Structuring flood insurance in the UK

JAN DUBBELBOER - 1534246
Delft University of Technology
Faculty of Technology, Policy and Management
jjdubbelboer@gmail.com

Abstract

In the winter of 2013-2014 the south of the UK (London, Oxford) experienced the heaviest rainfall since 1767. Evidence linking these kind of flood events to climate change has put pressure on the UK flood insurance system that is incapable of properly dealing with this kind of flood events. A proposed re-insurance system, FloodRe, is suggested to improve the UK flood insurance system, but lacks the needed risk management incentive to be a constructive solution to the problem. An agent-based model of a flood prone UK housing market area is developed and the working of FloodRe and flood protection measures are explored. Results from experiments run on the model show that the current setup of FloodRe does not affect the UK housing market other than making flood insurance premiums affordable. The proposed flood protection measures are effective but are not themselves affected by FloodRe in any way. It is recommended to do further research in using the information that FloodRe provides to incentivise flood risk management among persons and the government. In this way a FloodRe system can be set up that aids in keeping flood prone areas in the UK affordable and liveable.

Keywords: Flooding, United Kingdoms, London, Flood insurance, FloodRe, Agent-based modelling

I. INTRODUCTION

In the winter of 2013-2014 the south of the UK (London, Oxford) experienced the heaviest rainfall and flooding since 1767. It has seen its wettest winter on record, with January 2014 being especially wet [Redfern, 2014]. Research done at the University of Oxford in April 2014 concluded that global warming has a small, but significant effect on these extreme rainfalls and the floods resulting from it [University of Oxford, 2014]. At the recently held European Geosciences Union meeting in Vienna Prof Myles Allen presented his evidence of a link between the recent floods in the UK and climate change [Allen, 2014]. Extreme types of weather that cause floods, like those in January 2014, have increased by a small, but measurable amount.

Surface water flooding like this is one of the topics the ENHANCE project focuses on. This is a large project that aims to enhance risk management partnerships for catastrophic natural disasters in Europe [ENHANCE, 2014]. Research is undertaken in the way flood insurance may support risk management in flooding. Insurances can be used as a tool of flood risk management that reduces the economic impact and facilitates recovery after a flood event. A well-designed flood insurance system has the potential to reduce risky behaviour, promote risk-awareness, and encourage flood proofing. A specific case within the ENHANCE project, the Oxford-LSE London flooding case, will focus on the potential of insurance based mechanisms to incentivise better risk management in persons and the local government in a specific part of London that is flood prone.

I. FloodRe

One of these potential insurance based mechanisms that can be used to incentivise risk management is the FloodRe system [Association]. In the research done in this paper the focus will lie on the risk mitigation step by looking into flood protection measures.
As a reaction to the flooding in the south of the UK, the UK government and the Association of British Insurers came to a principle agreement on the configuration of this new FloodRe system in May 2014. Within this system a non-profit flood fund will be set up that ensures that flood insurance remains affordable and available to homeowners at high flood risk. This system allows insurers to transfer the flood insurance premium part of the homeowners insurance into a separate insurance; FloodRe. In return FloodRe will reimburse the insurers for flood claims they pay to their customers.

In its current form the FloodRe system does nothing more than plugging a hole. Insurers re-insure their high risk policies that are not profitable into FloodRe, and FloodRe will be a non-solvent system. However, with the adaptation of risk incentive measures to the FloodRe system, a potential system can be created that provides a solution for the current flood problematic, but also work towards a more risk aware future in which more houses are protected against flooding and the FloodRe system will not be needed any more.

II. Research focus
This papers contributes to the research done within the Oxford-LSE London flooding case by creating an agent-based model that models a flood prone UK housing market. This model will be able to be used to investigate different forms of FloodRe to see how they affect a housing market and how they evolve in the future. By experimenting on the created agent-based model, this paper will answer the question: What are the effects of the FloodRe system on a UK housing market area prone to flooding and how can the FloodRe system be structured to incentivise risk management better?

II. Methods
To provide insight into the FloodRe system an agent based model with the following specification is created:

- The London district of Camden was chosen as location to model.
- The area can be hit by 3 different kinds of modelled surface water floods.
- Person agents that own, sell and buy houses. The can insure their house against floods and invest in property level protection measures to protect their house against flooding
- An insurer agent that sells flood insurances to house owners. It also decides to re-insure houses it insures into FloodRe. In the model the technical flood insurance risk will be modelled, not the commercial flood insurance risk.

