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the current and newly proposed insurance
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Flood insurance in England- An assessment of the current and newly proposed insurance scheme in the context of rising flood risk

Swenja Surminski¹ and Jillian Eldridge²

Abstract

Flooding is the largest natural disaster risk in England and it is expected to rise even further as we experience a changing climate and continue putting more people and property in harm's way. Managing this growing flood risk requires a broad portfolio of measures to reduce the probability of flooding, keep impact and damages to a minimum and provide financial support for the residual risk. Agreeing on how we pay for this now and in the future is a challenge, with competing drivers such as fairness, economic efficiency, political feasibility and public acceptance all playing their part.

One example for this is the recent debate about the future of flood insurance. After more than two years of negotiations between government and the private insurance industry, details of a new scheme (Flood Re) have now been published, with the aim for implementation in summer 2015. While rising flood losses and increasing costs of insurance are the two main reasons for reforming the existing insurance arrangements, one important aspect has been widely neglected: how the existing arrangement and new flood insurance proposal reflect on the need to manage rising flood risks. We investigate this in the context of the assumption that insurance can support and trigger risk reduction behaviour if correctly designed and implemented. We ask if and how the existing and the proposed scheme contain incentives for risk reduction or whether they will increase moral hazard. By applying our analytical framework we find an absence of formal incentive mechanisms in the existing, and in the newly proposed Flood Re scheme. We highlight some of the barriers for applying insurance to risk reduction and point to some possible modifications in the Flood Re proposal to deliver a greater link between risk transfer and risk reduction. Our investigation offers some insights into the challenges of designing and implementing flood insurance schemes – a task that is currently being considered in a range of countries, including several developing countries, who hope to apply flood insurance as a tool to increase their climate resilience.

1. Introduction

Floods are one of the most wide-reaching and commonly occurring natural hazards in the world, affecting on average about 70 million people each year (UNISDR 2011). Flooding has noticeable impacts across cultures, religions and geographies, claiming lives, disrupting communities and businesses, damaging property and assets and causing stress and ill health. Socio-economic factors, such as more people living in coastal areas, as well as the expected impact of climate change, amplify these risks.

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How society responds to these risks is not simply a question of engineering, it is a rather complex area, with political, economic, social and environmental dimensions. A very topical example of this is the current debate about flood insurance, which is taking place in many countries around the world.

The interest in flood insurance arises first of all from the pursuit to find an efficient way of compensating those who suffer losses, and to manage the financial risk of uncertain losses. In its most basic form insurance is a mechanism where risks or part of a risk are transferred from one party (the insured) to another party (the insurer) in return for a payment (the premium). This reduction in uncertainty is widely seen as an important mechanism driving our economic systems: without insurance many activities and processes would be deemed too risky and would not be undertaken, and those affected by a loss might struggle to recover (Ranger *et al.* 2011).

Beyond this core function there is a growing recognition that insurance could also provide an incentive to act in a risk-reducing way, triggering adaptation activities and addressing the underlying physical risks that influence the impact of flooding. Furthermore there is the attraction of potentially having both aspects delivered through the private sector, with insurance as a market based mechanism, easing the burden of public budgets. This explains why the literature on climate change adaptation and disaster risk reduction include many references to insurance when searching for tools and instruments to address rising risk levels (see for example, Botzen *et al.* 2010).

Recognising the theoretical potential of the insurance tool is one thing, putting it into real action for flood risk management is another. While there is wide agreement on the role that insurance instruments can play in managing the financial risks of flooding, it is far less clear how they can help address the underlying physical risks (Surminski and Oramas-Dorta 2013). This is particularly relevant for flood insurance, where rising risk levels put pressure on existing compensation mechanisms. The issue is complex: If risks are left unmitigated, insurance may become unavailable, particularly that offered by the private sector. In this context, declining insurability or increasing costs of insurance are indicators of a lack of adequate risk management and growing risks. The flip side of this is moral hazard – where insurance becomes a disincentive to take risk reducing action for those who take out cover.

To illustrate the link between insurance and risk reduction we therefore need an understanding of a possible incentive-structure, which largely depends on who the agents are (suppliers, demand side, policy makers/regulators), what action they can possibly take, and how an insurance scheme can be designed to support these actions.

In our paper we investigate this for the existing and newly proposed flood insurance schemes in England. After more than two years of inconclusive negotiations between government and industry, a new flood insurance system has been proposed by government in summer 2013. The current agreement between the Association of British Insurers (ABI) and government, the Statement of Principles (SoP), (ABI 2008), officially ended on the 30th June 2013, but is still in operation whilst the political debate about the proposed new system, Flood Re, continues, with the aim to finalise and implement the new scheme by mid-2015. The proposed system is presented by government and industry as a roadmap to future affordability and availability of flood insurance, with an anticipated run-time of 20 to 25 years, (Defra and ABI, 2013) but we find surprisingly little evidence of how risk reduction is formally addressed, as well as hardly any reflections on how future risk trends may impact the scheme.

After a brief review of the recent literature on this topic we set the scene for our investigation by providing an overview of the specific flood risk and flood insurance situation in our case study area of England. We then apply a framework to assess any risk reduction elements for the existing and newly proposed scheme, reflecting on the roles of government, the insured, insurers and other stakeholders. This investigation concludes with a discussion of our findings.

2. The context of our case study and a reflection on recent literature

Insurance is an economic tool, with many different forms and shapes: (i) it can be provided by public or private entities³; (ii) the insured might seek cover on a voluntary basis or it can be compulsory; (iii) it can cover individuals, businesses, insurers/reinsurers (via reinsurance), organisations or governments; (iv) it can cover different types of hazards (e.g. flood or illness) and exposures (homes, motor cars or business interruption) and have different coverage designs (varying levels of cover, features such as deductibles, exclusions, conditions); (v) and the cover provided can be loss-based (a loss must be evident) or parametric (triggered by a certain event). (Surminski 2013) These design features are important when considering what the purpose and effect of insurance is: The main aim of insurance schemes is the compensation for damages and funding of recovery efforts, and there is broad agreement in the literature that insurance achieves this more efficiently than other tools, particularly with regards to large catastrophic events (Kunreuther 1996). But insuring rather than accepting risk comes at a cost, with each £1 of technical risk costing around £1.66 to insure (Defra 2013a).

The provision of risk transfer for natural disasters such as flooding faces a range of challenges, both for public and privately underwritten schemes, and there are several examples of schemes and companies not staying solvent. Flood losses are highly volatile, and the most common causes of financial problems in these schemes are a lack of risk assessments and insufficient funds, often due to inadequate premium levels. This in turn clashes with the requirements of affordability of insurance cover, which often results in subsidization to make insurance more economical for those at higher risk.

How a flood insurance scheme is designed and implemented depends on a range of factors – supply side, demand and policy or regulatory environment. The ability and willingness to pay for insurance are clearly the main drivers, influenced by income, risk awareness, financial literacy and cultural aspects. Many different modelling techniques have been used to tease this out for flood insurance, and evidence has begun to show that demand decisions often do not meet classical economic models. For example, individuals are much more likely to purchase insurance in the immediate aftermath of a catastrophic event, even if they already live in a high risk area (Browne and Hoyt 2000; Luffman 2010). Browne and Hoyt (2000) list several reasons behind this including; (1) adverse selection (Akerlof 1970; Lin 2013), (2) underestimating tail probabilities (Kunreuther 1984) and (3) expectation that some other entity will pay for any damages to property or livelihood, termed “charity hazard” (Browne

³ In general terms, insurance can be provided by the private sector or ‘publicly’ through governments and governmental agencies. Within this spectrum, variation exists and some large scale risks, such as terrorism or natural catastrophe, are covered through public-private partnerships, where the private insurance industry and government share risks. Private companies can be domestic or foreign, and the cover can be provided directly or via reinsurers, who mainly operate at a global scale. Insurance companies can also take the form of mutuals, which are owned by the insured, and function like co-operatives.

and Hoyt 2000). On the supply side, for private insurers their product offering must meet their calculations on costs, expected level of losses, expenses for risk assessment, operational costs and claims handling (Charpentier 2008; Kunreuther *et al.* 2009). Difficulties in estimating uncertain extreme events as well as the volatility of losses pose further challenges to those underwriting these risks. After a flood event, for instance, private insurers review their market position, pricing and coverage offers – which may trigger a re-assessment of the way flood insurance is provided, and could lead to greater risk-based pricing, larger deductibles and changes in terms and conditions although in the context of residential insurance this is often limited by the regulatory regime (McAneney *et al.* 2013). This also shows that rising losses can challenge the insurability of risk by the private market. In response, there is evidence of a range of activities conducted by the industry to foster prevention efforts. Surminski (2010) provides an illustration of how some insurers are engaged in risk reduction activities for natural hazards, including flood. The initiatives identified include raising awareness of disaster risks, promoting action by government, and supporting action by individuals through incentives, information, financial support and terms and conditions for policies. Despite these initiatives, it remains unclear to what extent they are effective and how they could be scaled up if deemed a success.

During the recent negotiations about the future of flood insurance in England, government, industry and other stakeholders have considered a range of design options for flood insurance, mainly in the context of availability and affordability of insurance, but what has been missing from the discourse is an assessment of the risk reduction potential of any new scheme (Surminski *et al.* 2013). We address this gap by developing a framework to test for several ways of how insurance could lead to physical flood risk reduction. This approach is based on previous work from Crichton (2008), Paudel (2012) and Surminski and Oramas-Dorta (2011): The key message emerging from this literature is that the design and implementation of a risk transfer scheme will determine the promotion of risk reduction and the level of moral hazard.

Our framework differentiates between seven criteria for establishing the risk reduction element of an insurance scheme:

1. Do flood insurance schemes increase risk awareness and knowledge about risks - such as the provision of risk-relevant information and knowledge transfer to educate policy-holders and the public?
2. Does flood insurance increase capacity for risk reduction by informing about the benefits of flood risk management and preventive measures?
3. Are there any explicit financial incentives that the insurance provides to policyholders to invest in mitigation?
4. Does the insurance scheme promote resilient reinstatement techniques after a flood loss?
5. Are there incentives for public flood risk management policy arising from the insurance scheme?
6. Does compulsory risk reduction, such as requiring policy holders to take certain preventive measures as a condition for cover, exist?
7. Does the insurance scheme provide incentives for not developing in flood risk areas?

Assessing design and implementation of an insurance scheme in the context of risk reduction requires an analysis of the signals that an insurance scheme sends to those agents who can

reduce risk, and of the practical aspects of implementation such as barriers to action. The framework is therefore built around two general questions: 1) who can take action to reduce flood risk? And, 2) how can the insurance scheme support this action? For the first aspect insurance providers, insurance buyers, regulators and policy makers are the obvious agents relevant for this in the context of existing properties. But with regards to new build, developers and local planners should be considered as well. This is covered by our seventh criteria. Of course there are a wide range of factors that determine if and to what extent these agents do take the required action: financial constraints, lack of knowledge or awareness, market failure and others (Surminski and Oramas Dorta 2013). We are therefore interested to establish how an insurance scheme can support risk reduction by addressing some of these barriers.

