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Fit for Purpose and
Fit for the Future?
An Evaluation of the
UK's New Flood
Reinsurance Pool

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Abstract

Flood Re is widely hailed as an innovative approach to disaster risk insurance. This paper offers a mixed-methods evaluation of the new pool, asking whether it is “fit for purpose” and “fit for the future.” The investigation considers the roles of the public and private sectors, risk modelling and risk communication, technical underwriting, distributional aspects and the behavioural implications of Flood Re, particularly with regards to risk reduction and prevention. The paper concludes that the new pool is a transitional reinsurance arrangement that supports the private insurance market and secures affordability of flood insurance in the UK through premium subsidies. However, this approach is likely to come under pressure in the face of rising flood risk as it fails to incentivize flood risk management and risk reduction efforts.

Key Words: Flood Re, flood risk management, reinsurance

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Swenja Surminski*

1. Introduction

Natural disasters such as drought, flooding and wind storms cause significant human and economic losses, affecting communities, businesses and governments and hampering economic development and poverty reduction efforts. In many countries, such disasters will become more likely with climate change according to IPCC projections. Moreover, the values at risk will become even greater due to increasing population concentration and rising wealth, often in highly exposed coastal locations. These trends have re-intensified discussions among private insurers, governments and international organizations about the role of insurance in addressing disaster risks. The discourse follows two broad strands: reform of existing insurance schemes, such as in the United Kingdom and the United States; and the design of new schemes in countries without disaster insurance, including in developing countries (see, for example, Surminski and Oramas-Dorta, 2013). Such efforts are based on the understanding that insurance mechanisms offer a more effective way of addressing the costs of disasters than relying on post-disaster payments (see, for example, Hallegatte, 2014; and Brainard, 2008). The sharing of risks and the distribution of the costs of compensation make insurance an attractive disaster response mechanism, particularly for large catastrophic risks (Mechler et al., 2014), but remains underused in many parts of the world.

In countries that have disaster insurance, this tends to be arranged through the state or via a partnership approach between public sector and private insurers, owing to the complex nature of disaster risks. The affordability and availability of disaster insurance can become a public policy goal, seeking to ensure that an economically efficient level of insurance is provided and

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accessible to those who need it. However, in many cases governments face conflicting objectives and aims; in particular being concerned with reducing public expenditure on flood losses, but at the same time remaining keen to offer a “helping hand” in times of flooding. If and how government intervenes in the flood insurance market depends, at least in part, on a country’s specific risk features, cultural approach to solidarity and responsibility, political will, as well as recent loss experiences (Surminski et al., 2015).

There are many different ways in which disaster risk insurance can be subsidized or otherwise supported by the government, ranging from direct premium subsidies to providing financial education. The most common aim is to increase take-up of insurance. Table 1 shows how possible interventions can target the supply of insurance, the demand for insurance, or premium levels.

Table 1. Public Disaster Risk Insurance Interventions with the Aim to Increase Take-Up of Insurance

Target Area	Intervention Measure
Supply	Set-up state-owned insurer
	Provide reinsurance
	Provide capital
	Pay operational costs
	Provide product development expertise and technical support
	Promote co-insurance pool
	Link to social safety nets and credit facilities
Premium Levels	Regulate premiums by setting limits or tariffs
	Regulate risk models used
	Data collection, audit, management and financing (can lead to higher premiums)
	Provide risk data to insurers (can also lead to higher premiums)
	Reduce risk levels through better risk management
Demand	Pay premiums in full or part
	Offer vouchers for insurance
	Offer incentives for insurance
	Mandate insurance
	Provide risk data / awareness campaigns
	Financial education
	Promote enabling environment via legal framework and consumer protection

Source: Surminski et.al. for DFID 2016.

The types of government intervention in disaster insurance markets vary significantly between states, ranging from no insurance, to only private or fully public insurance. For

example, whilst French law requires certain kinds of insurance contracts to cover natural catastrophes and fixes an additional amount payable by the insured (Maccaferri et al., 2012), the UK government has focused on making flood insurance more affordable by improving reinsurance options for insurers through its flood reinsurance program, 'Flood Re'. Whilst the former can be considered a more 'public' approach to flood insurance, the latter has continued to rely predominantly on the private market.

One aspect that is growing in importance for the public policy discourse is the suitability of insurance mechanisms to cope with changing risk profiles. This is particularly relevant in the face of rising disaster costs due to socio-economic factors and climate change, which can pose a threat to future insurability. Purchasing an insurance product can influence the behavior of those at risk. This can either be in a moral hazard¹ context, where insurance can lead to more risky behavior, or as an incentive, where insurance can trigger risk reduction investments or the implementation of prevention measures (see, for example, Kunreuther, 1996; and Kunreuther and Erwann Michel-Kerjan, 2009). This has triggered a renewed interest in risk reduction by policy makers and regulators in their quest to find ways to use insurance in order to insulate public finances from the financial impact of natural disasters (for a summary see Golnaraghi et al., 2016; PRA/Bank of England, 2015; and EC, 2013). Nevertheless, in practice most disaster insurance schemes are not designed or operated with prevention in mind, which raises questions about their suitability and effectiveness (Surminski and Hudson, 2016; and Surminski et al., 2015).

This is also evident in the UK, which has a long tradition of private flood insurance. Flooding is recognized as the most common and costliest kind of natural disaster (Harries, 2012) and is listed as a major risk on England's National Risk Register (Cabinet Office, 2013). While the recent flood loss trends in the UK are largely due to socio-economic factors, such as more development in exposed areas, climate change is expected to exacerbate these impacts (IPCC, 2013). Indeed, the UK Climate Change Risk Assessment (CCRA) 2017 has identified flood risk

¹ Moral hazard occurs when a member of the party acts conversely to the principles set out in an agreement between those parties. For example in an insurance contract, the individuals' motives and behaviour to prevent loss may be reduced if financially protected through a policy, thus resulting in an increased probability of loss. For more detail on moral hazard, please see Kenneth Arrow (1968) and Mark Pauly (1968). This can affect governments, where the existence of an insurance scheme may reduce the urgency to prevent and reduce risks, or at the insured level, where the purchase of insurance may lead to a false sense of security.

management as a priority area for action, as flood risks are projected to increase significantly across the UK throughout this century (Committee on Climate Change, 2016).

These concerns about growing flood losses led to the creation of a new reinsurance pool for flood risks: Flood Re, a not-for profit reinsurance pool owned and operated by the insurance industry, developed by industry and government, established through the Water Act 2014 and launched in 2016. It has been presented by industry and government as an “innovative way to ensure the availability and affordability of flood insurance, without placing unsustainable costs on wider policyholders and the taxpayer” (Defra, 2013). The pool is designed as a temporary support measure for those high-risk properties that may face rising insurance premiums in a competitive market. Presented as a “cushion” to smooth an eventual transition to risk-reflective pricing, it remains unclear if and how Flood Re will achieve this in the face of rising flood risk, especially because in its current set-up, it does not provide any direct means to encourage risk reducing behavior (Surminski and Eldridge, 2014; and Hjalmarsson and Davey, 2016).

This raises the question whether Flood Re is fit for purpose and fit for the future, and what lessons can be drawn for governments seeking to navigate between public policy and private market solutions to address affordability and availability of flood insurance.

As Flood Re only came into operation in April 2016, there is very limited quantitative evidence, while for the broader flood insurance market in the UK many of the metrics needed for an assessment are not publicly available. This shortfall can be addressed by applying a mixed-methods approach to the evaluation, as outlined in Section 2. After a brief reflection on the history of flood insurance in the UK and the justification for Flood Re (Section 3), this paper assesses the pool against five broad parameters: (i) the contribution to technical risk cost modelling and risk communication, (ii) the roles of the public and private sectors, (iii) whether insurance incentivizes risk reduction by policyholders, (iv) how it contributes to take-up rates of flood insurance, and (v) how insurance distributes the costs of disaster events (Section 4). This leads to an overall evaluation of the “fitness for purpose” and “fitness for the future” of Flood Re (Section 5), and a discussion of possible implications for other countries (Section 6).

2. A Brief Reflection on Methods and Data

The literature provides many assessment criteria for insurance mechanisms including those created through public policy interventions: Key aspects are availability of cover for the insured; affordability of cover for the insured; whether the mechanism is financially sustainable (i.e. it is able to pay claims and stay solvent); and whether the mechanism is commercially viable

for insurers participating in it, provided private sector involvement is required (Surminski and Hudson, 2016; and Surminski, 2014).

Traditionally, the focus has been on classic supply and demand questions, exploring the cost-effectiveness of an insurance scheme for any given policyholder, as well as the market-level efficiency in meeting as large a proportion of the potential demand as possible. In addition, given that public funding is sometimes used to support insurance with an explicit or implicit justification based on providing a public good, cost-effectiveness must take into account whether this funding is achieving good value for money. Finally, there is the longer-term financial sustainability (and hence availability) of an insurance mechanism in the face of risk. Various metrics for assessing these dimensions of cost-effectiveness in financing losses have been proposed in the literature, see Appendix 1 for an overview.

