THE CHANGING PRICE OF DISASTER RISK FOLLOWING AN EARTHQUAKE

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INTRODUCTION

New Zealanders are keenly aware of the devastation caused by the Christchurch earthquakes of September 2010 and February 2011 (plus the many other aftershocks). We know that unreinforced masonry buildings and brick structures, in particular, were susceptible to damage (or ruin). Most people, however always knew that this was the case in a major earthquake. Almost everyone who considers purchasing a house in a seismically active zone such as Wellington thinks about whether they wish to be living in a brick house during 'the big shake'.

After the Canterbury quakes, however, a new word entered the general lexicon: liquefaction. The extent of damage that resulted from the shaking of ground subject to soil liquefaction was a surprise to many of us, though not to scientists who had long warned about liquefaction dangers. Most of us prior to September 2010 probably never thought about liquefaction potential when purchasing a house. The Canterbury earthquake sequence can therefore be seen as a source of new risk information to home buyers in New Zealand, especially about the dangers associated with liquefaction. Our paper asks whether people's house purchasing decisions changed as a result of this new information, particularly within a seismically active zone.

We hypothesise that:

- People already incorporated construction-related earthquake risks into the price they are prepared to pay for brick (and other non-weatherboard) houses prior to the Christchurch earthquakes. As a result, the price of such houses should not have changed following the quakes.
- Before the earthquakes, people did not incorporate risks associated with liquefaction potential into the price they were prepared to pay for houses built on affected soil types, but that this changed in the aftermath of the disaster. If this is the case, we would expect that the price of liquefaction-prone houses will have fallen (relative to the price of other houses) following the Christchurch quakes. However, we also expect that this risk is really only relevant for seismically active areas and will not be material elsewhere.

METHODOLOGY

To test our hypotheses, we use data sourced from PropertyIQ to compare pre and post-earthquake sale prices of properties in two urban areas of the country outside of Canterbury: Hutt City, a seismically highly active area and Dunedin City a relatively low-seismicity area. In each location, we estimated how the pricing of earthquake-related risks changed following the Canterbury earthquakes. Specifically, we used a repeat sales approach to test for changes in risk premia associated with soil liquefaction potential and different house construction types.

The repeat sales method allows us to control for all unchanging house attributes, including those that are unobserved in our data. By exploiting two types of risk (one previously ignored and one well-recognised by households) across two areas with differing levels of background seismicity, pre- and post-earthquake, we technically use a difference-in-

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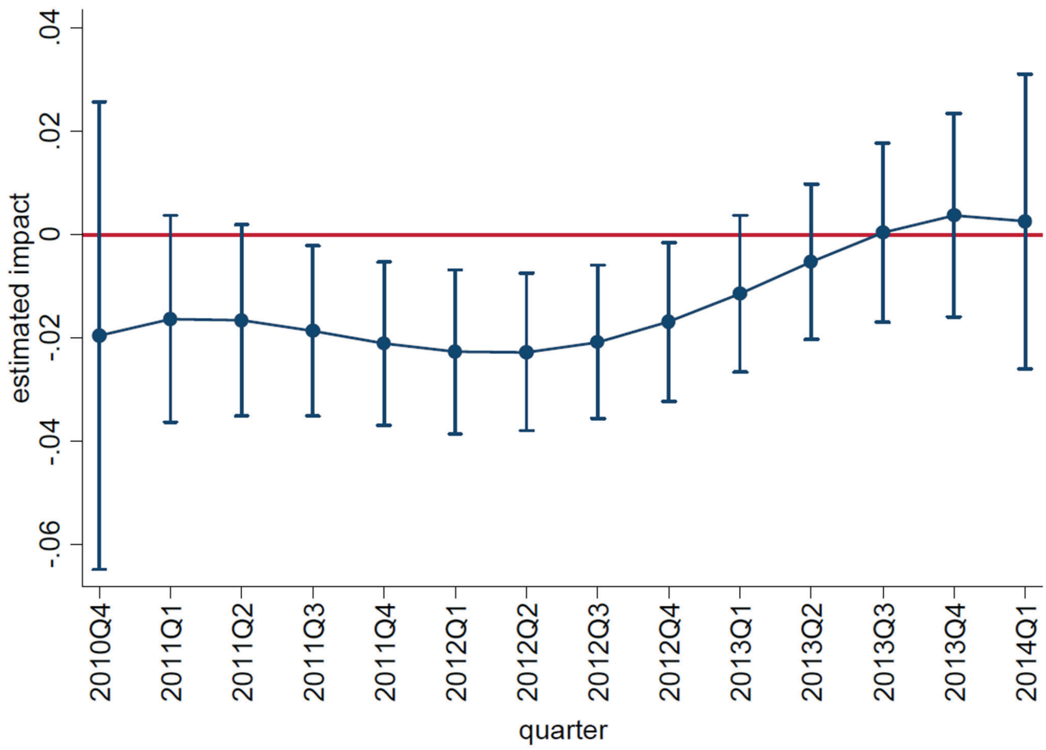
difference-in-difference approach to test our hypotheses about how people respond to a new clearly defined risk that is important only in certain circumstances. Importantly for the interpretation of our results, information on liquefaction potential was available to prospective property buyers in both cities long before the earthquakes: both city councils have disclosed the risk through Land Information Memoranda issued for affected properties. However, evidence suggests this information was almost universally ignored prior to the Canterbury quakes.