The literature has explored the risk reduction potential of insurance for some time. While the use of these mechanisms is well established in some insurance classes (such as commercial insurance for large risks and motor insurance), the effectiveness in reducing moral hazard and incentivising risk reduction in relation to residential natural catastrophe risks remains unclear. In theory insurance can put a price tag on flood risk and send signals to agents such as policy holders, governments or insurers themselves, incentivising or even forcing them to address the underlying risk [see for example Kunreuther (1996)]. Insurance incentives are stated to aid implementation of flood risk reduction measures (Camerer and Kunreuther 1989; Kunreuther 1996; Crichton 2008; Botzen *et al.* 2009; Kunreuther and Michel-Kerjan, 2009). But the practice shows that a range of factors prevent this from happening: The largest barrier is considered to be the absence of adequate risk-based pricing (Kunreuther 1996) due to its conflict with affordability of cover. Picard (2008) highlights the trade-off between the effectiveness of risk based pricing and equity – as the most vulnerable may not be able to pay for risk-based premiums. But even if risk-based pricing would be applied there can be barriers for incentivising risk reduction, as Bräuninger *et al.* (2011) note: the mis-match between required prevention investment by policy holders and premium savings, the short term nature of insurance contracts, simplified rating structures used by insurers, as well as a prevailing uncertainty about the benefits of risk reduction measures- due to lack of standardised assessment methods, and the need for active involvement of policy holders to put in place and operate those mitigation measures. (Bräuninger *et al.* 2011)

Some recent studies have explored the link between flood risk reduction measures and premium pricing, through methods such as interviews with the insured, hypothetical modelling and willingness to pay exercises: For the Netherlands, Botzen *et al.* (2009) suggests that many homeowners would be willing to make investments in risk reduction if this would lead to an insurance premium reduction: ‘In particular, approximately two-thirds are willing to invest in water barriers (...) and about a fifth are willing to replace floor types that are vulnerable to flooding with water resistant floor types. Furthermore, about a quarter are willing to move central heating installations to floors safe against flooding’ (Botzen *et al.* 2009). Thieken *et al.* (2006) found that in Germany insured households are more likely to undertake risk reduction measures than uninsured, suggesting that flood insurance does set an incentive for policy holders to take action.

There are two limitations to our approach: Our analysis is based on the information publicly shared by government and insurance industry about the SoP and Flood Re, as well as oral evidence gathered from stakeholders. We acknowledge that the Flood Re proposal is subject to political debate and negotiations, and changes to the eventual design and scope of the scheme are still possible. This paper therefore discusses some potential modifications of the proposal.

Furthermore, our approach considers the issue in a qualitative way, which is necessary at this stage due to limited data and clarity about the proposed scheme's mechanisms. As part of the ENHANCE project we are exploring options for underpinning our framework with a quantitative model. This will be a follow-up to the analysis provided in this paper.

3. The case study: flood risk and flood insurance in England

Flood insurance in England⁴ needs to be seen in the context of both current and future risk levels, as well as the policy response: In England, flooding is considered a major risk on the National Risk Register (Cabinet Office 2013) and recognized as the most common and costliest natural disaster (Harries 2013). The impacts of flooding can be widespread with far reaching consequences; affecting people, communities, buildings and infrastructure and resulting in severe displacement after an event, with for example, people being rehomed in temporary accommodation for several months as in the case of the 2007 floods (EA 2010). To compound these impacts, the sources of flooding can include fluvial, coastal, pluvial, sewer and groundwater (EA 2009a) occurring independently but also in combination, resulting in wide reaching effects and consequences. The Appendix provides a summary (*Table A1*) of key flood risk data available for flood in England demonstrating that socio-economic factors including population growth, a changing climate, new development in the floodplain and the relatively little understood surface water risk are the main challenges facing England's flood risk management.

Flood insurance across England and the whole of the United Kingdom is unique amongst most other national schemes as it is purely underwritten by the private market. Yet a relationship between insurers and government is present in the form of an agreement, the Statement of Principles (SoP) formally known as the 'Gentleman's Agreement' whereby flood insurance is included as part of a standard policy to households and SMEs, built before 2009, where flood risks are not significant or where defences are due to be built within five years (ABI 2008). In return Government has given its commitment to continue to invest in flood risk mitigation. This public-private relationship can be traced back to the severe flooding in 1952 and the East Coast floods of 1953. At this point few properties held contents cover and even less had buildings cover, leading to large uninsured losses and initiating the insurance industry to pay out in the first event – even though flooding was not specifically covered (Arnell *et al.* 1984). On the basis that flood insurance was deemed more financially sound than government payouts, the government considered the potential for a compulsory public scheme (Arnell *et al.*, 1984), this was mooted until large losses again occurred in 1960 – prompting government to approach insurers to deliver more flood insurance to private, commercial and industrial properties. The industry agreed to this, partly under the threat of nationalisation, and flood insurance became increasingly available from the 1970s as part of standard domestic policies and later for small commercial properties.

The SoP was established in 2000 in the wake of growing flood losses and sets commitments from both the insurance industry and government to establish flood insurance provision. Outlined in the figure below (*Figure 1*), the main obligations can be summarized as follows:

⁴ We focus on England, but acknowledge that the existing insurance scheme is similar across the UK, while the government's flood risk management policy differs across the devolved administrations

Flood insurance is provided by private insurers under the SoP to both households and small businesses, generally up to a risk level of 1:75 return period (RP) (1.3%) as part of their building and/or contents cover. Properties at higher risk are granted cover if insurers are informed by the EA about plans for flood defence improvements for the particular area within the next five years. Government commits to investment in flood defences and improved flood risk data provision as well as a strengthened planning system. The main cornerstone of the SoP is a mutual interest in a functioning private flood insurance system. The agreement deals with availability of cover, while pricing and terms and conditions are not affected by the SoP, and it allows for cross subsidisation between those households and businesses at differing levels of risk.

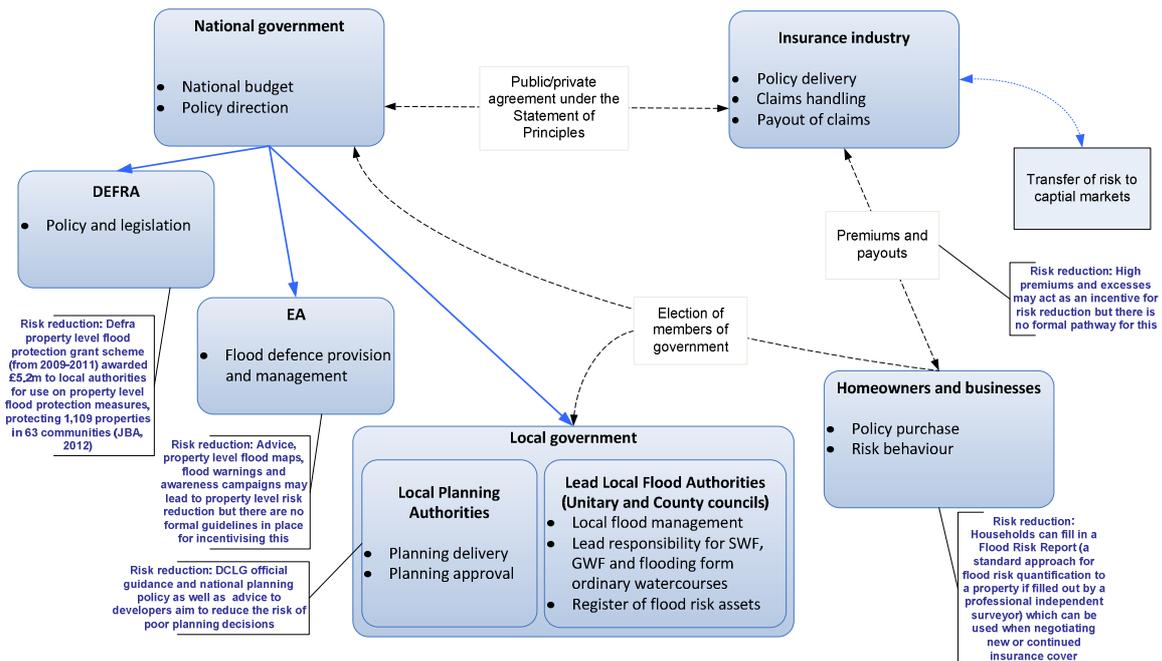


Figure 1: Roles and responsibilities of the government and insurers with highlighted risk reduction roles.

The SoP was due to expire shortly after the 2007 floods, with a renewed version agreed in June 2008 to last until July 2013. What would follow has been subject to discussion for more than two years. At the start of the negotiations a set of joint principles were agreed by the insurance industry and government and published by Defra (*Box 1*), outlining a vision for the future of flood insurance:

Principles

1. Insurance cover for flooding should be widely available.
2. Flood insurance premiums and excesses should reflect the risk of flood damage to the property insured, taking into account any resistance or resilience measures.
3. The provision of flood insurance should be equitable.
4. The model should not distort competition between insurance firms.
5. Any new model should be practical and deliverable.
6. Any new model should encourage the take up of flood insurance, especially by low-income households.
7. Where economically viable, affordable and technically possible, investment in flood risk management activity, including resilience and other measures to reduce flood risk, should be encouraged. This includes, but is not limited to, direct Government investment.
8. Any new model should be sustainable in the long run, affordable to the public purse and offer value for money to the taxpayer.

Box 1: Principles for flood insurance, source: Defra (2011) p.5.

For our investigation of the risk reduction elements, principles 2 and 7 are directly relevant. But in the context of rising risk levels we argue that risk reduction will become increasingly important to address availability and affordability, as well as the economic viability of a scheme. A key point in the debate is the government averseness to taking on the financial risk of an insurance scheme, this is highlighted by the Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs stating that money would be better spent ‘delivering defences rather than subsidising insurance premiums’, while at the same time aiming for universal availability of coverage and affordability (Hansard 2011).

