

FLOOD CRUNCH: A FISCAL APPRAISAL FOR COMMERCIAL AND RESIDENTIAL PROPERTIES IN ENGLAND

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Abstract

This paper establishes and applies a coherent and concise empirical framework for evaluating damage costs for commercial and residential properties during flooding in England by incorporating a novel methodology i.e. Flood Cost Assessment Tool. This research also analyses whether these damage costs significantly impact on the national economy as well as local economies. This strategy differs from previous economic flood damage estimation models by focusing on different grades of properties and level of damage in various flood events across England. Results reveal that Environment Agency and British Insurers estimations are too optimistic and some vital aspects are often neglected. Indeed, the new estimates for England's flooding costs for commercial and residential properties were found to be £1.6 Billion per year. While current English property damage costs represent only 0.1% of national (UK) and country (England) GDP, showing it to be inconsequential at either scale, it has considerable fiscal impact on local economies (County Councils) in both short and long term scenarios

Keywords: New Methodology- Flood Cost Assessing Tool, Floods, Damage Costs, National and Local Economy

JEL CODE: Q540 – (Climate; Natural Disasters; Global Warming)

1. Introduction

The study of flood costs has attracted global interest in both environmental and pure economics. Flood damage varies significantly from year to year and predictions identify increasing trends over the last century (Pielke, 2000). Europe's current annual flood damage costs are £5.2 Billion and it is likely to rise rapidly in the future (Ciscar *et al.* 2011).

Subsequently, this study questions whether flood damage data shaped by the Environment Agency and Association of British Insurers (ABI) really fulfil owner estimations? Are predictions realistic? Although extensive research has been undertaken, the answers to aforementioned queries remain indistinct, mainly due to lack of digitization of flood economic data over decades, as well as robust research methodologies. These issues prompted the present study to develop a novel and simple conceptual framework to estimate true flood damage costs for residential and commercial

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properties by grading properties. It also assesses the impact of flood damage costs at UK, English and local level GDP.

2. Study Area

England was selected as a study area because of the frequency of flooding incidents. It is bounded by the English Channel (south), Celtic Sea (southwest) and North Sea (East) (Figure 1) (Maps of World, 2013): its coastline is more than 5581 miles (Darkes, 2008) and the population is 52 million (ONS, 2013). England is vulnerable to all types of floods, as evidenced in various locations in 2007, 2009 and 2012 (Zhou *et al.* 2011 & Jha *et.al.* 2012). Consequently, this work estimates average annual flood damage costs of properties between 2007 and 2012.



Fig.1. Location of study identified for Primary Flood Assessment Conceptual Framework Application. (Source: Maps of World, 2013)

3. Theory

Approximately 5.2 million properties including 2 million commercial properties are at flood risk in England (Environment Agency, 2009). Summer floods (England) in 2007, turned into a nationwide catastrophe and caused £3.5 to £4 Billion worth of damage costs: of that amount, more than £3 Billion came from the housing sector (ABI, 2010, & Environment Agency, 2014). Besides, 2009 flooding costs £180 million and 2012 floods costs more than £600 million, and these events hugely impacted the England's economy (ABI, 2010, & Environment Agency, 2014)

3.1 UK and England GDP

The UK's economy is a paradox: while being the sixth largest economy in the world, with £1.6 trillion current (2012) GDP (World Bank, 2013) since 2007, its economic vigour has declined with a double credit crisis (The Economist, 2013). Consequently, for the last six to seven years, the economy has exhibited sluggish growth and flood costs have exacerbated the situation. Given the significance of these impacts, it is important to analyse residential and commercial property damage costs and impact of damage scenarios on national and local GDP.

4. Methodology - Conceptual Framework

This methodological approach contains two fundamental mechanisms. Primarily, it offers a conceptual framework for the precise evaluation of the flood water levels in properties. Secondly, implementing framework by establish three crude numerical equations to evaluate flood annual property damage costs as well as intensity of impact of damage costs on national and local economies. This approach was aggravated by FEMA's-USA (Federal Emergency Management Agency) flood cost tool. This crude numerical model relies on cm (centimetres) and m (metres) scales, indicated by various colour codes to categorise flood water levels (Figure 2).

