dependency in building vintages.

Two final-year architectural students classified a large sub-sample of approximately 25,000 images from our data set of Cambridge houses. This is a much larger sample than ultimately needed. In our case, each category requires less than 250 samples to reach almost fully diminished training accuracy for additional observations. We greatly exceed this number so that we can compare the out-of-sample convolutional neural network predictions to the groundtruth as assigned by the experts. This allows us to examine the power and size of the assignment tests. In addition having both human and machine classification for a large sample of the data allows for a robustness checks on the machine comparisons. The accuracy of the automatic prediction is high (Table 1): A machine can relatively reliably tell different building vintages apart, even *Revival* styles are detected. All comes at modest cost, classifying the universe of buildings in Cambridge takes only seconds on a contemporary laptop.

Coming back to the claim made by *Building Better, Building Beautiful* on historic aesthetics being valued by the people: If that were true, buyers should prefer revival architecture over more contemporary designs. Also, buildings with adjacent buildings in historic or revival appearance should command a price premium. How hard we look, we cannot find any evidence for such a preference in real transaction data. After controlling for a house's location, size and quality, modern designs are as sought after as replicas of old styles. Not surprising, reviving the good old times will not solve the housing shortage.

We have to speed up the publication of our paper as much as we can, or we risk losing our policy relevance again: The chairman of the helpful government commission has been fired in the meantime – for reasons not related to our research, though.

- [https://github.com/thies/paper-uk-1vintages/blob/master/text/manuscript\\_assa.pdf](https://github.com/thies/paper-uk-1vintages/blob/master/text/manuscript_assa.pdf)
- Scruton, Roger. 2018. "The Fabric of the City." Colin Amery Memorial Lecture. Policy Exchange. <https://policyexchange.org.uk/wp-content/uploads/2018/11/The-Fabric-of-the-City.pdf>.
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Source: <http://www.floodlondon.com/central-london/>

## Have Real Estate Markets Joined the 'Extinction Rebellion' Yet?

As the world reels from a swelling tide of worldwide weekly protests against climate change, -over six million people participated in last week's protests- the impending threat of sea level rise to cities and buildings has taken the spotlight

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of the public debate. Many of the world's major cities are situated on coastlines and rivers systems which house 40% of global population (in 1990), and by 2050 2.4 billion people will populate these areas, 80% within cities (Kummu et al., 2016). These coastal cities will likely be threatened directly or indirectly by sea level rise due to climate change (Neumann et al. 2015). Approximately 10% of the world's population situated in low-elevation coastal zones below 10 metres in elevation (McGranahan et al., 2007) Predictions for sea level rise are uncertain, as many forecasts are based on anticipated projections of reductions in carbon emissions and have varying consideration of factors that may amplify the effects of predicted sea level rise. Yet pessimistically, current approaches to mitigation are not meeting targets and future targets of the world's greatest polluters is at odds with a culture of economic growth, rising middle class consumerism and exponential population growth. As a result, sea level rise is not necessarily an uncertain event, more a known event that is occurring presently, albeit slowly, but will likely increase more rapidly in the future. The more pressing question, is what effect will this have economically, and one of the most exposed areas for consideration is property.

An opportunity and key driver for change in the property sector will be through identifying properties at risk and property value implication from firstly sea level rise and then the varying degrees of risk from other cumulative flooding effects. As demonstrated in the flood literature (Beltran et al., 2018), floodplain identification demonstrates a significant discounting to housing values; consequently, through provision of better information to purchasers of sea level risk and flooding should be more accurately incorporated into pricing (Chivers and Flores, 2002). This will propel the need for more investigation and structures to assess risk and create risk minimisation strategies and adaption to minimise the future impact of these events. In time, understanding of risk, risk mitigation strategies and adoption approaches or lack thereof, will influence investment and occupation decisions within the sector leading to future implications for market value and insurable values. However, as demonstrated in the flood literature and Ortega and Taspinar (2018), recurrent events of inundation and frequency will likely be the strongest drivers of discounting.