After more than two years of negotiation an agreement between industry and government seems to have been found, with the proposed changes to the new flood insurance system now being legislated for. Both sides are supporting the so-called Flood Re scheme which will create an insurance pool for properties at high risk of flooding (Defra 2013b). During the public consultation phase the government also presented three alternative options to Flood Re, which are detailed in *Table A3* in the Appendix. Flood. While an imposed ‘obligation’ for insurers to cover high risks remains the official ‘Plan B’ should Flood Re not deliver, the other two options have been dismissed by government and industry: free-market because of the potential for an immediate transition to fully risk reflective costs (although this option is in fact better in economic terms than Flood Re (Defra 2013a)) and a direct subsidy for high risk properties on the grounds of this being less beneficial than Flood Re (Defra 2013b). Flood Re (see *Figure 2*) is based on provision for households under low to normal risk with standard insurance provision, and high risk properties under the Flood Re pool. The subsidy for the latter is claimed from a levy taken from all policyholders. This levy will be imposed on insurers according to their market share, and equate to an average of £10.50 per policy. The premiums offered for high risk households are intended to be fixed based on council tax banding and cover offered at a set price, based on what is felt to be an affordable initial price

for high risk households to pay. The government proposal is that small businesses will not be covered by the Pool unless they operate from home with a domestic insurance policy in place. Policy excesses are intended to be limited to between £250 and £500. Several other technical aspects remain unclear, including the handling of flood losses beyond a suggested cap of 1 in 200 loss event, and will be subject to debate between insurers and government.

Flood Re is proposed as a transitional solution to ‘ensure the availability and affordability of flood insurance, without placing unsustainable costs on wider policyholders and the taxpayer’ (Defra 2013c) – pointing to principles 1, 3, and 8 in the above list, although the ‘value for money’ element is highly debated, as the scheme does not meet the minimum government standard for cost-benefits (Defra 2013a; Defra 2013b p.30). Risk reduction does not feature in the official proposal language, other than in the supporting Memorandum of Understanding, which sets out government’s commitment to flood risk management and joint efforts to improve flood risk data.

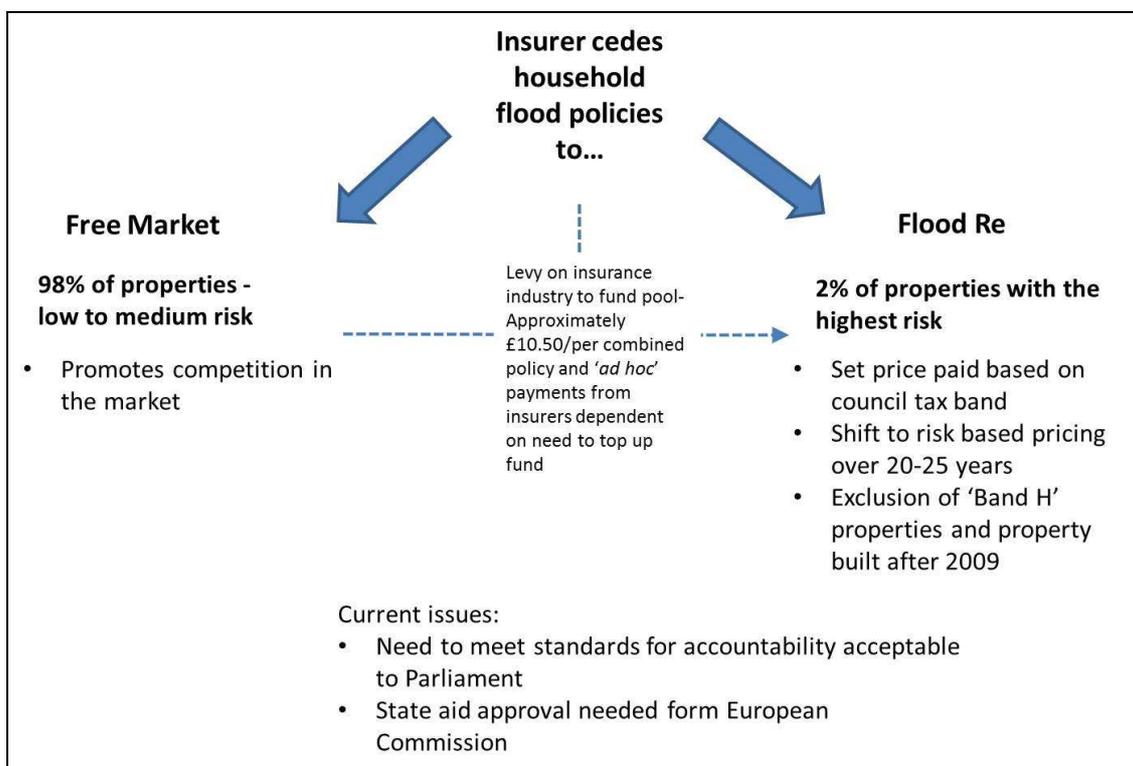


Figure 2: Detail taken from the Environment, Flood and Rural Affairs Committee (House of Commons 2013) on 26th February 2013 for the Flood Re insurance proposal and Flood Re Memorandum of Understanding (Defra and ABI 2013).

We will now investigate if and how the principle of risk reduction is considered in the provision of flood insurance in England by applying our framework to the existing SoP scheme and in the proposed Flood Re scheme.

4. Assessment of the risk reduction potential of the existing and proposed scheme

We first assess the formal arrangements in place for the SoP and those proposed for Flood Re, and then reflect on actions taken by the identified agents on an informal basis: for

example the insurance industry publishing guidance for property developers on how to consider flood risk in new developments, or government and industry co-operating on establishing a Flood Risk Report template, to enable homeowners to report flood resilience measures implemented in their home to their insurer. Both are examples for activities aimed at reducing flood risk, but they occur outside the formal requirements of the flood insurance scheme. As a final step we will consider the barriers and limitations that currently exist for utilizing flood insurance for risk reduction and conclude with recommendations on how to address this in a modified Flood Re scheme.

Table 1 summarizes the findings of our assessment of the formal risk reduction elements in the governing both SoP and Flood Re.

Does the insurance system:	Current insurance system (SoP)	Future flood insurance system (Flood Re)
Increase risk awareness and knowledge of risks through flood risk information provision?	Yes- improved public flood risk information is part of the Government's commitment under the SoP. No requirements for insurers to share information and data, or increase transparency about flood risk in insurance documentation.	Yes- under the new Memorandum of Understanding the ABI is to provide free of charge, a national database of property level flood claims by January 2014, and government commits to publication of surface water map and combined maps.
Build capacity for risk reduction through advice on risk reduction measures?	No formal requirement. But both government and insurers have published advisory documents and conducted research in this area.	Not referenced in the scheme, but informal approaches are present through community resilience capacity building.
Provide financial incentives for policyholders towards mitigation investment	Whilst the SoP does not govern pricing of risks, an element of risk –reflective pricing has emerged under the SoP.	Prices under Flood Re are intended to be capped for all high risk households at the same level, overriding pricing signals and incentives. Flood Re is designed to smooth the transition to risk based pricing, prices are controlled.
Promote resilient reinstatement techniques after a flood loss	Not formalized –information material is provided by insurers voluntarily.	No mention.
Incentivise public flood risk management policy	Yes –the government commit to stricter planning rules as well as for flood defence investment and maintenance. This is core element of the agreement, compliance is regularly checked.	Yes – through 'letter of comfort' stating government will provide flood risk management investment and planning policy. No mechanism for monitoring compliance.
Require compulsory risk reduction	Not for policy holders, but for government in terms of public flood risk management policy.	No
Incentivise not developing in flood risk areas	Yes, by excluding new build (from 2009) from SoP	Yes, by excluding new build (from 2009) from Flood Re

Table 1: Summary of the findings of our assessment of the formal risk reduction elements in both the Statement of Principles and Flood Re.

Based on our assessment framework both schemes appear fairly similar with one clear distinction: The existing SoP addresses flood insurance for those properties not at high flood risk and does not include price controls, while Flood Re is aimed at high risk properties subject to price controls, with those outside the scheme relying on the free private market (see *Figure 2*). In terms of incentives for risk reduction this is an important aspect. While Government and industry officially recognize the importance of risk based pricing, Flood Re is designed to delay this for high risk properties. Beyond the Memorandum of Understanding, which carries over the spirit of the SoP into this new arrangement, there are no requirements for built-in incentive mechanisms. However, a more detailed analysis of the seven criteria shows that there are certain risk reduction activities being conducted by stakeholders outside the formal insurance scheme. Below we outline our findings for each of the seven criteria in greater detail:

1. *Do flood insurance schemes increase risk awareness and knowledge about risks - such as the provision of risk-relevant information and knowledge transfer to educate policyholders and the public?*

Informing agents about flood risk levels can raise their risk awareness – which is widely seen as a pre-cursor to taking action to address risk and forms a fundamental component of flood management models (Treby *et al.* 2006). Within an insurance scheme this can be addressed through risk price signals and risk information in insurance policy documentations, or through general flood risk information sharing between industry, government and the public (WEF 2011; Surminski and Oramas-Dorta 2013). Both SoP and Flood Re contain no mechanism to educate those insured at the point of sale of insurance. Due to the existing cross-subsidisation between low and high risk properties the risk awareness impact of the current pricing structure is limited. Under Flood Re, the move to a levy could create a lever for risk awareness, if it could make risk levels and costs more transparent. The proposed Flood Re system does not contain requirements for this. Instead, the Flood Re elements would be invisible to insurance customers, as they will not deal with Flood Re and may not be aware that their policy is reinsured through Flood Re.

The SoP does contain a formal requirement for government to improve flood risk data: ‘Communicating flood risk effectively, including providing higher quality and more detailed information on flood risk, and on existing, new and upcoming flood protection schemes’ (ABI 2005a). In response there have been efforts to improve stakeholder access to flood risk maps (for example the EA Online Map), update the National Flood Risk Assessment Data (NaFRA) and broader information campaigns such as the current ‘Floods Destroy, Be Prepared’ awareness initiative and information on how to receive flood warnings, flood risk information and risk mitigation.

There is no formal requirement for insurance providers to share flood risk information with their customers or government under the SoP. While there is evidence for risk information work conducted by the ABI and its members, providing online flood risk information and raising awareness with customers and government, (ABI 2012a) this is not linked to the insurance policy documentation. However, under the MoU for Flood Re (Defra and ABI 2013), there is a requirement for the ABI to provide a database of claims history from insurers at property level by January 2014 (note this will be given to the public authorities and not available to the general public). This addresses the need for more transparency and greater sharing of data, which is often hampered by concerns about confidentiality and

licencing questions regarding public flood data when used for commercial purposes. Some insurance companies have invested heavily in flood risk models to gain a competitive edge, which has led to the emergence of a modelling industry and a growing understanding of risks. The experience with the SoP highlights further barriers to increasing flood risk information through insurance: communicating flood risk probabilities to individuals, and reaching those most vulnerable (Lloyd's 2011).

2. *Does flood insurance increase capacity for risk reduction by informing about the benefits of flood risk management and preventive measures?*

Advising on benefits of flood risk management can be a powerful tool to trigger action, particularly in the context of flood defence investment (EFRA 2013a). The fact that the SoP is based on government's commitment to invest in flood management is evidence that insurers see clear benefits in measures such as flood defence. In fact the ABI has been advising on benefits of defence investment (ABI 2005b) and continues to promote the EA's cost benefit ratio of 1 in 8 of flood defences (EA 2009a). The spirit of this agreement is reflected in the MoU that has been released with the Flood Re proposal: (Defra and ABI 2013), but without the explicit commitment that was given under the SoP.