These aspects provide a starting point for determining whether Flood Re is fit for purpose, based on its stated objectives of securing affordable and available flood insurance. The main criteria to look at are price of cover before and after the intervention, as well as any evidence for level of penetration and take-up before and after. However, many of those metrics still remain unclear for Flood Re due to its nascent character and the private sector underwriting that is underpinning it. As Flood Re only came into existence in April 2016, there is very limited data to underpin an assessment of its effectiveness, impact and policy consequences. For instance, analyzing the future behavior of insurers faces data limitations as the risk models that are commonly used by insurers for rate setting are sensitive business information and not freely accessible.

Furthermore, such an evaluation does not reflect on the risk reduction element, which is becoming increasingly important for future insurability and societal resilience. Therefore, the paper also considers additional factors that relate to Flood Re's role in risk reduction. This is based on the understanding that insurance, or risk transfer in general, can boost risk reduction if designed and structured accordingly, which in turn can secure future affordability and availability of cover. Various metrics for assessing how insurance promotes risk reduction/prevention have been proposed in the literature (including Crichton, 2008; Paudel, 2012; Surminski and Oramas-Dorta, 2013; and Surminski and Eldridge, 2014), with the key focus being on how risk pricing may encourage the reduction of exposure and lead to lower damage costs (Kunreuther, 1996; and Di Falco et al., 2014), how risk information and other measures influence the behavior of policyholders, how insurance directly promotes actions by policyholders, and how insurance directly or indirectly affects actions by third parties (such as the government).

This paper therefore deploys a mix of quantitative and qualitative metrics and criteria, based on available data analysis, stakeholder interviews and a review of existing literature. Appendix 2 summarizes the five criteria identified in the introduction, which are employed for this analysis, including a brief outline of the potential quantitative and qualitative metrics. These include direct measures of benefits (e.g. avoided losses in wealth) or costs (e.g. costs of preventive measures induced) and indirect measures (e.g. how many of the potential risk reduction/prevention measures are promoted by the insurance scheme). Taken as a whole, and given likely inconsistencies in information availability, this broad set of metrics has the advantage of providing a robust picture of Flood Re as a public policy intervention, allowing for comparison with other intervention types.

3. Flood Insurance in the UK—the Pathway to Flood Re

The UK has a long tradition of insurance provision, dating back to the 17th century with Lloyds of London starting the commercial underwriting of cargo ships. This partly explains the wide acceptance and utilization of insurance to address a wide range of risks, including flooding.

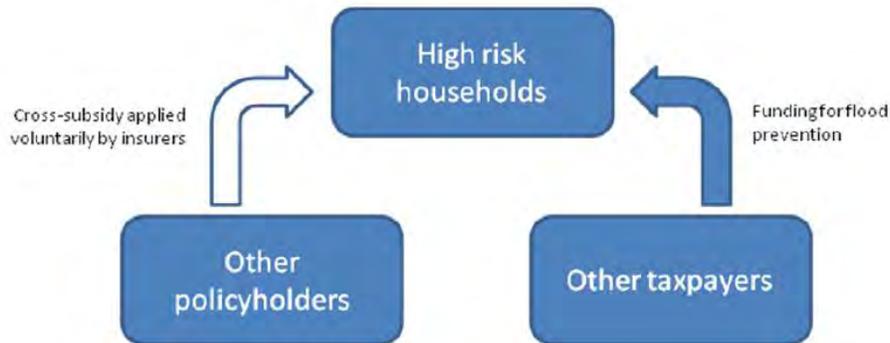
Historically, the provision of flood insurance in the UK has been addressed through a series of informal arrangements reached between the government and the insurance industry, but the underwriting has always been provided on a purely private sector basis. The first of these was the 1961 Gentleman's Agreement, which followed a number of significant flooding events such as the 1953 East Coast floods (which ultimately resulted in 308 deaths). These events exposed a low level of flood insurance penetration (Penning-Rowsell et al., 2014), and triggered efforts by government to increase usage of flood insurance. Against the threat of concerns of nationalization (Surminski and Eldridge, 2014), the industry reached an agreement with the government based on a commitment from the insurance industry to provide affordable insurance against flooding, if requested to do so, for all private dwellings which were permanently occupied. Because at that time flood risk could not be effectively determined per household (for example, through data mapping), this involved cross-subsidization between low and high risk homes. Although the Gentleman's Agreement was initially unsuccessful in increasing flood insurance penetration (due to the caveat that flood insurance need only be provided when requested by the policyholder), it was more successful once insurance coverage became a prerequisite to obtaining mortgage financing in the 1970s (Penning-Rowsell et al., 2014).

The Gentleman's Agreement was ultimately challenged by the Association of British Insurers (ABI) in the wake of rising flood losses. In 2001, the ABI issued a memorandum to the government stating that ABI member companies would only maintain insurance provision after

flood events if there was greater investment in flood risk reduction measures by the government in flood prone areas, better data provision and stricter planning regulation. Commentators such as Penning-Rowsell et al. (2014) attribute this to a new found sense of confidence in the insurance industry following positive feedback for its response to the flooding of 10,000 homes in the UK in 2000, and the losses the insurance industry suffered as a result of such flooding. Other commentators see these events as merely being a “window of opportunity” for change (Kingdon, 1995). Ultimately, this led to a series of Statement(s) of Principle between the insurance industry and the government, all based on a mutual interest in a functioning private flood insurance system (Surminski and Eldridge, 2014):

- The 2002 Statement of Principles on the Provision of Flood Insurance, which provided for flood coverage generally up to a risk level of 1:75 return period (RP) (1.3 percent) for households and small businesses as part of their building and/or contents cover.
- The 2005 updated version of the Statement of Principles, which continued the above commitment to 2008. For households exceeding the 1:75 risk level without adopting flood defense measures, insurers could not “guarantee to maintain cover”.
- The 2008 Revised Statement of Principles on the Provision of Flood Insurance, which also continued the above commitment to 2013, but did not apply to any new property built after 1 January 2009. This has since been carried over into Flood Re. In turn, the government agreed to continue investing in flood risk mitigation.

Although the Statement(s) of Principles have been considered a success in terms of expanding flood insurance penetration (reaching approximately 95 percent according to the National Flood Resilience Review, 2016), insurers raised concerns about market price distortions in the form of underpriced flood insurance for houses in high flood-risk areas (Oxera, 2015). Recently, the ABI estimated that 78 percent of policyholders were paying a premium that does not fully reflect their flood risk (Defra, 2014). As a result, households in low flood-risk areas were cross-subsidizing those in high-risk areas—as illustrated in Figure 1:

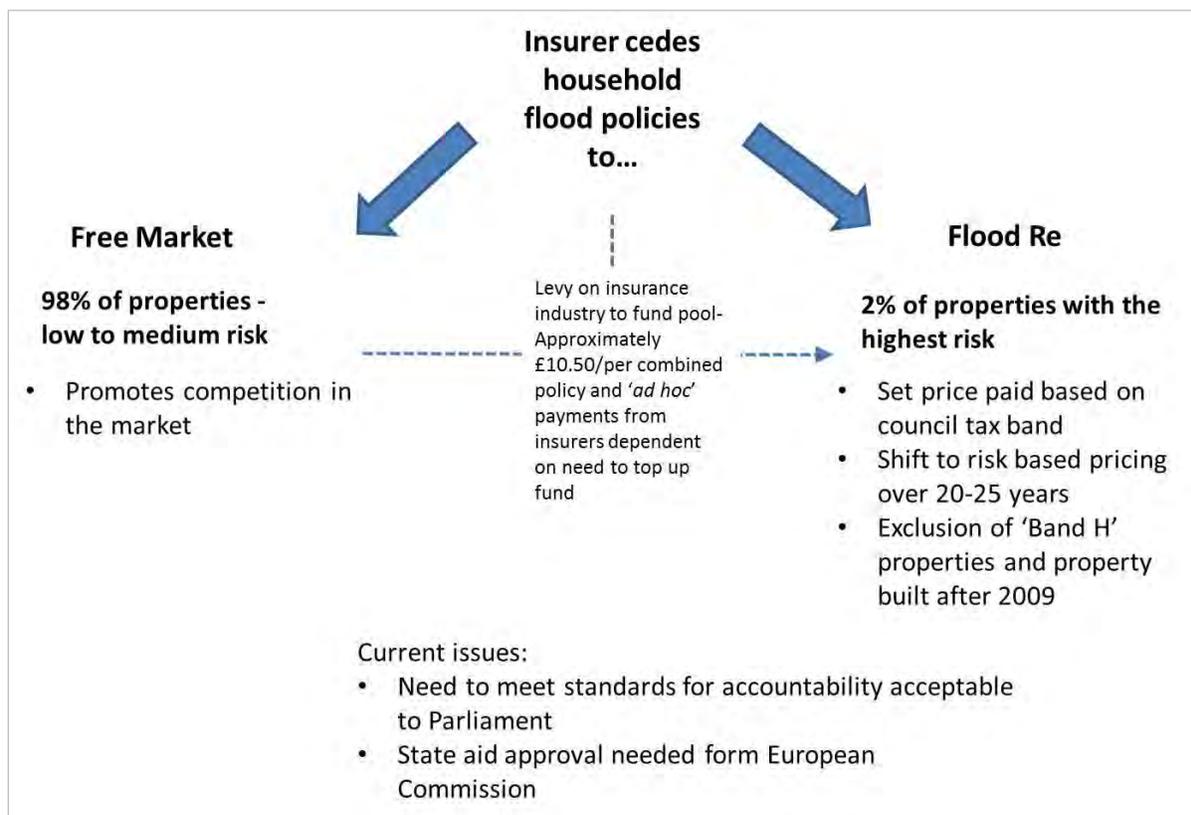
Figure 1. Cross-Subsidy for High-Risk Households

Source: Defra, 2013.