RESULTS

We find no evidence that the price of known construction risk (i.e. brick and other non-weatherboard construction) changed in either seismic area. We also find no evidence of a change in the price of liquefaction risk in the low-seismicity area (Dunedin City) following the Christchurch earthquakes. However, we do find strong evidence that a liquefaction risk discount emerged in the high-seismicity area (Hutt City) immediately following the first earthquake. These findings are all in accord with rational responses to a natural disaster.

Our results do however, suggest that the liquefaction risk discount in the high-seismicity area dissipated after about two years and has disappeared entirely since then. This finding is illustrated in the accompanying figure. Prices of houses in the liquefaction zone of Hutt City fell by 2% (after adjusting for house characteristics and other market movements affecting Hutt City) immediately after the first earthquake. The 2% discount figure is stable for nine consecutive quarters and is statistically significant (i.e. the price change is clearly negative) from quarters 4 to 9 following the first quake. After nine quarters, however, the discount diminishes and no trace of it remains within another year.

Figure 1: Estimated post-earthquake risk discount for liquefaction: Hutt City



Note: Vertical bars represent the 90 percent confidence interval.

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This finding is similar to those identified in a limited number of previous international empirical studies on responses to natural hazard events. While we cannot rule out entirely that the time-varying risk premium is a rational response to policy uncertainty (e.g. because of changing expectations around insurable versus non-insurable risks or around future insurance premia), we find it more plausible that it reflects behavioural responses to risk.

One of these behavioural responses is associated with cognitive dissonance literature in which people may have preferences not only over states of the world, but also over their beliefs about the states of the world. Essentially, this leads them to manipulate their beliefs so that they ignore "bad" events to which they may expose themselves through their choices. We postulate that when liquefaction risk has high salience (shortly after the earthquakes) it will be reflected as a discount since its prominence in the media makes it difficult for a prospective house purchaser to ignore. However, as its salience diminishes over time, the marginal prospective purchaser may override the risk if other features of a house make it an otherwise preferred choice.

SUMMARY

Our results suggest that there may be a case for a public policy role to improve property market outcomes. At a minimum, greater highlighting of liquefaction risk for a house located in a high seismicity area (e.g. giving even greater prominence than currently to liquefaction risk on the house's LIM report) may be warranted so as to increase the ongoing salience of the risk to prospective purchasers. Alternatively, given the New Zealand government's ownership of EQC, the provider of natural disaster insurance to owners of residential properties, government could require EQC to differentiate its premia according to seismicity combined with liquefaction potential.

These interventions may lead to a more efficient pricing of houses (ultimately affecting development and location decisions) in the presence of behavioural or other features that lead at least some people to downplay known risk elements. We note, however, that despite the possible efficiency gain, these interventions would not necessarily be welfare enhancing if the cognitive dissonance explanation holds and people do indeed prefer to believe that the risk is inconsequential.