With regards to property level protection measures (PLPMs) there are no formal mechanisms to advise policyholders about the options under SoP or Flood Re. Beyond the insurance schemes there is a range of information available for homeowners to learn more about different types of measures that can be implemented for property resilience from government (see for example, the EA Website, <http://www.environment.gov.uk/homeandleisure/floods/105979.aspx>), but also from the industry (see, for example, ABI 2012a).

Similar to criteria 1 above there is limited evidence how information about the benefits of flood risk management measures actually increase action by policy holders in England. The key barrier remains financial (JBA 2012), but there are a wide range of more subtle factors at play, such as hassle, social and psychological issues (Harries 2009). A recent study by Ball *et al.* (2013) finds that the insurance industry actually remains doubtful that property level resilience and resistance measures provide a foundation for lowering policy costs or excesses: how PLPMs can actually be assessed consistently and accurately once in place remains an issue.

3. *Are there any explicit financial incentives that the insurance scheme provides to policyholders to invest in mitigation?*

Granting improved terms or reduced premiums to those who take risk reduction measures or benefit from defence structures is considered as the most obvious form of financial incentive that insurance can create and it is the main reason why risk-based pricing is widely advocated amongst risk reduction experts (Kunreuther 1996).

Both the SoP and the Flood Re proposal do not contain any formal mechanisms for this, in fact the Flood Re model is aimed at smoothing a transition to such a risk-based pricing scenario in the future. Although research by Lamond (2009) demonstrated that little correlation could be found between flood risk and insurance pricing, by 2010 this has changed according to the industry, with a fifth of households at significant flood risk paying a risk reflective price (ABI 2010). This transition towards risk-reflective pricing may have

been what both the government and the insurance industry had in mind when the 2008 agreement was reached. This would allow insurance companies to gradually manage down their exposure whilst provoking additional risk mitigation by households.

There is some evidence that particularly for high risk properties the installation of flood risk measures has led to improved insurance terms – such as reduced excess or premium reduction (Surminski 2013). But the National Flood Forum states that installation of PLPMs in most cases do not result in improved terms (Cobbing and Miller 2012). Under the SoP there is an incentive for risk reduction through the existence of a risk threshold of 1 in 75 years – properties with higher risk levels are not covered by the SoP and may struggle finding insurance. While this can be interpreted as an incentive for risk reduction, without the necessary action this leads to ‘uninsurability’.

The closest formal route that can be found in England for insurers to accommodate a price reduction for mitigation measures is the Flood Risk Report that can be used as a standard approach to provide insurers with information on any resilience measures in place for a property, this can be then taken into consideration for current or future terms, yet there is no guarantee it can be used to gain a financial incentive. As Ball *et al.* (2013) state; adoption of property level measures are difficult to assess so insurers do not necessarily see them as a basis for lowering policy costs.

4. Does the insurance scheme promote resilient reinstatement techniques after a flood loss?

Increasing the flood resilience of a property after a flood loss could potentially be an effective measure to reduce the impact of future floods. There is no reflection on this in either the SoP or Flood Re. A consultation on Scottish legislation has proposed that resilient reinstatement should be the norm in flooded properties (Crichton 2012) – however, the economics of this remain unclear. A report commissioned by the ABI states that on average resilient reinstatement costs 40% more than standard reinstatement, a cost of around £12,000 (Wassell *et al.* 2009) and if the cost is greater than standard repair in previously flooded property, then insurers will only fund the standard repair (ABI and NFF 2012). The study also finds that there are difficulties in reinstatement for certain house types, for example semi-detached or terraced properties and a major challenge is actually providing information and guidance to property owners when they are perhaps at their least able to manage during a particularly difficult time.

5. Are there incentives for public flood risk management policy arising from the insurance scheme?

Depending on design and implementation an insurance scheme can send signals to policy makers in support of flood risk management policies, which would address risk levels and provide political guidance. The clearest link would be a financial liability, which makes government responsible for paying certain losses above a loss threshold with an interest in keeping losses low. This concept is absent from the SoP scheme, and also from the proposed Flood Re. Throughout the negotiations between industry and government this appears to have been a critical aspect and even now there is lack of clarity about how catastrophic losses that might exhaust the pool would be dealt with.

The agreement from insurers to provide cover under the SoP is based on the expectation that government would deliver on their commitment of sufficient investment in flood defences and an improved public planning policy, outlined as clear indicators in the main SoP agreement document: As ‘action from Government’ it lists ‘reducing the probability of flooding in the UK; at least maintaining investment in flood management each year and discuss future funding taking into account climate change, implement reforms to the land use planning system; communicate flood risk effectively and provide more detailed higher quality flood risk information and develop an integrated approach to urban drainage’ (ABI 2005a).

While the fulfilment of these policy demands has been subject to debate – particularly with regards to investment levels, but also about the success of the planning system – it is a clear lever to steer public policy and government spending, particularly in times of public spending constraints. The 2010 Comprehensive Spending Review (2011/2 to 2014/5) delivered a six per cent reduction in central governmental funding between 2007/8 and 2010/1 (NAO 2013), something which was a ‘disappointment’ to insurers (ABI 2010). However the Treasury, in late 2012, provided an additional £120m for flood management project (HM Treasury 2012), an indication perhaps of government resolve for further commitment to the insurance industry. Yet maintenance and upgrading of defences as well as new defences are required and it is yet to be seen how funding will be provided over future periods. This has previously led to a very narrow focus on flood defence spending, ignoring the importance of other flood risk management approaches.

Within Flood Re the MoU (Defra and ABI 2013), maintains this approach to some extent, with a ‘letter of comfort’ by government, stating long term commitment to expenditure on flood risk management and that inappropriate development should be avoided in-line with the National Planning Policy Framework (NPPF). While this reflects on the aims outlined under the SoP, it is unclear how important it will be once Flood Re is operational.

6. *Does compulsory risk reduction, such as requiring policy holders to take certain preventive measures as a condition for cover, exist?*

Any insurance contract is subject to terms and conditions and the use of minimum safety standards (for example the requirement of locking doors, installing window locks etc.) is common in home insurance.

Both the SoP and the proposed Flood Re do not contain formal risk-related requirements for policyholders, apart from the existence of the risk threshold of 1 in 75 that determines eligibility under the SoP. In order to fall under the SoP agreement a house must be below this risk level, or prove that flood defence schemes planned in that particular location will result in lower risks within the next 5 years. Flood Re is designed to protect high risk properties, and in its current form there is no clear incentive for a homeowner to aim for a lower risk level than the Flood Re threshold. Interestingly the Flood Re proposal is based on an assumption that individual risk reduction efforts will naturally occur through an eventual move to risk reflective pricing (Defra 2013b). How this will be achieved considering all the barriers outlined above remains unclear.

On the public policy side the provision of flood defences through public investment as well as the commitment from government to reforming the land use planning system can be interpreted as compulsory elements of the scheme. Under the SoP compliance is regularly

checked – but monitoring performance is challenging, as outlined above. The Letter of Comfort provided to insurers under Flood Re maintains some of this spirit, but it does not amount to an enforceable ‘condition’ of cover.

7. *Does the insurance scheme provide incentives for not developing in flood risk areas?*

The availability of insurance can play a role in the decision to build new properties. Both the SoP and Flood Re do not apply to new buildings built since January 2009 – on the assumption that the planning system as well as increased awareness of developers should deliver and prevent new high risk properties from being built. When this came into practice ABI published a guidance document for property developers with advice on how to make future flood insurance cover more likely, which also included references to flood resilience. Flood Re maintains this exclusion for new buildings. There is limited evidence if this ‘disincentive’ has worked. The effectiveness of the planning system remains a cause of debate, with twenty per cent of floodplain development over the last ten years in areas of significant risk and development in the floodplain between 2001-2011 increasing by 12% (ASC, 2012). The issue is problematic as property developers have only a limited interest in the insurability of the new homes, not beyond the point of sale.

The picture emerging from this analysis is that both the SoP and Flood Re contain very few formal mechanisms to make insurance work for risk reduction. As indicated above, there are several barriers preventing a greater use of insurance for risk reduction. The experience with the SoP, our discussions with stakeholders and recent literature reveal some of them - as summarized in the table below (*Table 2*).

Barriers to risk reduction	Detail of barrier
Risk information	Insurers’ concerns about confidentiality of their claims data, licencing questions regarding public flood data when used for commercial purposes, communicating probabilities and flood risk information to individuals, reaching those most vulnerable; large group of data-owners; cost of collating and streamlining data
Information about risk reduction measures	Unclear cost-benefits
Financial incentives for risk reduction measures	Unclear cost-benefits, behavioural barriers, hassle factor, size of premium not big enough to trigger investment, difficulty in tracking/data implementation of PLPM, affordability challenge, contract length
Resilient repairs	Unclear cost-benefits, might take longer than standard repairs
Incentives for public policy	Difficulty of tracking and monitoring enforcement;
Compulsory measures	Unclear cost-benefits, competitive market, affordability
Incentive for new build	Limited interest by property developers to consider insurability, administrative burden for insurers, lack of data/tracking of

Table 2: Barriers to risk reduction under the Statement of Principles and Flood Re. Designing a new scheme such as Flood Re is an opportunity to address some of these barriers. To this extent the proposed Flood Re mechanism is a missed opportunity. In the

following discussion we will reflect on our findings and point towards some measures that would integrate risk reduction more closely into flood insurance.

5. Discussion Of options for addressing risk reduction in Flood Re

In 2011, at the official start of the latest round of debate about a future flood insurance scheme for England, Government and insurance industry outlined their key principles for effective flood Insurance in 2011 (see *Box 1* above). After two years of negotiations it is clear that several of those principles seem to have been sacrificed for the purpose of ensuring affordability and availability of insurance. Most notably, this applies to the principles 2, and 7, which focus on risk reduction. To what extent the new scheme offers 'value for money' (principle 8) is also far from clear.

Assessing the existing and newly proposed flood insurance arrangements for England against our risk reduction framework reveals that Flood Re as proposed by Government in July 2013 is not designed with risk reduction in mind, although in theory it could lead to risk reduction through a 25 year perspective to flood risk rather than a 1 year perspective as with current contracts. But there are no formal mechanisms within the proposed scheme that would utilize insurance for risk reduction. The only elements of risk reduction mechanisms visible are an exclusion of newly build properties, which may work as an incentive, and a letter of comfort, confirming government's commitment to invest in flood defences and ensure that the planning system constrains the increase in flood risk exposure.