However, recent improvements in risk analysis technologies such as data mapping, led to growing concerns that flood insurance would become unaffordable for those in high flood-risk areas once their risk could be properly ascertained by insurers (Oxera, 2015). As such, between 2010 and 2013, the insurance industry and government took steps to reach an understanding on how to replace the Statement(s) of Principles. For example, a Flood Summit was held in 2010 which considered future flood insurance models. The ABI itself proposed “a free market for flood insurance, and thoughts on how flood insurance could potentially be subsidized above a certain premium threshold” (Defra, 2011). Negotiations between the government and insurers continued through 2012 (Edmonds, 2016). A key point in the debate was the government’s averseness to taking on any financial risk of an insurance scheme or flood damages, an example of which was delivered by the Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs, who stated that money would be better spent delivering defenses rather than subsidizing insurance premiums, while at the same time aiming for universal availability of coverage and affordability (Hansard, 2011).

After a public consultation on four different flood insurance mechanisms, the government selected Flood Re, the option that had initially been proposed by the insurance industry. Figure 2 outlines the pool concept that was presented jointly by the government and the ABI.

Figure 2. Pool Concept for Flood Re



Source: 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).

Flood Re seeks to satisfy the dual objectives of market autonomy and insurance affordability. The main idea is a continuation of the provision for households under low to normal risk with standard insurance, while giving insurers the option to cede any properties to Flood Re at a highly discounted price. The subsidy for the latter is claimed from a levy taken from all insurers according to their overall home insurance market share, which is expected to be passed on to policyholders. (Aviva, 2016). It also mirrors the value of the cross-subsidization which occurred under the Statement(s) of Principles (Diacon, 2013). As such, Flood Re retains an element of cross-subsidization. The levy is estimated to be £10.50 per policy. By limiting the insurers' risk in this way, the logic goes that the insurer can in turn limit the premiums they charge to policyholders in high flood-risk areas (although this remains at their discretion). Furthermore, Flood Re charges insurers an excess of £250; to the extent an insurer charged a higher excess on a policy ceded to Flood Re, it would, in turn, charge the insurer that same excess (Flood Re Annual Report, 2016). The flood premiums offered by Flood Re are fixed, based on council tax banding. The premium thresholds for 2016 are provided in Figure 3 below:

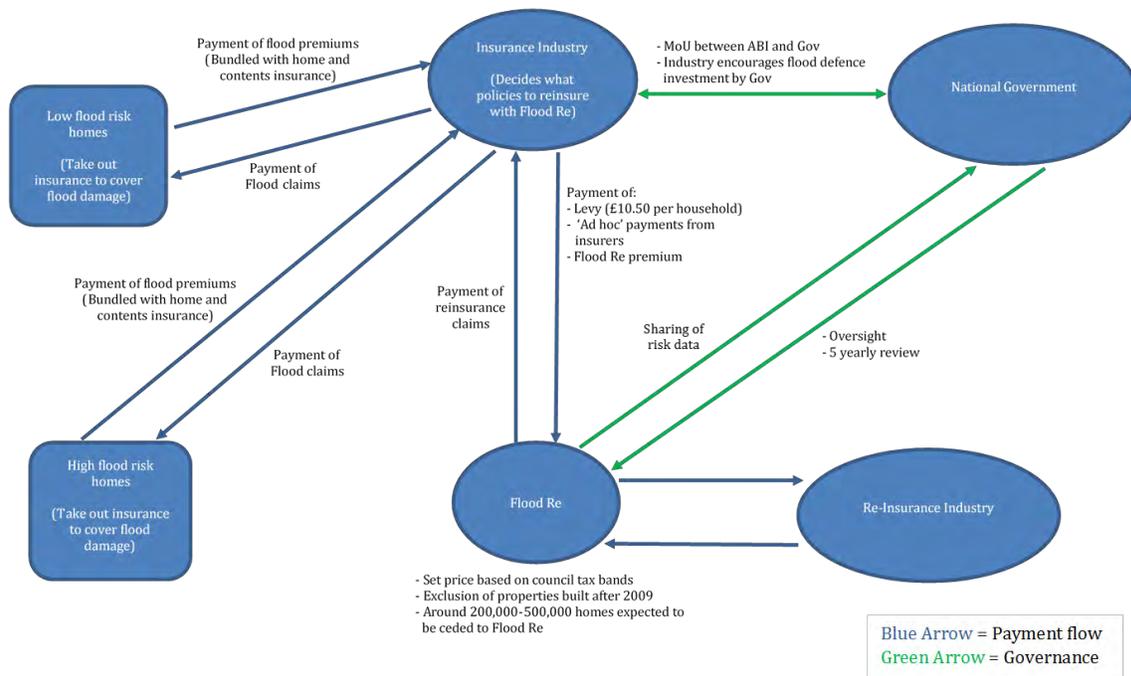
Figure 3. Flood Re Premium Thresholds for 2016

Property tax band in England and Scotland	A	B	C	D	E	F	G	H
Property tax band in Wales	A&B	C	D	E	F	G	H	I
Flood Re category in Northern Ireland	1	2	3	4	5	6	7	8
Building only – net	£132	£132	£148	£168	£199	£260	£334	£800
Contents only – net	£78	£78	£98	£108	£131	£148	£206	£400
Combined – net	£210	£210	£246	£276	£330	£408	£540	£1200

Source: The first Flood Re transition plan, 2016.

The final structure and mode of operation of Flood Re is illustrated in Figure 4.

Figure 4. Structure and Mode of Operation of Flood Re



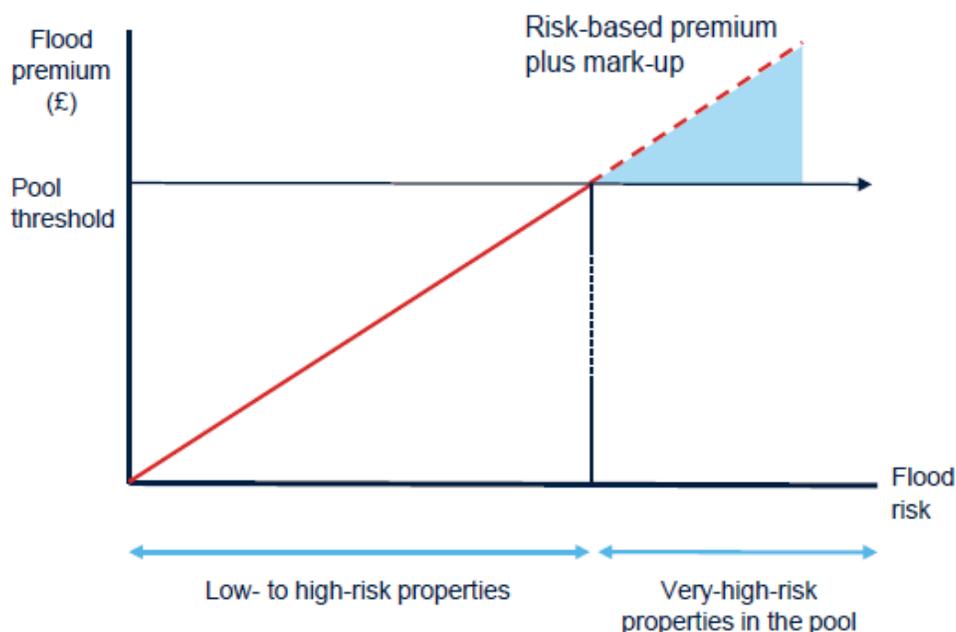
Source: Crick et. al. 2016

Consumers have no direct interaction with Flood Re; instead, private insurers remain the sole source of flood insurance in the market and it is left to their discretion whether or not to cede into the new pool. Insurance providers representing 85 percent of the flood insurance market have so far agreed to participate in Flood Re (Insurance Newslink, 2016).

The levy and premiums are only sufficient to cover the costs associated with a 1 in 200 year event (i.e. flooding six times the severity of the 2007 floods). This is the regulatory capital limit set by the Prudential Regulation Authority. In accordance with current actuarial modelling, this would amount to approximately £2.5 billion (Diacon, 2013). In the event that post-flood claims exceed Flood Re's reserves, Flood Re can make a levy II call on insurers for additional funding. Importantly, there is no formal public back-up mechanism should Flood Re become insolvent.

Preliminary market data suggests that insurers are applying a degree of selectivity regarding which policies they cede to Flood Re. Specifically, they have tended not to opt low flood-risk households into Flood Re (Direct Line Insurance, 2016). This makes sense from an economic perspective; if an insurer can offer flood insurance at a rate that is more competitive than the premium they are required to pay under Flood Re, there is no incentive to cede the relevant policy. This is reflected in Figure 5 below:

Figure 5. Flood Re Pricing Approach



Source: Oxera, 2015.