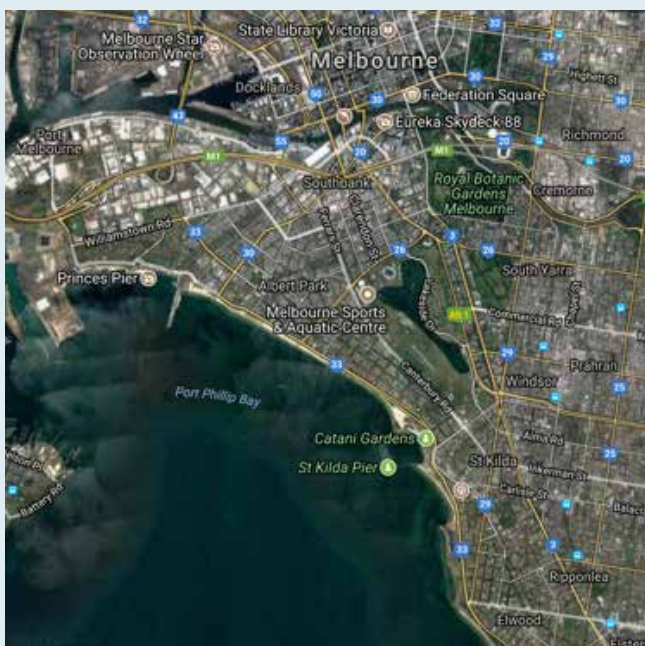
As part of a research project using data from Melbourne, Australia, we set out to demonstrate the relative implication of information asymmetry for a case study area, by examining the discounts associated with the floodplain identified areas compared to sea level rise inundation.

To do so, we use a unique combination of GIS database; planning and flood information; rating authority valuation data; and residential sales data to investigate the consideration of sea level rise and flood discounting in current value estimates for housing. Further examining knowledgeable actors in the market of flood plains and the market perception of discounts associated with flood prone properties or stigma of known areas.

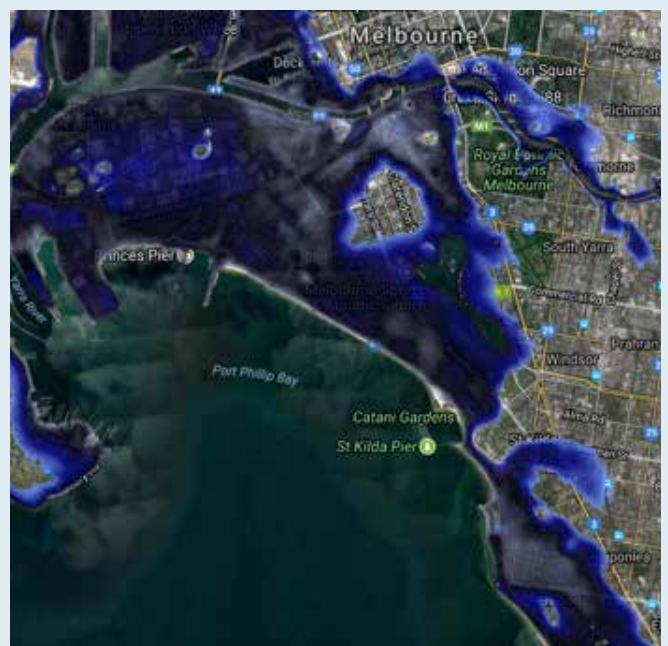
One of the main results of our hedonic pricing regressions is that flood risk designated properties are discounted compared to non-flood risk identified properties. The model specification controls for a very large number of dwelling characteristics not normally included in residential regression analysis due to data limitations; locational and neighbourhood amenity elements; and the effects of

premiums associated with beachfront coastal properties. This result is not surprising and in fact supports the findings of many similar studies of current flood risk around the world. However, we do not find any empirical evidence to suggest that discounting also occurs in relation to future sea level rise. This is understandable in the context of sales prices, because at present consumers' are not provided with any information that might affect their decision-making in relations to sea level rise and the perceived risk to their property. The lack of current information available to both potential purchasers, owners and valuers could create future liability and responsibility issues in the future. For property valuers, if they are not accurately reflecting the current markets' perception of flood risks of properties within the municipality; the estimation of the sea level rise effect may be much greater. This does have implications for policy implementation, as the market may have a stronger reaction and subsequently lead to a stronger discounting of at-risk properties.

The example of Australia demonstrates to other regions of the world that the increasing frequency of substantial precipitation, extreme storms and winds, creates both short-term discounts and long-term impingement on capital growth. Consequently, it is not unlikely that the effect of sea level rise will have a significant effect on property values, those directly affected will face discounting and subsequent total loss; and those properties not directly inundated will face the costs and losses associated with increased flooding. Future changes to regulation, legislation or even environmental considerations are likely to affect real estate markets and pricing in most urban markets. To gain greater understanding of the likelihood of the impact on property, measures need to be put in place to identify, ascertain and quantify risks in order to demonstrate strong reasoning for implementing mitigation and minimisation strategies for property assets. By connecting the value to the profiling of sea level rise risk identification process, this can be considered by property stakeholders and governments and result in subsequent action; however, these stakeholders need to be able to understand and quantify the risks posed.



Current situation



2.7m sea level rise scenario