This result is not surprising, as it is well known that a lot of barriers exist for making flood insurance work for risk reduction (*Table 2*). While in theory insurance can play an important role in driving flood risk reduction, in practice this remains a challenge. Limited political will and lack of appetite from the industry for innovation does not help either. It is somewhat encouraging to see that in Defra's response to the public consultation on securing the future availability and affordability of home insurance in areas of flood risk, government has acknowledged the importance of incentivising risk reduction through Flood Re, but it remains unclear if and how this will be translated into clear amendments of the Flood Re proposal. When it comes to design and implementation of the insurance schemes the risk reduction aspect does not appear at the core, but at the periphery of the debate. This is particularly important if one considers latest flood risk projections: Rising risk levels, due to socio-economic and climatic trends will be a challenge for any new flood insurance scheme, and not addressing the underlying risks will threaten affordability and availability of cover. There are a range of options for addressing the lack of risk reduction emphasis of Flood Re by amending the current proposals. But what would this consideration entail? Here it is important to focus on practical aspects of implementation: Who can take action, what are the barriers and how can insurance help?

- To begin with risk reduction should be established as an official aim of the new scheme. Current proposals state the 'Flood Reinsurance Scheme is a scheme which (a) is established for the purpose of providing reinsurance to relevant insurers in respect of such risks relating to flooding as are identified by the scheme, in such a way as to promote the availability and affordability of flood insurance for household premises while minimising the costs of doing so' (House of Commons 2013). Once risk reduction is included in this initial set-up, then it will need to be considered by all those who operate and administrate the scheme.

- Flood Re should help to build awareness of flood risk. Under the current proposal, the scheme is 'invisible' to the households it covers. Those households covered by the new scheme should be made aware in their policy documentation that they are benefitting from subsidised insurance cover and be provided with information about their flood risk level and what measures are in place to protect them. This would also help to promote transparency about the relationship between flood risk and premiums. The MoU outlines some promising flood risk information improvements and this should be further facilitated and supported by the Flood Re administrators. This may even lead to a public flood risk model, creating a level playing field for public, private and individual stakeholders, with cost savings for all involved. Despite progress with mapping, modelling and quantifying risks we still do not have a one-stop-flood risk database that creates level playing field between all stakeholders. Public and commercially derived maps show huge differences in detail, while surface water flooding is still not fully recognized and incorporated into our understanding of flood risk. Unless directly linked to the communication with Flood Re customers it is unclear what the impact the proposed data sharing will have.
- A clear plan for the proposed phasing out of Flood Re within 20-25 years is needed, within the context of an overall flood risk management strategy that includes details of future investment levels. Risk-based pricing is outlined as a future vision, with Flood Re as a stop-gap measure. The new system proposes a long term outlook of 20-25 years, with a moving target bringing premiums towards a risk reflective nature, but does not outline how this will be achieved. The danger of instant risk based pricing is used as justification for government intervention, to guard affordability and availability of cover. Interestingly there are no further details on how to achieve this longer term view in the Flood Re proposals.
- But even within the proposed pricing structure of Flood Re there is scope for encouraging and rewarding flood risk reduction measures by homeowners: Insurers could be required to utilise insurance retention and excess design to avoid claims inflation, while the scheme administrators could advise homeowners about risk reduction measures that can be carried out on their properties and the benefits of community-level flood risk management measures. Due to the pool's nature it would likely to be more economical to conduct these investigations for the whole pool portfolio rather than relying on individual insurers to do this.
- Clearer incentives for government action are needed. Flood Re creates only limited incentives for government to foster flood risk reduction. The Letter of Comfort outlines a broad commitment to managing flood risks, but it is unclear how effective this will be if the government has no financial liability for costs under Flood Re (Horn and McShane 2013). A stronger emphasis on risk reduction could be created by extending the proposed supervisory role of the Secretary of State to ensure that Flood Re considers risk reduction and reflects on official climate change projections. Local communities could be brought into the Flood Re incentive structure – possibly

by rewarding those who manage to reduce their reliance on Flood Re through flood risk management efforts. Here an incentive for home owners to move out of Flood Re would be important.

- In addition, there may be value in exploring how to bring in new stakeholders, such as property developers or mortgage providers. This will be particularly relevant for dealing with new-build properties. Flood Re should be accompanied by policy incentives that encourage developers and planners to give greater consideration to long-term flood risk management. Mechanisms that could be explored include a new flood insurance obligation for developers, covering the first 5–10 years of a new home.
- Flood Re should address those barriers that prevent the industry from playing a more enhanced role in risk reduction. Market dynamics as well as lack of economies of scale at household level can hamper efforts. Here it is important to make a distinction between what works in a commercial insurance context, such as pollution insurance and for individual homeowners, where the size of a premium does not justify individual risk surveys and advice, and often the policy holder only interacts with the insurers via a website, in an automated process. The one-year policy contract is another barrier, reducing the economic rationale for an insurer to invest in risk reduction at a property – as there is a risk that this customer may move elsewhere, once the measures are established. Flood Re as a new pool provides an opportunity to address these market problems. An example would be a standard requirement for making resilient repairs mandatory for claims paid by Flood Re – this may increase the cost to the pool initially, but should help some homeowners moving out of the scheme.

6. Conclusion

Flood risk is a challenge for England – today and most likely even more so in the future. The current debate about insurance illustrates a fundamental challenge: the concern about affordability is usually seen in a short-term perspective, often driven by election cycles, while there is no strategy for the longer-term, despite the fact that Flood Re is officially aimed at securing flood insurance for the future. The effectiveness of such a scheme relies on the underlying prevention and damage control. Concerns about the affordability and availability of flood insurance are symptomatic, rather than the cause, of the need for reform. If risks are left unmanaged insurance becomes invalid, particularly if provided by the private sector. Design and operation of an insurance scheme should have good risk management behaviour in mind and avoid moral hazard. This is why modifications to the proposed Flood Re scheme are so important.

As our analysis shows there are some potentially relevant activities occurring outside the formal insurance arrangement, through government and insurance. This should not be dismissed as this can trigger action and lead the way for risk reduction. We argue that through the SoP a close working relationship between government, industry and some other

stakeholders has been established. Joint research and publications, events and working groups indicate this. The effectiveness of these initiatives is difficult to measure, but at least there is a degree of exchange and communication between the stakeholders. This is encouraging and should provide a more fertile ground for amending the proposed Flood Re scheme and building in incentives for risk reduction for homeowners, insurers, and governments. This message is also relevant to other countries, where existing schemes are currently reviewed, such as in the US and across the EU, or in countries that don't yet have flood insurance cover. The barriers for utilizing insurance for risk reduction are clear – factoring those in at the design stage of a scheme can provide scope to further enhance this and strengthen this link going forward.

Finally we need to keep in mind that insurance is just one tool amongst the many that are required for a holistic strategy on flood risk management. It is important to remember that insurance is intended to cover unexpected losses, and does not prevent a flood from occurring. Compensation for financial losses is important, but the consequences of a flood are much greater, affecting infrastructure, disrupting lives and livelihoods, causing stress and health problems, and resulting in other so-called 'noneconomic' losses. Risk reduction is important for all this; the benefits go beyond the insured losses. The benefits of effective planning policy and flood risk management go beyond insured losses

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8. Notes

¹The term return period or RP is the probabilistic estimate that an event may occur in any given year, it can also be expressed as a percentage, however it must be also noted that it is independent of when the last event may have occurred.

9. References

ABI (2013a) A guide to resistant and **resilient** repair after a flood. [online]. Association of British Insurers. https://www.abi.org.uk/~/_media/Files/Documents/Publications/Public/Migrated/Flooding/A%20guide%20to%20resistant%20and%20resilient%20repair%20after%20a%20flood.ashx [accessed 30 July 2013].

ABI (2013b) ABI responds to Owen Paterson comments on flood defence funding [online]. Association of British Insurers. <https://www.abi.org.uk/News/News-updates/2013/09/ABI-responds-to-Owen-Patterson-comments-on-flooding> [accessed 30 October 2013].

ABI (2013c) Home insurance [online] . Association of British Insurers. <https://www.abi.org.uk/Insurance-and-savings/Products/Home-insurance> [accessed 4 September 2013].

ABI (2010) Massive rise in Britain's flood damage bill highlights the need for more help for flood vulnerable communities says the ABI, ABI News Release [online]. Association of British Insurers. <https://www.abi.org.uk/News/News-releases/2010/11/massive-rise-in-britains-flood-damage-bill-highlights-the-need-for-more-help-for-flood-vulnerable-communities-says-the-abi.aspx> [accessed 30 July 2013].

ABI (2008) Revised Statement of Principles on the provision of flood insurance [online]. Association of British Insurers. <http://archive.defra.gov.uk/environment/flooding/documents/interim2/sop-insurance-agreement-080709.pdf> [accessed 23 April 2013].

ABI (2005a) ABI Statement of Principles on the provision of flood insurance. Association of British Insurers, London.

ABI (2005b) *Financial Risks of Climate Change*. Association of British Insurers, London.

ABI and NFF (2012) Repairing your home or business after a flood – how to limit damage and disruption in the future [online]. Association of British Insurers and National Flood Forum.

<http://www.cila.co.uk/files/Repairing%20your%20home%20or%20business%20after%20a%20flood.pdf> [accessed 15 November 2013].

Akerlof, G. A. (1970) The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, **84** (3), 488-500.

Arnell, N.W., Clark, M. J. and Gurnell, A. M. (1984) Flood insurance and extreme events: the role of crisis in prompting changes in British institutional response to flood hazard. *Applied Geography*, **4** (2), 167-181.

ASC (2012) Climate change – is the UK preparing for flooding and water scarcity? Adaptation Sub-Committee Progress Report 2012 [online] Committee on Climate Change. http://hmccc.s3.amazonaws.com/ASC/2012%20report/1586_ASC%20Report%202012_Bookmarked_2.pdf [accessed 30 July 2013].

Ball, T., Werritty, A. and Geddes, A. (2013) Insurance and sustainability in flood-risk management: the UK in a transitional state. *Area*, **45** (3), 266-272.

Bräuningner, M., Butzengeiger-Geyer, S., Dlugolecki, A., Hochrainer, S., Köhler, M., Linnerooth-Bayer, J., Mechler, R., Michaelowa, A. and Schulze, S., (2011) Application of economic instruments for adaptation to climate change Final report [online]. Perspectives GmbH.

http://ec.europa.eu/clima/policies/adaptation/what/docs/economic_instruments_en.pdf [accessed 17 December 2013].

Born, P. H. and Klimaszewski-Blettner, B. (2013) Should I Stay or Should I Go? The Impact of Natural Disasters and Regulation on U.S. Property Insurers' Supply Decisions. *Journal of Risk and Insurance*, **80** (1), 1-36.

Botzen, W. J. W., Aerts, J. C. J. H. and van den Bergh, J. C. J. M. (2009) Willingness of homeowners to mitigate climate risk through insurance, *Ecol Econ*. **68** (8–9), 2265–2277.

Botzen, W. J. W., van den Burgh, J. C. J. M. and Bower, A. E. L. M. (2010) Climate change and increased risk for the insurance sector: a global perspective and an assessment for the Netherlands. *Natural Hazards*, **52**, 577–598.