4. Assessing Flood Re Against Five Parameters

4.1 Roles of the Public and Private Sector

Flood insurance in the UK is unique amongst most other national schemes as it is provided entirely by the private market. Flood Re, despite being a public policy intervention, does not change this. The pool is an addition to the standard home insurance market rather than a replacement (Horn and McShane, 2015). It does not replace private insurance cover but is expected to encourage private carriers to write affordable flood insurance policies for high-risk properties, as the pool offers insurers a low-cost option to offset the costs of property insurance claims for flood damage (United Kingdom Insurance Report, Q4, 2016).

There is no direct financial liability for government, unlike in many other pools and disaster insurance schemes, where government picks up losses beyond a pre-defined threshold. Throughout the negotiations between industry and government this point was highly controversial, with the ABI calling for government to take on a clear financial obligation, and government refusing to commit. There remains the possibility of government stepping in as an emergency bail-out should Flood Re fail, but as the pool has to comply with standard solvency regulation and is buying commercial reinsurance cover this risk is considered to be low at the moment. (Defra 2013)

Despite its independence in terms of underwriting, there is a role for the government in determining the rules of operation and monitoring as well as possibly adjusting the remit and scope of Flood Re. Furthermore, Flood Re, being created by public law, has direct accountability to parliament, with the Secretary of State in an oversight function. This can create some governance confusion—with the government treating Flood Re as a quasi-public body, subject to public procurement processes, and Flood Re taking a much more commercially oriented approach to reinsurance purchasing and operations (personal communication from Defra and Flood Re). It is important to remember that Flood Re was developed and proposed by the industry, with companies calling for government intervention.

As such, both the previous Statement of Principles and Flood Re can be described as public-private partnerships (Surminski, 2015). In line with the agreement set out under the Statement of Principles, government remains responsible for flood risk management activities such as the construction of flood defenses and the regulation of water utilities who construct and maintain sewers. It also attempts to reduce risk by providing grants to victims of floods, such as following Storm Desmond in 2015 (National Flood Resilience Review, 2016). In 2005, the ABI listed the obligations of the government as “reducing the probability of flooding in the UK; at

least maintaining investment in flood management each year and discussing future funding taking into account climate change; implementing reforms to the land use planning system; communicating flood risk effectively and providing more detailed higher quality flood risk information and developing an integrated approach to urban drainage” (ABI, 2005). The fulfilment of these policy demands has been subject to debate—particularly with regards to investment levels and success of the planning system (ASC 2015).

The roles of the public and private sectors are summarized in table 2 below.

Table 2. The Roles of the Public and Private Sectors

<p>How are duties split between the public and private sectors?</p>	<ul style="list-style-type: none"> • Insurance industry provides primary cover. • Reinsurance market and Flood Re provide reinsurance. • Flood Re is a not-for-profit entity, created by statutory law and responsible to parliament, but owned and administrated by private sector. • Government has no financial obligations/liability under Flood Re arrangement. • Government is responsible for flood risk management and flood risk maps, delivered through the Environment Agency. • Other public bodies share that responsibility, including local authorities and regional boards.
<p>How much of the risk does the public sector bear?</p>	<ul style="list-style-type: none"> • No formal “insurer of last resort” arrangement. • Claims to Flood Re covered by a levy charged to insurance companies based on their market share (not on their use of Flood Re). • Expected that levy is passed on to all insurance customers—replacing previous cross-subsidy. • Flood Re is buying commercial reinsurance.
<p>At what point does the public sector begin to cover a risk?</p>	<ul style="list-style-type: none"> • Not formalized. • Possibility of public bail-out if Flood Re fails, but no agreed cut-off point. • If insufficiently funded, Flood Re can make Levy II call for increased contribution from insurers.
<p>How does the program encourage or discourage private market involvement in the market?</p>	<ul style="list-style-type: none"> • Insurance market is purely private—Flood Re can only work if there is a functioning private insurance market. • Aim is to encourage flood insurance provision at affordable rate—impact on competition is unclear, but expected to be positive as Flood Re has been developed by the industry. • Complements private reinsurance provision, Flood Re buys own commercial reinsurance cover. • Allows insurers to better offset costs (United Kingdom Insurance Report, Q4, 2016).

4.2 Take-Up Rates of Flood Insurance

As there is very limited data on usage of Flood Re the following assessments looks at overall take-up rates of flood insurance in the UK. This appears to be very high, with two separate estimates in 2016 suggest the take-up rate for homeowners is 95 percent (National Flood

Resilience Review, 2016) and 98 percent (Flood Re, 2016). The rate remains similar for homes in low and high risk flood areas (Flood Re, 2016). The take up rate for renters is lower, reaching 55 percent in high-risk areas (Flood Re, 2016). However, earlier statistics suggest that up to 35 percent of very-low income households have no insurance of any kind (ABI, 2007). Furthermore, recent ABI statistics suggest take-up rates are only 76 percent and 63 percent for contents and building insurance respectively (ABI, 2015). It is unclear which set of figures provides a more accurate portrayal. Importantly those figures are not specifically for flood risk, but for home insurance in general, due to the bundled nature of cover.

There are two reasons why take-up rates of flood insurance are so high in the UK: (i) flood insurance is generally included as standard with building and contents insurance, meaning that customers do not choose to get flood insurance, but automatically receive it along with their standard cover; and (ii) basic structural flood insurance is a pre-requisite for prospective homeowners obtaining a mortgage (National Flood Resilience Review, 2016). As such, the availability of flood insurance tends to not be an issue other than for a few properties at high risk that have been repeatedly flooded; instead, the main concern for low income households is its affordability (Defra, 2015).

In this context, Flood Re is unlikely to have a significant impact on overall take-up rates of flood insurance, but should address those cases where high prices might lead to non-purchase of insurance.

One area where take-up rates are of concern are small and medium sized businesses (SMEs). However, businesses are not covered under Flood Re, with the caveat that government may reconsider this decision if availability and affordability of cover for businesses becomes a growing issue. For the moment, industry and government have concluded that the evidence suggests that SMEs struggling to get flood insurance is a very localized problem and would not justify a country wide solution (UKCCRA, 2017). The take-up rate of flood insurance is summarized in Table 3 below.

Table 3. Take-Up Rates of Flood Insurance

What are take-up rates for insurance?	<p>For Homeowners</p> <ul style="list-style-type: none"> • 95% (National Flood Resilience Review, 2016). • 98% (Flood Re, 2016). <p>For Renters</p> <ul style="list-style-type: none"> • 55% in high-risk areas (Flood Re, 2016). • However, see ABI (2007) statistics, which suggest 35% of people in very-low income households have no insurance of any kind.
Why are they at this level?	<ul style="list-style-type: none"> • Bundled with other insurance (National Flood Resilience Review, 2016). • Pre-requisite for getting a mortgage (National Flood Resilience Review, 2016; and Flood Re 2016).
What are the contributing factors?	<ul style="list-style-type: none"> • Main concern for low income households is the affordability of insurance rather than its availability (Defra, 2015 (IPsos-Mori Survey)).
How does disaster aid and/or investment in loss reduction measures influence take-up rates of insurance?	<ul style="list-style-type: none"> • Rates so high that take-up rates probably not influenced.
How is insurance purchase handled for those not able or willing to pay for coverage?	<ul style="list-style-type: none"> • Flood Re designed to make insurance affordable. Not handled for those still unwilling to purchase it.
How are take-up rates influenced by other financing mechanisms and other governmental programs, such as provision of disaster aid or hazard mitigation programs?	<ul style="list-style-type: none"> • This does not seem an issue, as shown by high penetration rates.

4.3 Distribution of the Costs of Catastrophes

The move from the Statement of Principles to Flood Re has not created a significant shift in how the costs of catastrophes are distributed. The pool formalizes the previous degree of cross-subsidization from low-risk properties to high-risk properties. Policies ceded to Flood Re have the benefit of the subsidy provided by insurers in the form of the £180m flood levy. This is meant to replace the cross-subsidization which existed under the Statement of Principles. It is expected that insurers will pass on the subsidized reinsurance price when making underwriting decisions, which could also benefit those not ceded to Flood Re. For example, leading insurer Aviva has announced plans to remove any additional flood excesses on existing customers' policies at renewal, even if it is not transferred to Flood Re (M2 Presswire, 2016). However, it is

not made clear how transparent this (or the estimated additional charge of £10.50 per policy) is being made for policyholders.

As explained above, Flood Re does not impose any regulated rate setting, but offers insurers subsidized reinsurance, which they in turn can use to limit the rates they charge to policyholders in high risk areas. Thus far, this seems to be working, with overall premiums remaining relatively stable (ABI, 2016). This will likely form part of the first 5 year review into Flood Re. Overall, Government and industry estimate that Flood Re will only affect a very small number of domestic insurance policies, limiting the implications of the policy intervention. (personal communication from Defra and Flood Re))

Further distributional impacts could occur through the use of council tax as a rating criteria. Flood Re's use of council tax bands (see Figure 4 above) as a means of setting premiums will likely continue to lead to cross-subsidization because council tax bands are an indicator of wealth, not risk (Institute and Faculty of Actuaries, 2016). Households which are asset rich but income poor can expect to pay more for flood insurance (including through cross-subsidization) than those homes which are asset poor but have significantly higher disposable income (or, alternatively, invest in different assets such as financial instruments or automobiles) (Herrington & Carmichael, 2009). Furthermore, the passed on cost of flood insurance may have a negative effect on take-up rates of flood insurance by low-income household groups, particularly if the levy would have to rise.