![Overview of the agent based model](image-url)
• A bank agent that forecloses houses of persons that default on their mortgage. The bank then sell these houses on the market again.
• A developer agent that develops new houses and sells these on the market.
• A local government agent that builds flood defences, gives out grants to persons for investing in property level protection measures and evaluates development proposals from developers.

Figure 1 provides an overview of the model structure and design.

To gain insight into the effect of FloodRe on a housing market prone to flooding and how FloodRe can be adapted to incentivise risk management, experiments are run on the agent-based model. Within these experiments the influence three separate behaviours have on a large set of output parameters is checked. The three behaviours that are investigated are:
• The FloodRe system in its current form, without risk incentivizing adaptations
• The investing in property level protection measures (PLPMs) by persons
• The building of flood defences by the local government

In running these experiment insights can be gained, not only the working of the FloodRe system, but also on the working of the two modelled risk mitigation methods, to see how they potentially can be influenced by adaptations in the FloodRe system to better incentivise risk management.

III. Results

Analysing the output of the experiments shows that the FloodRe system effects the housing market successfully, but limited. The simple goal of the FloodRe system as it is currently set up is to make flood insurance premiums affordable again for persons that currently have unaffordable flood insurance premiums. FloodRe succeeds in doing this. With FloodRe active the number of persons that have to sell their house because of too high annual fee is not different for persons living in a house with flood risk than person living in a house that is not in flood risk, as can be seen in figure 2. This means that FloodRe does the work it is set out to do by making flood insurance premiums for persons living in high flood risk houses affordable again.

Because less persons are forced to sell their house the house values in the market are influenced positively. This is however the only side effect the FloodRe system has on the housing market. It does not do anything to lower the flood risk in the model or to lower the unaffordable flood insurance excesses persons have to pay.

When looking into the effects of the flood protection measures that are researched, the investing in PLPMs and the building of flood defences, it can be seen that unlike the FloodRe system the flood protection measures do positively influence the flood risk houses are in, as can be seen in figure 3 which lowers the flood premiums and excesses person have to pay and lowers the damage floods do to their houses.
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Lastly looking at how the flood protection measures and the FloodRe system affect each other it can be seen that FloodRe has no influence on how persons and the local government manage their flood risk; invest in flood protection. The other way around the positive effect the flood protection measures have on the flood risk, influences the FloodRe system positively in two ways. It lowers the number of persons that have to be re-insured in the FloodRe system because they have a too high flood insurance premium, as can be seen in figure 4. Furthermore protected houses take less damage when hit by a flood, which lower the payouts that have to come from the FloodRe system to repair these houses.

IV. Recommendations

When looking at ways FloodRe can incentivise flood risk management, using the money that FloodRe ‘saves’ because of flood protection measures can be an option. When looking at both flood protection measures, money can form an incentive. Persons are more likely to invest in PLPMs when they do not have to fully pay for it themselves and the local government will be more likely to invest in building flood defences if they get money from the national government with the specific task to build flood defences. By investing more money in flood protection measures the FloodRe system will save more money. This money can then be invested again into more flood protection measures, and so on (positive feedback loop). This is theoretically one of the ways FloodRe can be used to incentivise flood risk management. However to see if such a feedback loop really exists further research should be done.

However this positive feedback loop is just one of the possibilities for further research for which the created agent-based model can be used. The insight gained in the experiments that are run and overall are gathered in the creation of the model are used to formulate more promising further research topics to research the way FloodRe can be structured to incentivise flood risk management.

One of the most promising aspects in which further research can be done is how FloodRe can provide persons with information that would incentivise them to invest in property level protection measures. This could either
be information about the specific things they can do to protect their house, or can focus on incentivizing them to protect their house by showing them it will be financially beneficial for them in the long run. Besides this further research should also be done in how the FloodRe system can work together with local governments to realize the building of flood defences by sharing flood risk information and co-finance projects. Last the way FloodRe will be scaled down over the upcoming 30 years can also provide a very strong incentive for persons to invest in protecting their house, as long as the right method for scaling down is chosen in which people can control no longer being re-insured in FloodRe by investing in protecting their house. On this topic further research with the created agent-based model can also provide promising results.

V. Discussion

The results gathered so far are still very limited compared to what the created agent-based model is capable of. Because so much focus was put on the creation of the model, sight was lost in actually doing research with the model. However the model have shown itself to be capable of providing insights into the working of a housing market prone to flooding and the FloodRe system. The model can be used to do further research with on adaptation that can be made to FloodRe to make it incentivise risk management. While doing further researched based on the created model the most important thing to keep in mind will be the assumption made to create the model. Only when understanding the consequences of the made assumption, the results coming from the model can be fully understood.

References


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