Browne, M. J., and Hoyt, R. E. (2000) The demand for flood insurance: empirical evidence. *Journal of risk and uncertainty*, **20** (3), 291-306.

Cabinet Office (2013) National Risk Register of Civil Emergencies 2013 edition [online]. Cabinet Office.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211867/2900895_NationalRiskRegister_acc.pdf [accessed 24 July 2013].

Camerer, C., F. and Kunreuther, H. (1989). Decision processes for low probability events: Policy implications. *Journal of Policy Analysis and Management*, **8** (4), 565-592.

CCC (2010) 19/11/2010 - Cumbria floods: One year on [online]. Cumbria County Council.
http://www.cumbria.gov.uk/news/Archive/2010/November/15_11_2010-162510.asp
[accessed 10 July 2013].

Charpentier, A. (2008) Insurability of Climate Risks. *The Geneva Papers*, **33**, 91-109.

Cobbing, P. and Miller, S. (2012) Property Level Protection and Insurance Main Report. National Flood Forum. <http://nationalfloodforum.org.uk/wp-content/uploads/PLP-and-Insurance-Report-FINAL.pdf> [accessed 27 November 2013].

Crichton, D. (2012) *Floodplain Speaking 3rd Edition*. The Chartered Insurance Institute, London.

Crichton, D. (2008) Role of insurance in Reducing Flood Risk. *The Geneva Papers*, **33**, 117-132.

Dailey, P., Huddleston, M., Brown, S. and Fasking, D. (2009) *The Financial Risks of Climate Change Examining the financial implications of climate change using climate models and insurance catastrophe risk models ABI Research Paper no. 19*. AIR Worldwide and the Met Office, London.

Defra (2013a). Managing the future financial risk of flooding Impact Assessment. [online] Department for Environment, Food and Rural Affairs.
https://consult.defra.gov.uk/flooding/floodinsurance/supporting_documents/20130627%20FINAL%20Flood%20Ins%20%20consultation%20stage%20IA.pdf [accessed 21 August 2013].

Defra (2013b) Securing the future availability and affordability of home insurance in areas of flood risk [online]. Department for Environment, Food and Rural Affairs.
https://consult.defra.gov.uk/flooding/floodinsurance/supporting_documents/20130626%20FINAL%20Future%20of%20Flood%20Insurance%20%20consultation%20document.pdf
[accessed 10 July 2013].

Defra (2013c). Reducing the threats of flooding and coastal change [online]. Department for Environment, Food and Rural Affairs. <https://www.gov.uk/government/policies/reducing-the-threats-of-flooding-and-coastal-change/supporting-pages/funding-flood-and-coastal-erosion-risk-management-in-england> [accessed 10 July 2013].

Defra and ABI (2013) Flood Re Proposal: Memorandum of Understanding [online]. Department for Environment, Food and Rural Affairs and the Association of British Insurers.

https://consult.defra.gov.uk/flooding/floodinsurance/supporting_documents/20130626%20Flood%20Insurance%20MOU%20June%202013%20unprotected.pdf [accessed 8 July 2013].

Defra (2012a) The UK Climate Change Risk Assessment 2012 Evidence Report, Project deliverable number D.4.2.1 [online]. Department for Environment, Food and Rural Affairs. http://randd.defra.gov.uk/Document.aspx?Document=10067_CCRAEvidenceReport16July2012.pdf [accessed 30 July 2013].

Defra (2012b) UK Climate Change Risk Assessment 2012 Floods and Coastal Erosion [online]. Department for Environment, Food and Rural Affairs. <http://randd.defra.gov.uk/Document.aspx?Document=CCRASummaryFloodsandCoastalErosion.pdf> [accessed 30 July 2013].

Defra (2012c) UK climate change risk assessment 2012, Agriculture section. Department for Environment, Food and Rural Affairs. <http://randd.defra.gov.uk/Document.aspx?Document=CCRAfortheAgricultureSector.pdf> [accessed 30 July 2013].

Defra (2011) Flood risk and insurance: A roadmap to 2013 and beyond Final report of the flood insurance working groups [online]. Department for Environment, Food and Rural Affairs, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69467/pb13684-flood-risk-insurance.pdf [accessed 30 July 2013].

EA (2013). Freedom of Information request from the Environment Agency. Environment Agency, Bristol.

EA (2011a) Environment Agency (EA) National Flood Risk Assessment (NaFRA) 2011 [online]. Environment Agency. <http://data.gov.uk/dataset/number-of-properties-at-risk-of-flooding> [accessed 30 July 2013].

EA (2010) The costs of the summer 2007 floods in England, Flood and Coastal Erosion Risk Management Research and Development Programme SC070039/R1 [online]. Environment Agency. <http://a0768b4a8a31e106d8b0-x50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/scho1109brja-e-e.pdf> [accessed 30 July 2013].

EA (2009a). Flooding in England A National Assessment of Flood Risk [online]. Environment Agency. <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0609bqds-e-e.pdf> [accessed 30 July 2013].

EA (2009b) Flood and coastal risk management in England A long-term investment strategy [online]. Environment Agency. <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0609bqdf-e-e.pdf> [accessed 30 July 2013].

EFRA (2013a) Environment, Food and Rural Affairs Committee - Third Report of Session 2013-2014 Managing Flood Risk [online]. Environment, Food and Rural Affairs Committee. <http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenvfru/330/330.pdf> [accessed 30 July 2013].

EFRA (2013b) Flood Funding, Written evidence submitted by the NFU [online]. Environment, Food and Rural Affairs Committee.

<http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenvfru/writev/flood/m05.htm>
[accessed 18 July 2013].

EFRA (2009) Environment, Food and Rural Affairs Committee - Sixth Report
The Draft Flood and Water Management Bill [online]. House of Commons.
<http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvfru/555/55502.htm> [accessed 18 July 2013].

Evans, E. P., Ashley, R., Hall, J., Penning-Rowsell, E. C., Saul, A., Sayers, P., Thorne, C. & Watkinson, A. (2004). *Foresight Future Flooding Scientific Summary Volumes I and II*. Office of Science and Technology, London.

Hansard (2011) HC Deb 19 December 2011 c141 Written Statement [online]. House of Commons.

<http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm111219/wmstext/111219m0001.htm#1112191000143> [accessed 21 August 2013].

Harries, T. (2013) Responding to flood risk in the UK. *In*: Joffe, Helene, Rossetto, Tiziana and Adams, John, (eds.) *Cities at risk: living with perils in the 21st century*. Springer: Dordrecht.

Harries, T. (2009) Review of the Pilot Flood Protection Grant Scheme in a Recently Flooded Area. EA Project: FD2651/TR [online]. Environment Agency. http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/Review_of_Pilot_Flood_Protection_Grant_-_Technical_Summary.sflb.ashx [accessed 15 October 2013].

HM Government (2013). The National Adaptation Programme: Making the country resilient to a changing climate [online]. Her Majesty's Government.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf [accessed 31 July 2013].

HM Treasury (2012) Press release £120 million boost to flood defences will protect homes and businesses and help drive growth [online]. <https://www.gov.uk/government/news/120-million-boost-to-flood-defences-will-protect-homes-and-businesses-and-help-drive-growth--121> [accessed 28 May 2013].

Horn, D. and McShane, M., (2013). Flooding the market. *Nature Climate Change*, **3**, 945-947.

House of Commons (2013) Flood insurance clauses Part 1 – Flood insurance [online]. House of Commons.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/237133/flood-insurance-clauses.pdf [accessed 4 December 2013].

House of Commons Library (2010) Key Issues for the New Parliament 2010 [online]. House of Commons Library.

http://www.parliament.uk/documents/commons/lib/research/key_issues/Full-doc.pdf#page=2 [accessed 16 July 2013].

Huber, M. (2004) Reforming the UK Flood Insurance Regulation. The **Breakdown of a Gentlemen's Agreement** [online]. London School of Economics and Political Science. <http://eprints.lse.ac.uk/36049/1/Disspaper18.pdf> [accessed 24 April 2013].

JBA (2012). Evaluation of the Defra Property-level Flood Protection Scheme: 25918 [online]. JBA <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0312bwdv-e-e.pdf> [accessed 16 October 2013].

Kunreuther, H. (1996) Mitigating disaster losses through insurance. *Journal of Risk and Uncertainty*, **12**, 171-187.

Kunreuther, H. (1984) Causes of Underinsurance against Natural Disasters. *The Geneva Papers on Risk and Insurance*, **31**, 206–20.

Kunreuther, H.C. Michel-Kerjan, E.O. (2009) Managing catastrophes through insurance: Challenges and opportunities for reducing future risks, working paper 2009-11-30. The Wharton School, University of Pennsylvania, Philadelphia.

Lamond, J. E., Proverbs, D. G. and Hammond, F. N. (2009) Accessibility of flood risk insurance in the UK: confusion, competition and complacency. *Journal of Risk Research*, **12** (6), 825-841.

Lin, X. J., (2013) The Interaction Between Risk Classification and Adverse selection: Evidence from California's Residential Earthquake Insurance Market. *Aria* (in press).

Lloyd's (2011) Flood, resilience, response and recovery [online]. Lloyd's. <http://www.lloyds.com/~media/lloyds/reports/emerging%20risk%20reports/rusi%20final%20copy.pdf> [accessed 27 November 2013].

Lowe, J.A., Howard, T.P., Pardaens, A., Tinker, J., Jenkins, G., Ridley, J., Leake, J., Holt, J., Wakelin, S., Wolf, J., Horsburgh, K., Reeder, T., Milne, G., Bradley, S., and Dye, S. (2009) UK Climate Projections Science Report: Marine and Coastal Projections [online]. Meteorological Office, Hadley Centre. http://ukclimateprojections.defra.gov.uk/images/stories/marine_pdfs/UKP09_Marine_report.pdf [accessed 27 November 2013].

Luffman, I. E. (2010) Wake-up Call in East Tennessee?: Correlating Flood Losses to National Flood Insurance Program Enrollment (1978-2006). *Southeastern Geographer*, **50** (3), 305-322.

McAneney, J., Crompton, R., McAneney, D., Musulin, R., Walker, G., Pielke, R. (2013) Market-based mechanisms for climate change adaptation: Assessing the potential for and limits to insurance and market based mechanisms for encouraging climate change adaptation [online]. National Climate Change Adaptation Research Facility. http://www.nccarf.edu.au/sites/default/files/attached_files_publications/McAneney-Market-based-mechanisms-for-climate-change-adaptation1.pdf

NAO (2013) *Flood Risk Management in England – an update of progress. Memorandum for the House of Commons Environment, Food and Rural Affairs Select Committee*. National Audit Office, London

NAO (2011) Flood Risk Management in England, Report by the Comptroller and Auditor General [online]. Department for Environment, Food and Rural Affairs and Environment Agency <http://www.nao.org.uk/wp-content/uploads/2011/10/10121521.pdf>

OECD (2003) *Environmental Risk and Insurance: a Comparative Analysis of the Role of Insurance in the Management of Environment-Related Risks*. The Organisation for Economic Co-operation and Development, Paris.