The social justice element of flood insurance has been discussed for the UK by O'Neill and O'Neill (2012), who warn that any move towards an "increasingly individualized, risk-sensitive regime" may lead to social blight. This underpins the argument for some form of cross-subsidization between low and high risk homeowners, as now formalized under Flood Re. In fact the ABI argued for this at the beginning of the negotiations, stating that "no country in the world has a free market for flood insurance which provides affordable and accessible cover for high risk households without some form of Government involvement and it makes no sense to rule out a subsidy before Defra have even done the analysis. To ensure potentially 200,000 high risk households have access to flood insurance in 2013, the Government needs to...help develop a sustainable subsidy model which is paid for either by taxpayers, low risk households or both." (ABI, 2011)

However, it is unclear to what extent Flood Re's pricing structure will address any social issues. Davey (2015) highlights some regional disparities between the council band categories, noting that "the level of Band A–H houses varies considerably between regions and is not

perfectly correlated with levels of disposable income. It represents instead historic differences in property value.” (Davey 2015)

Distributional impacts arising for those outside the scope of Flood Re or not insured remain unclear. First of all, it is unclear how the private market will react - just because a property is not eligible for Flood Re does not mean that it will not get flood insurance. SMEs and properties built after 2009 are not eligible for Flood Re, and it has been argued that this places an unfair burden on small businesses and new home owners. However, while the 2009 exclusion rule is presented as a measure to avoid new development in high risk areas, it could be subject to political lobbying and be amended. This date cut-off may also raise serious questions of justice in the future; for example, what if building on flood plains becomes cheaper, and it is the poorest who bear the brunt of flooding? Should new developments in this context be excluded?

For SMEs, the British Insurance Brokers’ Association has confirmed that it is working on developing a scheme to make flood insurance more affordable (Barton, 2016). The government has also announced that it is considering a Flood Re style mechanism for SMEs (Axling, 2016). However, Flood Re maintains the position that because of the differences in risk (for example with regards to BI) a joint pool of homes and SMEs would be unworkable.

Despite the high insurance penetration in the UK, it is important to acknowledge that not all flooding costs are insurable. This is because many of these costs are not identifiable or financially measurable. On a personal level, these include the loss of items of sentimental value, and the loss caused by long-term damage to land. For example, there are concerns that land fertility in Somerset has been significantly reduced as a result of hectares of land being inundated for multiple months (Flood Block, 2015). Furthermore, insurance will not cover the costs of emergency procedures and repairs faced by local authorities. Instead, these costs become covered by initiatives such as the Bellwin Scheme, which reimburses local authorities for amounts spent on “taking...immediate action to safeguard life or property; or...prevent[ing] suffering or severe inconvenience in their area or among their inhabitants” (House of Commons Briefing Paper, 2015). As such, pre and post-event financing, despite the existence of Flood Re, will continue to be covered by a mixture of insurance, government investment and unilateral homeowner behavior. This also applies to homeowners, who face the burden of paying for any home resilience measures, often supported through a government grant. But as Flood Re does not subsidize resilience measures this might lead to an increased burden for homeowners. (Penning-Rowsell and Priest 2015).

The distribution of the costs of catastrophes under Flood Re is summarized in Table 4 below.

Table 4. Distribution of the Costs of Catastrophes

How does this policy distribute the costs of a disaster event?	<ul style="list-style-type: none"> • Flood Re covers claims on ceded policies through insurer premiums and £180m levy from insurers. • Insurance industry provides primary cover and cedes to Flood Re or commercial reinsurance. • Government provides disaster relief to flood victims where necessary (e.g. following Storm Desmond in 2015). • Government provides disaster relief to local authorities where necessary (e.g. Bellwin scheme).
Are there implicit or explicit cross-subsidies among groups?	<ul style="list-style-type: none"> • Levy imposed on insurers replicates cross-subsidy that existed prior to Flood Re (Diacon, 2013). • Levy passed on to consumers (i.e. implicit cross-subsidy).
Is there some level of premium beyond which consumers resist paying?	No evidence—affordability will be reviewed as a criteria during the 5-year reviews of Flood Re.
How are the most extreme events financed?	<ul style="list-style-type: none"> • If Flood Re lacks funding, Flood Re can make a Levy II call on insurers (Flood Re, 2016). • Flood Re liability limited to 1:200 year threshold.
What is the division between pre-event and post-event financing?	<ul style="list-style-type: none"> • Insurers pay premiums for ceded policies based on council tax banding of properties. • Flood Re funded by £180m levy imposed on insurers. • Flood re pays out insurance claims to insurers, who then pay out policyholders.
Are lower or middle income households or small businesses given any assistance with respect to their premiums?	Flood Re is designed to keep prices low and promote affordability. No other assistance is provided as part of Flood Re.
If so, what is the criteria for their being given assistance?	N/A

4.4 Technical Risk Cost Modelling and Risk Communication

The insurance industry and Flood Re use a combination of in-house models, commercial models (such as RMS, JBA), and public data (EA, Nafra, Ordnance Survey) to measure their exposure, diversify their portfolios and gain regulatory approval. However, the NATCAT models used by insurers for solvency calculation and capital allocation are not necessarily the same as those used for underwriting, giving rise to a possible mismatch between modelled and underwritten risk.

Flood risk modelling has made several advances in the UK, particularly in the commercial sector, where several models are available and continue to improve in resolution. Figure 6 outlines the kinds of national flood maps currently existing in the UK. Despite these improvements some weaknesses remain, particularly with regards to mapping vulnerability based on flood area and monetary values, and factoring in effectiveness of flood risk management measures. Recent initiatives attempt to align public data and industry modelling, particularly with regards to incorporating flood defense information. Another key challenge is the lack of surface water flood risk information, where even very high resolution models show significant uncertainty. Furthermore, the impact of climate change on disaster event volatility is generally not included in these models due to the uncertain nature of climate change itself (Committee of Climate Change 2016 2016). Because of factors such as these, concerns remain with regards to the use of public data for insurance pricing.

Figure 6. National Flood Maps

Map name	Shows
Flood Map for planning (rivers and sea)	The chance of flooding in any given year from rivers and the sea, without defences, used primarily for development and spatial planning decisions
Risk of flooding from rivers and sea (also known as the National Flood Risk Assessment (NaFRA))	The chance that any location will flood from rivers and/or sea, taking account of flood defences, in any given year
Risk of flooding from surface water	The chance that any location will flood from surface water, in any given year
Risk of flooding from reservoirs	Areas that could be at risk of flooding in the realistic worst case scenario of a major breach of a reservoir

Source: National Flood Resilience Review, 2016.

Overall, any improvement in flood mapping technology would make it easier for insurers to individually price insurance policies (Oliver, 2016). This reflects a movement away from the historical approach of pooling risk and cross-subsidizing between low and high risk policies (Oliver, 2016). The ABI sees risk pricing as the optimum because, amongst other things, it encourages competitiveness and may promote risk reducing behavior by policyholders, while also improving the insurability of households because there is greater information available to determine individual flooding risk (ABI, 2008). However, many analysts disagree. Instead, they argue that improvements in flood mapping have made premiums unaffordable for households in high risk areas (Oliver, 2016). It is unclear what the balance between these two alternative

viewpoints is, but it is clear the latter view is currently prevailing; indeed, it was the primary motivation for adopting Flood Re as a tool for transition, to protect homeowners from risk-based pricing.

Interestingly, the discussion about pricing levels is somewhat flawed due to the lack of transparency about flood insurance prices charged by individual insurance companies. As flood premiums are bundled with other home insurance costs, insurers usually do not disclose to their customers the premium load relating to flood insurance. It does not appear as a separate item on the standard home insurance policy and customers usually are only made aware of their risk status when a dedicated flood excess is charged. Any pricing information is therefore based on market estimates from insurers and brokers, and remain difficult to disaggregate or verify.

In addition to the lack of transparency about flood insurance pricing there is also no clear risk communication between Flood Re and home owners, due to its role as a reinsurer. It remains the decision of the relevant insurance company what information they share with customers and how flood risk is communicated, if at all.

Technical risk cost modelling and risk communication under Flood Re are summarized in table 5 below.

Table 5. Technical Risk Cost Modelling and Risk Communication Under Flood Re

How are technical risk costs modelled and calculated by insurers and by Flood Re?	<ul style="list-style-type: none"> • Insurer: in-house models, commercial models (RMS, JBA), Government data (EA, Nafra) • Flood Re: uses JBA model.
To what extent is the “true” cost of the risk visible to consumers?	<ul style="list-style-type: none"> • Not visible due to bundling of flood insurance with household policies. Only visible if there is a flood excess.
Is cost of risks communicated effectively by insurers/Flood Re?	<ul style="list-style-type: none"> • See above. • Separately, Flood Re does not communicated risks directly to policyholders.
To what degree is risk-based rating and insurance pricing occurring under Flood Re?	<ul style="list-style-type: none"> • Flood Re does not impose rate setting on insurers. • Goal of transitioning to risk-based pricing by 2039.
Are risk costs incorporated into property design, prices, or development decisions?	<ul style="list-style-type: none"> • Exclusion of new properties from Flood Re discourages development in high flood risk areas. • Developments in high risk areas require a flood risk assessment from developers.