OECD (2003). Environmental risk and insurance: a comparative analysis of the role of insurance in the management of environment-related risks [online]. The Organisation for Economic Co-operation and Development.
<http://www.oecdbookshop.org/oecd/display.asp?LANG=EN&SF1=DI&ST1=5LMQCR2JJ5WD> [accessed 23 October 2012].

Ofwat (2011) Future Impacts on Sewer Systems in England and Wales [online]
http://www.ofwat.gov.uk/sustainability/climatechange/rpt_com201106mottmacsewer.pdf
[accessed 10 July 2013].

O'Neill, J. and O'Neill, M. (2012) *Social Justice and the Future of Flood Insurance*. Joseph Rowntree Foundation, York.

Paudel, Y. (2012) A Comparative Study of Public--Private Catastrophe Insurance Systems: Lessons from Current Practices. *Geneva Papers on Risk & Insurance, suppl. SPECIAL ISSUE ON CLIMATE RISK AND INSURANCE*, **37** (2), 257-285.

Penning-Rowsell, E.C., Johnson, C. and Tunstall, S.M. (2006) 'Signals' from pre-crisis discourse: Lessons from UK flooding for global environmental policy change? *Global Environmental Change*, **16**, 323–339.

Picard, P. (2008) Natural disaster insurance and the equity-efficiency trade-off'. *Journal of Risk Insurance*, **75**, 17-38.

Ramsbottom, D., Sayers, P. And Panzeri, M. (2012) Climate Change Risk Assessment for the Floods and Coastal Erosion Sector UK Climate Change Risk Assessment [online]
Department for Environment, Food and Rural Affairs.

<http://www.climatenorthernireland.org.uk/cmsfiles/resources/files/CCRA_for-the-Floods-and-Coastal-Erosion-Sector.pdf> [accessed 15 November 2013].

Ranger, N. and Surminski, S. (2012) A preliminary assessment of the impact of climate change on non-life insurance demand in the BRICS economies. *International Journal of Disaster Risk Reduction*, **3**, 14-30.

Ranger, N., Hallegatte, S., Bhattacharya, S., Bachu, M., Priya, S., Dhore, K., Rafique, F., Mathur, P., Naville, N., Henriot, F., Herweijer, C., Pohit S. and Corfee-Morlot, J. (2011) A Preliminary Assessment of the Potential Impact of Climate Change on Flood Risk in Mumbai. *Climatic Change*, **104**, 139–167.

The Stationary Office (2013) The National Adaptation Programme: Making the country resilient to a changing climate [online]. The Stationary Office.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf [accessed 15 November 2013].

The Stationary Office (2010) Flood and Water Management Act 2010 (c.29). The Stationary Office, London.

Surminski, S. Crick, F., Eldridge, J. and Ward, B. (2013) Response to public consultation on 'Securing the future availability and affordability of home insurance in areas of flood risk'. Policy Paper [online].

Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment <http://www.ccecep.ac.uk/Publications/Policy/docs/Securing-insurance-in-areas-of-flood-risk.pdf> [accessed 27 November 2013].

Surminski, S. and Oramas-Dorta, D. (2013) Flood insurance schemes and climate adaptation in developing countries. *International Journal of Disaster Risk Reduction*, in Press.

Surminski, S. and Oramas-Dorta, D. (2011). *Building effective and sustainable risk transfer initiatives in low- and middle-income economies: what can we learn from existing insurance schemes?* Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment, London.

Surminski, S. (2013) *Harnessing Foreign Investment to Promote Environmental Protection*. In Dupuy, P-M. and Viñuales, J. E. (eds.) Cambridge University Press: Cambridge.

Surminski, S. (2010) *Adapting to the extreme weather impacts of climate change – how can the insurance industry help?* Climate Wise, Cambridge.

Thieken, A. H., Petrow, T., Kreibich H. and Merz, B. (2006) Insurability and Mitigation of Flood Losses in Private Households in Germany. *Risk Analysis*, **26** (2) 383-395.

Treby, E., Clark, M. and Priest, S. (2006) Confronting flood risk: Implications for insurance and risk transfer. *Journal of Environmental Management*, **81**, 351-359.

UNISDR (2011) *Global Assessment Report on Disaster Risk Reduction: Revealing Risk, Redefining Development*. Information Press, Oxford.

Wassell, P., Ayton-Robinson, R., Robinson, D. and Salkeld, I. (2009) Resilient Reinstatement The Costs of flood resilient reinstatement of domestic properties ABI Research Paper No 14 [online]. Association of British Insurers <http://www.betterregulation.com/external/ABI%20Research%20Paper%20No.%2014.pdf> [accessed 21 August 2013].

WEF (2011) A Vision for Managing Natural Disaster Risk, World Economic Forum April 2011, World Economic Forum, Cologne/Geneva [online]. http://www3.weforum.org/docs/WEF_VisionManagingNaturalDisaster_Proposal_2011.pdf [accessed 19.06.13].

Yin, H., Pfaff A. and Kunreuther, H. (2011) Can Environmental Insurance Succeed Where Other Strategies Fail? The Case of Underground storage tanks, *Risk Analysis*, **31** (12), 12-24.

10.APPENDIX

Affordability and availability of flood insurance cover have been the main criteria when assessing the performance of the SoP and designing the successor arrangements:

- **Insurance penetration:** this is an indicator of supply and demand. The main drivers of insurance demand can vary over time in response to, for example, recent losses, and changes in market conditions (which affect the price and availability of insurance). The UK has a very high flood insurance penetration rate: Defra place the level for buildings insurance at 91% for owner-occupiers (Defra, 2013b) and the ABI figures place the rate for contents at 74.9% with the assumption that flood insurance is included in these standard policies (ABI, 2012b). This is relatively high due to the ‘bundled’ approach of including flood insurance as part of normal household policies (Crichton, 2008; Huber, 2004) and has been achieved without mandatory participation. The main driver for high uptake of insurance is the requirement from mortgage providers for valid insurance, including flood cover. On the supply-side, insurers’ willingness to offer coverage can be influenced by their loss experience. Born and Klimaszewski-Blettner (2013) investigate the impact of natural disaster losses and regulation on the supply decisions of property insurers in the United States. Their empirical evidence suggests that homeowners’ insurers are more likely to reduce their cover supply in response to unexpected severe events, while commercial lines insurers appear less likely to change their coverage in response to changes in severity or frequency of loss events (Born and Klimaszewski-Blettner, 2013). For England, it can be argued that the SoP has maintained supply levels despite increasing loss experience. But the industry has always maintained that the SoP is distorting the market, as it does not apply to new companies entering the market or to those not operating under ABI membership.
- **Affordability:** The SoP does not regulate the way insurers’ price risk or impose terms and conditions. On average, the cost of flood insurance in the UK remains competitive, with the average cost for buildings cover reaching £211 and contents £174, with a combined average of £363 (Defra, 2013b). Due to the bundling of flood insurance with other cover types there is lack of transparency around flood insurance prices. For those at higher risks of flooding insurance costs and the application of excesses have risen over the past years (House of Commons Library, 2010 p. 111). Insurers state that a high degree of cross-subsidisation between those at low risk and those at high risk has helped keeping overall costs low. At the same time there is move towards risk-based pricing, based on improved flood risk assessment methods, which allows a more accurate risk price to be applied (O’Neill, and O’ Neill, 2012).
- **Costs to the industry:** The price charged to flood insurance is also influenced by the loss experience.

- Costs to taxpayers: Public funds have been required to manage flood risk and compensate for uninsured losses, but the public has not been involved in underwriting any liabilities.

Summary of new insurance scheme

The proposed scheme will operate as a non for profit fund into which high risk households will obtain flood insurance accessed through their insurance companies. For affordability the pricing limits are determined by council tax bands, allowing low income homes a better opportunity to meet the costs of insurance, the highest council tax band H, is excluded, alongside new property built after 2009 and ‘genuinely insurable properties’ (Defra, 2013b), yet this may still lead to affordability issues for some.

The threshold to enter this high risk pool (yet to be determined) enters a household or small business into the system with low and medium risk properties dealt with insurers on a free market basis. If the bundle exceeds a given threshold, including the risk based flood cover, the flood risk element is given over to the high risk pool. The rest of the bundle is handled as normal by the provisioning insurance company. Any claims for flooding are paid out under this high risk pool. Responsibility for the high risk pool will be through Flood Re who essentially act as a reinsurer (Defra, 2013b), costs incurred by an independent body could push up the premiums minimising the benefit to using such a pool. In achieving an affordable premium for each household the threshold is set using council tax bands.

The new system proposes a long term outlook of 20-25 years, with a moving target bringing premiums towards a risk reflective nature. The system will be a reinsurance scheme managed entirely by the insurance industry and Flood Re itself will have reinsurance. The current cross subsidy will effectively become a levy that will be paid into the pool and whilst the fund is building up any large events that don’t trigger Flood Re’s own reinsurance will be met by ‘ad hoc’ payments from the insurance companies (Defra, 2013b).

Flood Re (see *Figure 2*) is based on provision for households under low to normal risk with standard insurance provision, but high risk properties under high risk pool. The subsidy for the latter is claimed from cross subsidising from a levy taken from those holding policies as opposed to a subsidy from the government (the latter have already mooted that they will not be involved in provision of such a subsidy). This levy will be between £10.50 per combined policy. The premiums offered for high risk households are fixed based on council tax banding and cover is offered at a set price, this is based on particular threshold level for defining high risk.