4.5 Incentives for Risk Reduction

Although risk reduction was identified as one of the design principles for future flood insurance at the start of the negotiations for a renewed partnership (Defra, 2011), it is not a central aim of the new insurance pool (Surminski and Eldridge, 2014). Comparing the Statement of Principles approach and Flood Re (see Figure 7 below), Surminski and Eldridge conclude that very few formal options for incentivizing risk reduction have been adopted in the new scheme.

Figure 7. Comparison of Prior Insurance System with Flood Re

<i>Does the insurance system ...</i>	<i>Statement of Principles</i>	<i>Flood Re</i>
... increase risk awareness and knowledge of risks through flood risk information provision?	Yes	No – but could change if Flood Re loss data is shared.
... build capacity for risk reduction through advice on risk reduction measures?	Limited – insurance industry has provided advisory guidance for home owners	No
... provide financial incentives for policyholders toward mitigation investment?	No	No
... promote resilient reinstatement techniques after a flood loss?	No	No
... incentivize public flood risk management policy?	Yes; is part of SoP agreement	Encouraged through Memorandum of Understanding
...require compulsory risk reduction?	No for policyholders, yes for government	No
... discourage development in flood-risk areas?	Yes	Yes

Source: Author, based on Surminski and Eldridge 2014.

The one exception is the exclusion of post-2009 properties from Flood Re, which can be seen as an incentive for resiliency in developments in flood plains or, as a deterrent for new developments in high risk areas. (Hoban, 2016). Certain guidance and rules exist, with new property developments in high-risk areas requiring a flood risk assessment to support their planning application (Alexander et al., 2016). The ABI has also issued guidance to assist developers with building flood resilient properties through practical steps such as raising floor levels of properties (ABI, 2009). However, it is unclear how successful these measures are and there is evidence that costs of risks are become less of an concern, overridden by the growing concern about lack of housing, which has led to an easing of planning rules.

Beyond this, Flood Re does not have any direct levers to incentivize homeowners, insurers or governments to reduce flood risk. There is (i) no formal scheme for building capacity for risk reduction, (ii) no requirement for compulsory risk reduction, and (iii) no program for resilient reinstatement techniques after flooding, and (iv) limited commitment from government to do more for flood risk reduction (Surminski and Eldridge, 2014).

Despite the lack of levers, the risk reduction element remains particularly important for Flood Re because of its proposed transition to risk-reflective pricing: It is intended to provide a buffer to protect insurance customers from a steep rise in insurance costs, while gradually preparing them for a move towards risk-reflective pricing. If and how the transition to risk reflective pricing can be achieved without more risk reduction efforts remains very unclear (see also Section 5). This has led to criticism, with several commentators calling for Flood Re to provide better incentives for risk reduction measures (for example, see Alexander et al., 2016; and Surminski and Eldridge, 2014). In response Flood Re has now identified the need to build strong partnerships with a range of actors from the public, private and civil society sectors as a key strategy to ensure a successful transition phase (Flood Re, 2016). Some options for this have been outlined in Figure 8.

While the lack of resilience incentives available to Flood Re is a missed opportunity, there are still options to create greater support for flood risk reduction through the pool (Surminski and Eldridge 2014): One opportunity will arise through Flood Re's own data sets. Over the course of its operation the pool will have a map of high flood risk homes, a clearer picture of which of these homes are flooded, the cost of claims and how those costs are made up (Flood Re, 2016). While it remains unclear how this information will be shared in the future, Flood Re is considering how it can be utilized to smooth the transition to risk-reflective pricing (Flood Re, 2016). For example the data could allow the government to calibrate measures for managing flood risk in different areas (Oxera, 2015).

In addition, there are opportunities for Flood Re to collaborate with insurers to support risk reduction, such as in the context of resilient repairs after a flood, through information sharing and awareness raising, or combined government lobbying for flood risk management. Flood Re could also help to address key underlying barriers for risk reduction: Insurers do not necessarily value all kinds of risk reducing behavior. For example, engineered defenses are perceived as the "gold standard" for reducing vulnerability, whilst non-engineered measures such as warning systems are perceived as ineffective (The Property Flood Resilience Action Plan, 2016). Meanwhile a survey of 400 homeowners in the UK by Lamond et al. (2009) shows that Insurers have also been ineffective in encouraging their policyholders to adopt flood mitigation

measures (Lamond et al., 2009). As Ball et al. (2013) state, the adoption of property level measures are difficult to assess so insurers do not necessarily see them as a basis for lowering policy costs.

Figure 8. Examples of the Role that Flood Re Could Play in Helping to Reduce the Costs of Providing Flood Insurance

Insurance cost driver	Flood Re's potential role		
	Direct lever	Indirect lever	Role in supporting action of others
Risk of flooding			
Likelihood of flood events	No	No	Yes. For example, through use of its data to guide investment in flood defences
Likelihood of a given household flooding	No	Yes. For example, through the information it provides on steps householders might take to protect their property	Yes. For example, through building understanding of the impacts of property level resistance measures
Costs of flood claims			
Severity of flood event	No	No	Yes. For example, through use of its data to guide investment in flood defences
Cost of repair (including re-housing)	No	Yes. For example, through the information it provides on steps householders might take to protect their property	Yes. For example, through increasing understanding of the impacts of property level resistance and resilience measures. Also through the data it holds on claims costs.
Administration	No	No	No
Competition in the market			
Number of firms	No	Yes. The creation of Flood Re should encourage new entrants into the market	—
Consumer engagement	No	Yes. The creation of Flood Re should increase engagement by giving households more choice over their household flood insurance provider	—

Source: The first Flood Re transition plan, 2016.

In conclusion, the lack of risk reduction incentives creates significant challenges for the pool in the face of changing risks. This is discussed in Section 5. Table 6 below summarizes Flood Re's role in incentivizing risk reduction.

Table 6. Incentives for Risk Reduction

Does this program have explicit or implicit incentives for reducing risk?	<ul style="list-style-type: none"> • No formal incentives other than the post-2009 building exclusion. • The first Flood Re transition plan commits Flood Re to consider resilience initiatives within first two years of operation. • Some insurers encourage customers to apply for government’s resilience grant of £5000.
Do we have evidence on the magnitude of these incentives?	<ul style="list-style-type: none"> • No evidence available.
What are the relevant roles of the public and private sectors in risk reduction?	<ul style="list-style-type: none"> • Government provides disaster aid for improving resilience (National Flood Resilience Review, 2016). • Some (but not all) insurers encourage resilience measures (Surminski, 2015; and Lamond et al., 2009)
Is there any financing in the form of loans and grants for hazard mitigation as part of the program?	<p>No, but:</p> <ul style="list-style-type: none"> • Disaster relief provided separately (National Flood Resilience Review, 2016). • £700m investment in resilience measures (The Property Flood Resilience Action Plan, 2016). • £5000 resilience grants for homeowners from government.
What has been the government’s role in risk protection/reduction and how can this role be shown to have influenced the pricing and take up rates for disaster insurance?	<p>Per above.</p> <ul style="list-style-type: none"> • The pricing impact is difficult to determine. • Insurers tend to value engineered measures (The Property Flood Resilience Action Plan, 2016), but don’t value non-structural measures (per above). • EA’s Long Term Investment strategy. • No evidence of specific pricing impact.
Is their assistance in financing risk reduction for lower or middle income households?	<ul style="list-style-type: none"> • Not as part of Flood Re. • See other assistance above and in notes.
What roles do zoning, building codes, and land use play in connection with insurance?	<ul style="list-style-type: none"> • Business properties not covered by Flood Re (House of Commons, Future Flood Prevention - Oral Evidence (July 2016)). • New housing developments not covered. • Mixed-use properties generally out of scope (Flood Re, 2016). • ABI guide for property developers in 2009

5. Evaluating Flood Re: Fit for Purpose and Fit for the Future?

Although Flood Re has only been operational for a short period of time, the above assessment provides some valuable pointers for a first evaluation. The data collected is underpinned by recent quantitative and qualitative analysis, conducted prior to Flood Re becoming operational, including the UK government’s economic impact assessment for Flood

Re (Defra, 2014), an actuarial evaluation of government's insurance modelling (Diacon 2013), an agent-based model assessing Flood Re's operation in the face of future climate change (Jenkins et al., 2016), and a qualitative analysis of the design process, aims and objectives of Flood Re with a special consideration of flood risk reduction (Surminski and Eldridge, 2014; and Surminski and Hudson, 2016). While these calculations and assessments offer estimates and are based on underlying assumptions rather than evidence from the market, they still provide useful insights into the mechanics and performance of Flood Re under certain conditions.

The evaluation looks at two dimensions: is Flood Re “fit for purpose” in terms of achieving its statutory aims and objectives; and does the pool offer a forward looking solution to address the challenges that led to its creation - in other words is it “fit for the future”?

5.1 Fit for Purpose?

An insurance mechanism created by public policy is subject to different expectations, ambitions and assumptions amongst government, industry and other stakeholders. Whether or not these are met once the mechanism is in operation depends on many factors, including design, behavior and risk characteristics. A useful starting point for any evaluation are therefore the underlying aims and objectives for Flood Re. At the start of the negotiations a set of principles were published by Defra, outlining the vision for flood insurance (see Figure 9):

Figure 9. Principles for Flood Re Negotiations

- 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.

Source: Defra, 2011.

While offering a very comprehensive list of features for sustainable flood insurance, it became obvious during the negotiations that stakeholders saw clear trade-offs between those principles, particularly between affordability and risk based pricing (Surminski and Eldridge, 2014). In subsequent negotiations, the remit of the new flood insurance intervention was limited to principles 1, 3 and 8, stating at its core the aim to “ensure the availability and affordability of flood insurance, without placing unsustainable costs on wider policyholders and the taxpayer” (Defra, 2013).

For Flood Re this implies that it has to satisfy multiple objectives: It seeks to maintain market autonomy, keeping the role of government as minimal as possible, and it is conceived as a transitional tool, in order to pave the way towards risk-reflective pricing in a private market.

Evaluating the overall cost effectiveness of the Flood Re policy intervention is complicated as it requires more than a basic assessment of costs versus benefits to what degree, for example, a subsidy to an insurance provider translates into a reduction in premiums. To fully capture the cost effectiveness of insurance interventions, a wider view of the relevant insurance market has to be taken. Overall it will be the behavior of market participants that will determine how Flood Re will be used, and what risks will be ceded, the costs of reinsurance for Flood Re itself, and if Flood Re will have an impact on primary cover provision. There is commitment and the fact that Flood Re has been proposed by the industry indicates that there is willingness from companies to use it as a mechanism to support low flood insurance premiums.

First indicators show that the private market has adopted Flood Re. Since inception, Flood Re is estimated to have underwritten 53,000 policies (based on personal communication with Flood Re in October 2016), while the stated annual aim is to reach 350,000 policies. As it is outside Flood Re’s control whether or not insurers decide to cede their policies, it is difficult to interpret these initial figures.

Flood Re’s ability to pay after a flood event has not been tested, but it had to gain regulatory approval under the same conditions as any private market provider, so an acceptable level of solvency can be expected. However, it is unclear what would happen should the Flood Re pool be exceeded. As discussed above, a levy II call can be made, but if a flooding event exceeds the 1:200 threshold, the government will work with the industry to explore available options. Importantly, there is no financial commitment from the government to provide public funds should the Flood Re pool be depleted. This can be seen as a significant achievement for the government, who had to resist lobbying from industry throughout the Flood Re negotiations to provide financial guarantees for risks beyond the Flood Re cap and in case that Flood Re’s funds

should not be sufficient to pay for claims. However, for some observers there is still a clear anticipation that government would pay for events beyond the 1/200 PML level). (Hornstein 2015)

Early figures also suggest that the price of insurance has remained stable and there have been no reports of homeowners struggling to access flood insurance. This indicates that Flood Re is delivering on its key aim of ensuring availability and affordability, but a full evaluation will only be possible once Flood Re establishes what risks have been ceded and once it is tested by a significant flooding event. Market studies to monitor any changes in availability and affordability of cover will be required throughout its operations.

Reducing the insurance premium for those at high risk can be considered as a necessary but not sufficient condition for cost effectiveness. Changes in take-up rates of insurance are currently not visible, but would also need to be monitored. A better picture of cost effectiveness would emerge with an understanding of any possible deadweight loss, which captures the degree to which the intervention “wastes” money by providing transfers without changing behavior. A full appraisal of Flood Re would also need to consider the primary and secondary benefits derived from the pool, as well as any perverse or unintended effects.

In fact, the cost effectiveness of Flood Re has been questioned by government, openly declaring that the proposed scheme does not meet the minimum government standard for cost-benefits (Defra, 2013). Consequently, the Secretary of State had to sign an exemption statement, justifying the policy intervention despite not meeting cost-benefit targets. A key argument for the justification came through the wider benefits of Flood Re, referencing “wider socio-economic and equity reasons for pursuing the Flood Re scheme which are not fully reflected in the strict value for money calculations made in this Impact Assessment—for example it brings more certainty to future evolution of insurance prices with beneficial effects not only on policy holders but also in other markets such as the property market and mortgage lending. Flood Re also ensures industry support in managing a smooth transition during the interim period between the Statement of Principles ending and the new policy coming in” (Defra, 2014). This has been criticized (see Hjalmarsson 2015), but has not interfered with the parliamentary approval process—indicating the high political will to get Flood Re into operation. Another key justification for Flood Re’s political approval despite its costliness was the argument that Flood Re does not create new forms of subsidization, but merely formalizes the already existing degree of cross-subsidization. This was one of the main reasons why Flood Re gained the EU’s State-Aid-Exemption approval, alongside its transitional nature (Surminski et al., 2015). In its review, the European Commission (EC) recognized the goal of ensuring affordable insurance

against flood risk as a legitimate scope of public policy and adopted the decision not to raise objection. The EC acknowledged that the pool was designed so as to minimize the (competitive) advantage granted to the insurers. (Mysiak and Peres-Blanco, 2016).

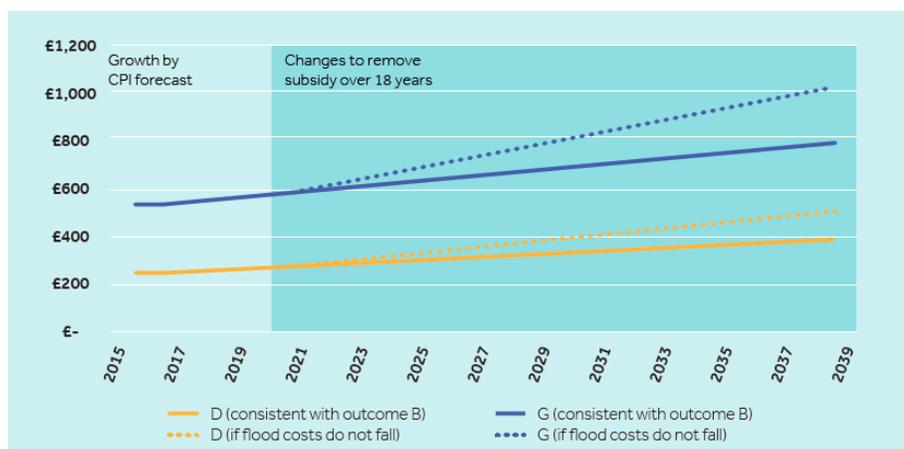
However, a recent report from the Finance Department in Ireland concluded that Flood Re had much higher set up costs than originally anticipated (IFPCG, 2016), which led to the conclusion that the pool would be too costly a model for Ireland to follow.

5.2 Fit for the Future?

Flood Re’s other key objective is to provide a smooth transition to risk reflective pricing. The first Flood Re transition plan, published in early 2016, seeks to provide a framework through which future transition plans for removing the subsidy provided under Flood Re can be analyzed and implemented. In particular, it notes that a combination of amending premium thresholds and encouraging disaster risk reduction strategies will be necessary to keep flood insurance affordable as it transitions to risk-reflective pricing. This will need to be carefully balanced. If such cross-subsidization remains, there may be little incentive for policyholders in high flood-risk areas to make their properties more resilient, making premium levels unsustainable following transition to a risk-reflective market. To reiterate, creating this incentive is seen as one of the key benefits of risk-reflective pricing (see ABI, 2008; and Oxera, 2015).

Figure 10 demonstrates how premium thresholds would have to change over time in order for Flood Re to transition to risk-reflective pricing. “D” and “G” refer to the council tax band of properties. “Outcome B” refers to “a market where household flood insurance is widely available at a price that is regarded as affordable”.

Figure 10. Indicative Potential Changes to Premium Thresholds



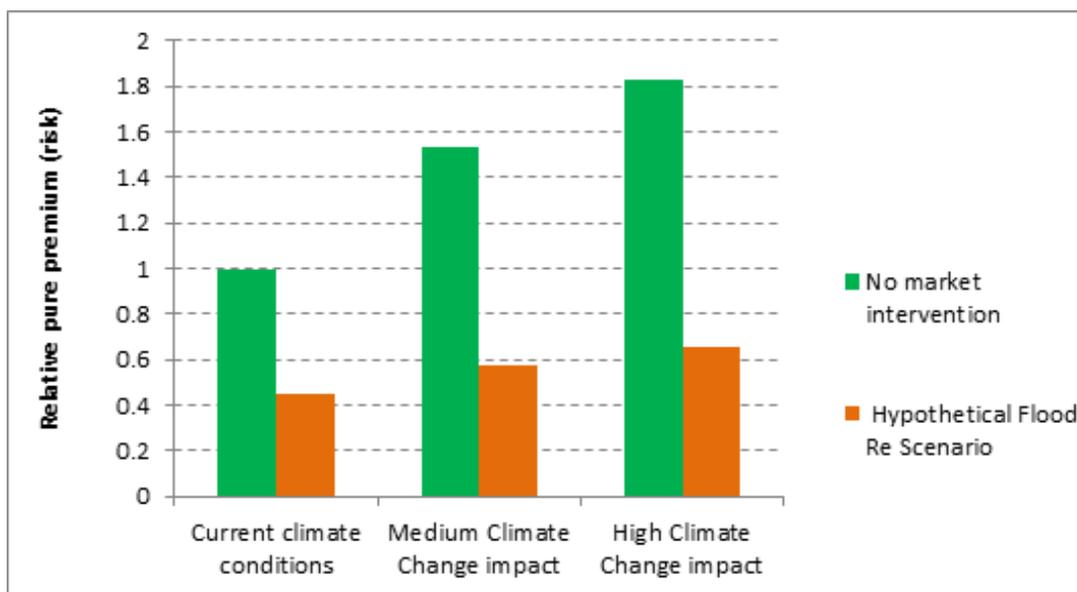
Source: The first Flood Re transition plan, 2016.