Table A1: Summary of key flood risk data for England

Flood risk indicator	Latest data	Trend over last 10 years	Future Projections
Number of residential properties at risk of flooding from rivers and sea (England and Wales)	Significant risk*: 359,000 (17%) Moderate risk: 644,000 (31%) Low: 1,047,000 (50.6%) Total: 2,070,000 (EA, 2011a) Significant risk England only 230,000		For England homes at significant risk: River flooding: (From an ASC figure of 230,000) Between 320,000 and 580,000 properties in 2080s with population growth this increases to between 350,000 and 1,100,000 (ASC, 2012 Table 2.1) Coastal flooding: 310,000 and 570,000 properties in 2080s with population growth increase to between 330,000 and 840,000 (ASC, 2012 Table 2.1)
Number of residential and non-residential properties at risk of flooding from rivers and sea (England and Wales)	Significant risk: 546,000 (20%) Moderate risk: 852,000 (31%) Low: 1,316,000 (48%) Total: 2,740,000 (EA, 2011a) Significant risk England only: 100,000		Number of properties with a significant likelihood of flooding is expected to rise from around 560,000 today to between 770,000 and 1.3million by the 2050s and to between 980,000 and 1.5million by the 2080s (Ramsbottom, 2012)
Number of properties at risk from surface water flooding (England)	1.9m (8% of stock in England) (ASC, 2012)		Increase in annual damages from £320m to between £510m and £1bn over the next 50 years (ASC, 2012)
National infrastructure in flood risk areas (England)	7,000 electricity infrastructure sites 14 per cent of all in England, about 10 per cent of main roads and 21 per cent of railways (EA, 2009a)		

Sewer Flooding (England)	4,709 at 1 in 10 annual chance (<0.1% stock in England) (Ofwat, 2011)		Properties at 1 in 10 annual chance may increase from 4,700 today to between 4,700 and 8,100 the 2040s due to climate change. With population growth and urban creep, this could increase to between 5,500 and 8,900 (ASC, 2012; Ofwat, 2011),
Risk to agricultural land in England and Wales	1.5m ha (14%) of agricultural land is at risk from rivers and sea (58% of Grade 1 farmland is in floodplain) (EFRA, 2013b)		By 2020s 35,000 ha of horticultural and arable land flooded every 3 years by 2080s this rises to 130,000ha (Defra, 2012c)
Economic losses	Cumbria 2009: Approximately £275m (CCC, 2010) 2007 floods: Total costs £4 billion (£3bn insured and £1bn additional costs) (EA, 2010) Total assets at risk from flooding alone £200bn in England and Wales (Evans et al., 2004)		
Insured losses from flood damage (UK)	2012: £1.9bn (ABI, 2013b) 2009: £174m (ABI, 2010) 2007: £3.2bn (EA, 2010) 2005: £272m (ABI, 2010)		Up to £27bn by 2080s (House of Commons Library, 2010 p. 111)
Annual damage to properties from flooding	£1.2bn (Defra, 2012a)		£1.5-3.5bn by 2020s (Defra, 2012a) £1.6-6.8bn by 2050s (Defra, 2012a)

from rivers and sea (England and Wales)			£2.1-12bn by 2080s (Defra, 2012a)
Cost of annual damage to residential properties alone from tidal and river flooding (England and Wales)	£640million (HM Government, 2013)		By 2020s: £1.1billion under CCRA mid-range scenario (HM Government, 2013)
New development in floodplain (England?)		13% of all new development built in floodplain over last 10 years (ASC, 2012) Development in the floodplain between 2001-2011 in England increased by 12% (ASC, 2012)	
New development in high risk areas	2012-13: 560 residential units built in UK flood risk areas against EA advice (EA, 2013)	20% of floodplain development in areas at significant risk (over the past 10 years) (ASC, 2012)	
Development in floodplain on previously developed land	70% of allocations**** (ASC, 2012 p. 29)		
Number of homes built against EA advice	2012-13: 560 homes (1% of total number of homes proposed in planning applications); 2011/12: 143 homes (EA, 2013)	2008/9: 2,492 2009/10:335 2010/11:400 2011/12:143 2012/13: 560 (EA, 2013) Total: Last 5 years: 3930 homes (EA, 2013)	
Insurance penetration for flooding	For buildings insurance is 91% for owner-occupiers in		

	<p>the UK (Defra, 2013b)</p> <p>For contents 74.9% (ABI, 2012c)</p> <p>29% of lowest income households have buildings insurance (Defra, 2013b)</p>		
Cost of insurance	<p>Average cost*****: buildings £211 and contents £174, combined average £363 (DEFRA, 2013b)</p>	<p>Claims and excesses have risen over the past several years (House of Commons Library, 2010 p. 111)</p>	<p>For a combined policy ceded to Flood Re flood risk element will not exceed (2013 price) :</p> <ul style="list-style-type: none"> • Council Tax Band A £210pa • Band B £210 pa • Band C £246 pa, • Band D £276 pa • Band E £330 pa • Band F £408 pa a • Band G £540 pa. • Band H properties¹, properties built after January 2009 and genuinely uninsurable properties will be excluded (Defra and ABI, 2013) <p>Excess for Flood Re standard £250-500 (Defra and ABI, 2013)</p>
Combined annual average domestic and commercial flood insurance claims			<p>Could increase to between £700million to £1billion by 2080s (The Stationary Office, 2013)</p>
Investment in flood risk management	<p>England: £2.3billion to be spent by government on flood and coastal erosion risk management until March 2015 (includes the additional £120million of funding</p>	<p>Non Government investment: £5.3 million of partnership funding (from public and private</p>	<p>Non government investment: EA now expects that partnership funding between 2012–13 and 2014–15 will total £70.6 million, rising to around £160 million if local levy contributions are included(EFRA, 2013a)</p>

	<p>announced by government in 2012 for flood defences) (NAP) (Spending in current spending period 2011/12-2014/15) (Defra, 2013b)</p> <p>Wales: £180 spend by Welsh government on flood and erosion risk management between 2011/12 to 2015/16 plus an additional £60m from European Regional Development Fund (Defra, 2013b)</p> <p>Scotland: £73m for large projects and £53m to local authorities between 2012-2105</p> <p>NI: £60,</p> <p>£20m annual spend on channel maintenance (inc. dredging (EFRA, 2013a).</p>	<p>contributions) was achieved for 2011–12 (EFRA, 2013a)</p>	
Annual spending on flood defences** (local and national?)	<p>National:</p> <p>2012-13: £266m (EFRA, 2012b)</p>	<p>2007-8: £189m 2008-9: £313m 2009-10: £349m 2010-11: £354m 2011-12: £259m (NAO, 2011)</p>	<p>2013-14: £294m(House of Commons Environment, Food and Rural Affairs Committee, 2013)2014-15: £344m (NAO, 2011) 2015-16: £370m (EFRA, 2013a)</p>

	Local Authorities***:		
	2011/12: £156.3 (EFRA 2013b) £88.6m omitting coastal protection	£91.5 million in 2009-10	
	External co-funding:		
	2011/12-2014/15: £148m (Defra, 2013c)		

*Significant risk: greater than 1 in 75 chance in any given year; Moderate risk: 1 in 75 to 1 in 200 chance in any year; Low risk: less than 1 in 200 chance in any year.

** Capital funding includes spend on new and improved defences, refurbishment of current defences, and includes expenditure on assets, plant and equipment (EFRA, 2013a).

***For Flood defence, land drainage and coastal protection.

**** Sample of 42 local authorities (ASC, 2012 p.29).

***** Current cost of flood insurance is dependent on several factors including: Technical price, claims history, competition amongst insurers

Table A2: Recent Governmental flood risk management policies and measures

Type of policy or measure	Date implemented/published	Timeframe (long-term or short term outlook)	Type of policy/tool
National Planning Policy Framework and Technical Guidance	2012	Long term	Guidance for development and consolidating planning guidance and lays out implementation of the guidance specifically in areas of flood risk
National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England	2010	Long term	Strategy document what the authorities can do to manage flood and coastal erosion risk and consequences.
Flood and Water Management Act 2010	2010	Long term	Legal obligation setting responsibilities for authorities in managing flood risk
Flood Risk Regulations	2009	Long term	Complements the Flood and Water Management Act 2010 and details what maps and plans the EA and LLFAs need to produce
Investing for the future Flood and coastal risk management in England A long-term investment strategy	2009	Long term (25 years)	Investment strategy taking into account climate change predictions
The Pitt Review	2008	Immediate and long term	States focus for action to effectively manage flood risk and minimise the consequences of flood events
Future Water	2008	Long term	Strategy on water as a resource and plans to 2030 for water supply demands. Considers the water system as a whole.
Making Space for Water	2005	Long term	Strategy for joining up plans for water in the future, taking the water cycle as a whole and considers
Foresight Future	2004, updated 2008	Very long	Report on how climate

Flooding Report		term	change will affect flooding in 30-100 years, aims to inform policy
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Table A3: The proposed flood insurance solutions

Solution:	Public/private:	Advantage	Disadvantages	Exclusions	Detail
Flood Re*	Private delivery and administration/ Public oversee and ministerial accountability for policy matters	<ul style="list-style-type: none"> • Not for profit • Affordable to high risk households • Threshold limits price increase • Customers deal with insurers as normal • Proposed levy is same as existing cross subsidy • Can build up cash reserves if flooding is less than average 	<ul style="list-style-type: none"> • Loss on every premium (does not reflect risk) • Requires legislation (State Aid Approval – takes 18-24 months) • Affordability remains an issue for some • Flood Re’s reinsurance may fluctuate in price • Cost of Flood Re remains more than the benefits it delivers • Possible weakening of incentives for household risk 	Property built after 2009 Council tax band H (highest value property)	<ul style="list-style-type: none"> • Flood Re acts as a reinsurer to insure only high risk households at set price based on council tax band, scheme to last 20-25 years • Flood Re holds own reinsurance policy, if claim cost does not trigger this then insurance companies make ad hoc contributions for reimbursement • Upper limit on Flood Re not expected to be exceeded in 99.5% of all years (of exceeded Gov. to decide how to distribute)

			reduction		
Direct subsidisation	Private and public (Gov. maintains register of high risk households)	<ul style="list-style-type: none"> • Direct subsidy to households • Clarity on level of support to households • Benefits exceed costs • Promotes market innovation • Legislation quicker to obtain than Flood Re or Obligation 	<ul style="list-style-type: none"> • Legislation needed • Insurers may not pass on subsidy • Insurers need to agree with government's register of high risk properties • Price discount possible uncertainty on how much households pay for insurance • Use of public funds questionable if all households discounted at same rate • Possible high admin. cost to give subsidy to households • EC State Aid Approval needed 		<ul style="list-style-type: none"> • Internal industry levy on all households to reduce premiums with a subsidy from insurers or voucher scheme from government. • The Government will determine high risk household register

<p>Flood insurance obligation</p>	<p>Private (Delivery and administration) /Public (Gov., sets target of high risk households to be insured at any one point and maintains register)</p>	<ul style="list-style-type: none"> • All high risk households guaranteed flood insurance • Affordability met by insurers avoiding enforcement penalties • Customers can shop around • Availability met through quotas • All insurers must take part or face penalties • Prices lower than Flood Re • Fixed discount to households on top of risk price (element of risk based pricing) • Innovation in market 	<ul style="list-style-type: none"> • Legislation required for Gov. to introduce Obligation, supervision and enforcement • Impact on pricing hard to quantify • Flood risk can be mis-classed if so then up to household to amend • Obligation needs to be set at a level to stop impact on wider policyholders • Time to implement • Not supported by insurance industry 		<ul style="list-style-type: none"> • All insurers writing domestic property insurance in the UK must insure a proportion of high risk households based on their share of the property market or face enforcement from an internal industry levy on all UK households • Gov. Register of high risk households required
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		<ul style="list-style-type: none"> • Benefits outweigh costs • Customers deal with insurers as norm. • No need for EC State Aid designation 	<ul style="list-style-type: none"> • Too prescriptive 		
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Source; Details taken from Defra (2013b)

*Preferred solution by ABI and members