According to the first Flood Re transition plan, Flood Re aims to phase out the annual insurer levy of £180m by gradual price reduction, while attempting to maintain premium threshold levels, through the following combination of factors: reduction in risk of flooding, reduction in cost of flooding, and increased competition in the insurance market (Institute and Faculty of Actuaries, 2016). However, it remains unclear whether or not the risk environment would allow such a transition. This raises the question whether Flood Re is fit for the future.

Rising losses and increased volatility can affect the fine balance between affordability and profitability for insurers. In extreme cases this could lead to insurers withdrawing from certain markets and regions, as highlighted by the Prudential Regulation Authority (Prudential Regulation Authority, 2015). While the recent flood loss trends in the UK are largely due to socio-economic factors, such as more development in exposed areas, climate change is expected to exacerbate these impacts (IPCC, 2013). One important aspect therefore is if and how flood insurance provision can be integrated into overall risk management and climate change adaptation efforts, and how insurers can collaborate with other stakeholders to achieve greater resilience and ensure future insurability.

The lack of risk reduction incentive can therefore be seen as a major drawback for Flood Re. The UK Committee on Climate Change has found that, in its current design, Flood Re is likely to be counter-productive to the long-term management of flood risk as it does not provide enough incentives for high-risk households to put measures in place to avoid or reduce flood damage (Committee on Climate Change, 2015). This raises the question of whether in its current format this new insurance partnership will achieve its aim of moving towards risk reflective pricing while maintaining insurance affordability.

Indeed, a recent study by Jenkins et al. (2016) finds that Flood Re is likely to lead to an increasing gap between subsidized premiums and technical risk price, as summarized in Figure 11. These findings were highlighted by the Bank of England in its first report on the impact of climate change on the insurance industry, calling for more efforts to address underlying risk drivers (Prudential Regulation Authority, 2016).

Figure 11. Pricing Implications of Rising Risks Levels

Source: adapted from [Jenkins et al., 2016](#), in Prudential Regulation Authority and Bank of England: [The impact of climate change on the UK insurance sector \(2015\)](#).

The underlying agent-based model simulation of Flood Re shows that the pool is beneficial in its function to provide affordable insurance, even under climate change: the study finds that Flood Re would achieve its aim of securing affordable flood insurance premiums. However, the analysis also highlights that the new pool would be placed under increased financial strain if challenged with increasing risk as highlighted by the future climate change projections. If the intended transition to risk-based pricing is to take place, then a determined and coordinated strategy would be needed to manage flood risk, which utilizes insurance incentives, limits new development, and supports resilience measures (Jenkins et al., 2016).

The ABM also provides a platform to investigate the transitional mechanisms recently proposed as part of the Flood Re scheme (Flood Re, 2016), as well as how changes to regulatory measures and the roles and behavior of different stakeholders could be enhanced to support flood risk reduction under future climate change (Jenkins et al., 2016). A key issue is how the scheme will cope with the increasing gap between subsidized and risk based premiums given urbanization and climate change, and what impact an increase in demand for Flood Re could have. While the simulations indicate that Flood Re could ensure the affordability of insurance to homeowners, even under future climate change, this is modelled here without constraint on the number of properties which can be placed into Flood Re. Yet, an extension of Flood Re to include more properties could have significant consequences for Flood Re's funds and reinsurance cover, with affordable cover becoming harder to sustain under the future scenarios.

In conclusion, there are several pressure points that could threaten the proposed transition to risk-reflective pricing. If flood risk continues to rise, this would be likely to increase take-up of the reinsurance pool, while the gap between technical risk price and the Flood Re price would continue to widen. This would become a major challenge for government, which might have to intervene to plug this widening gap by providing funds or back-up cover for Flood Re. Political will, risk behavior and, most importantly, the success of public flood risk management policies will determine the future of Flood Re. For many observers Flood Re is a stop-gap, or “a breathing space for government to implement more resilient flood defenses” (Institute and Faculty of Actuaries, 2016)).

6. Concluding Observations

Flood insurance is technically challenging and often highly politically charged, with questions of fairness, justice, and effectiveness appearing at the interface between public and private sector activities. Therefore any effort to reform an existing scheme or introduce a new insurance solution needs to reflect on the broader context: what are the aims and objectives of different stakeholders? Where is existing capacity to underwrite, inform, incentivize, and take action to reduce risks? And how can insurance provide a mechanism that allows transparency about risk levels and risk trends, ensures fair and equitable access to those who need it while not creating unnecessary burdens for those who don't? Addressing those points is difficult in any context—but when changing risk levels and conflicting views on responsibilities and ownership are added to the mix this becomes one of the infamous “wicked problems” (Rittel and Webber 1973) of planning and decision-making.

This explains why there is such a patch work of flood insurance approaches in operation across the world, and why a large number of countries still have no such insurance at all.

In broad terms, the approaches follow either a solidarity-based concept, such as in France, where mandated through the government, all policyholders contribute and thus support those at high risk. The alternative is a fully risk-reflective approach, using risk pricing as a way to steer individuals and society towards a more resilient future. While this is widely seen as the rational way forward, in many cases, it is politically impossible without significant subsidizations of those faced with costly insurance premium. Flood Re can be seen as an effort to bridge both worlds—a solidarity based first phase, which would then gradually shift towards a risk based system in the longer run. Still, there remain questions about eligibility, which appear subject to political lobbying rather than based on sound technical assessments. Hence Flood Re's scope of cover might be adjusted, with SMEs and new -build properties potentially becoming

eligible for cover. For Flood Re the expansion of scope and rising take-up rates by insurers would require a revision of the underlying funding model and might lead to a reassessment of the required size of the pool funds.

Overall the success of Flood Re will heavily depend on risk trends, loss events, and market behavior: A series of floods, together with an improved understanding of growing future risks, vulnerabilities and exposure levels would place strain on any insurance system, public or private. The only truly sustainable response would be a significant increase in efforts to address the underlying risks by the government. Anything to reduce likelihood of loss would help to secure affordability and availability of insurance. This would also support those who are not benefitting from insurance by resilient communities, businesses and individuals, which in turn would help address the broader costs of floods, including those intangible aspects such as emotional stress, health issue or economic competitiveness for communities and regions.

In time of rising risks this is the main selling point for insurance: if correctly designed and implemented it can be hugely influential in driving societal resilience, while also delivering its economic benefits. However, as Flood Re shows, this is still lagging in practices. And indeed there are concerns that flood insurance can de-incentivize resilience, creating a false sense of security. This is the area where Flood Re could play a significant role by sending the right signals that would help to prepare homeowners for a risk—reflective approach to insurance. But until today this remains a missed opportunity.

The debate about flood insurance in the UK thus illustrates a fundamental challenge: the concern about affordability is usually seen in a short-term context, often driven by election cycles and the one-year nature of insurance contracts, while there is no strategy for the longer-term. While it is laudable that the government appears committed to risk-reflective pricing, whether or not this will be achieved through Flood Re remains highly questionable. The pool has a 23 year life span—built on the assumption that over this time government, homeowners and other stakeholders will do their bit to reduce flood risk, thus leading to a situation where no further public intervention in the market would be required. As the above evaluation shows, this appears to be wishful thinking rather than a sound strategy. Flood Re now needs to explore how it could achieve this transition—and it has already noted that the lack of levers to influence risk trends and risk behavior is a significant challenge for the pool.

The example of Flood Re warns of potential pitfalls but also highlights many opportunities for harnessing flood insurance to increase overall resilience: for example, the involvement of other agents whose behavior determines the flood resilience of homes, namely

businesses and communities. Banks, property developers, planning officials, architects, local government and the build environment industry—just to name a few of those stakeholders who are indirectly benefitting from insurance without paying for it, and whose action determine the resilience of buildings and systems. There are options for insurance to incentivize and engage those (Crick et.al.2016)—but at the moment this is still largely missing.

Thus there is room for optimism as, despite the lack of formal risk reduction measures, there appears to be a growing recognition from Flood Re and the industry that flood resilience will be a key contributor to future affordability and availability of flood insurance.

However, it is very clear that insurance is not a silver bullet, and it needs to be supported and integrated in a solid flood risk management approach. This is important for those countries that have insurance, but even more so for newly emerging markets or developing countries. Insurance against floods or other climate risks should be considered with healthy skepticism unless it can be developed with risk reduction and stakeholder influencing in mind.

It is still very early days for Flood Re, and much of the underpinning analysis in this paper is driven by assumptions, expectations and scenarios, rather than hard evidence from the market. It is therefore very important to monitor all those variables outlined above and see how Flood Re and the wider market perform. This should also include monitoring of the wider risk trends and flood risk behavior.

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