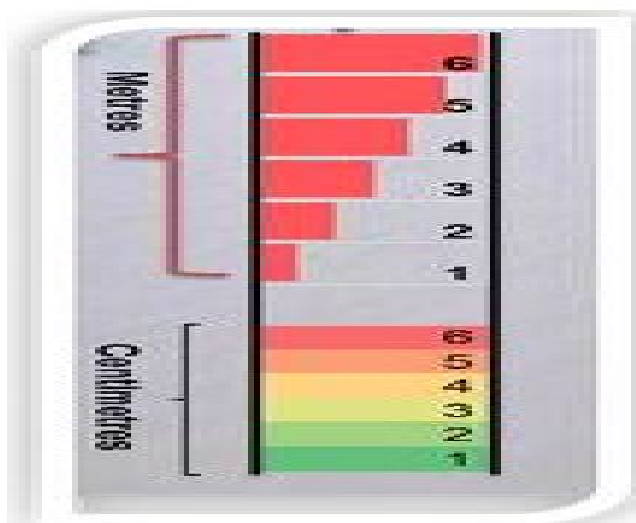


Fig. 2. Flooding Cost Assessment Tool

Accordingly, this linear model empirically measures floodwater levels and assesses effects in various qualitative property grades based on household income: Grade 1 (Very High); Grade 2 (High); Grade 3 (Medium) and Grade 4 (Low), in England to show clearly flood damage severity. Inundation into properties of between 3 cm and 5 cm generally causes no serious damage, but there is potential damage to construction, equipment, carpeted and wooden floors, walls and other materials if the flood water level reaches > 5 cm (Figure 3(a) and 3(b)). Consequently, this distinct measurement tool enables analysis of the magnitudes of commercial and residential property damage costs during recent flooding events.

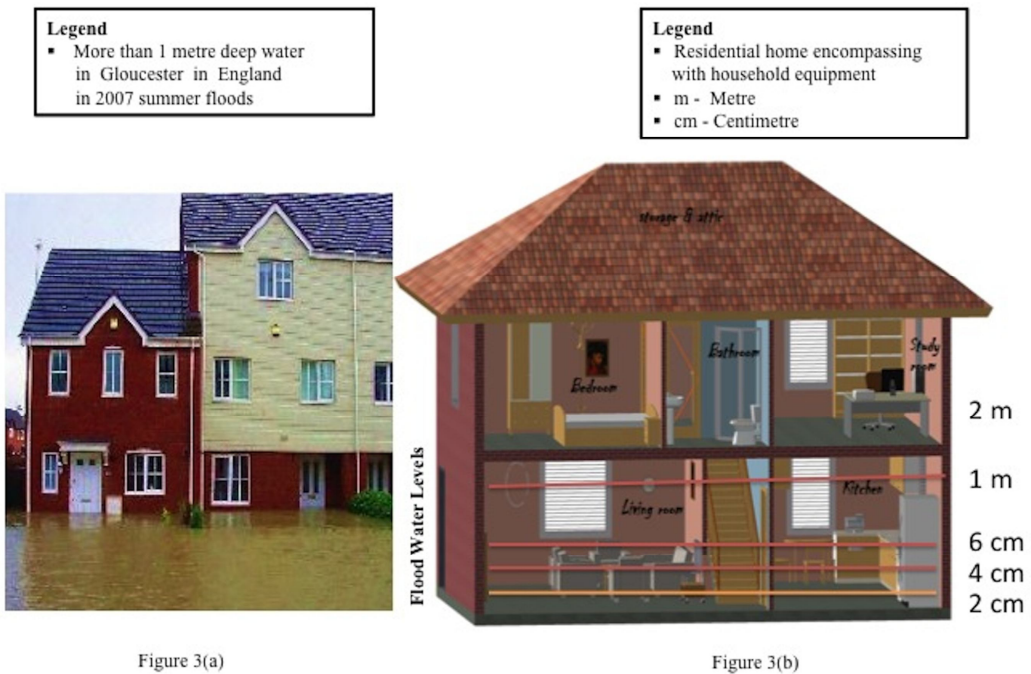


Figure 3(a)

Figure 3(b)

Fig. 3 (a & b): Applications of Flooding Cost Assessment Tool to Property
(Source: (a)- BBC, 2009)

This framework also consists of three crude numerical formulas as support pillars to assess impact: % of flood damage costs on local and national economies along with evolution of mean values of properties. These are,

$$\left(\frac{FDCcr}{NGDP} \right) \times \% \quad (1)$$

Here, FDCcr denotes flood damage costs of commercial and residential properties and NGDP signifies national gross domestic product.

$$\left(\frac{FDCcr}{LE}\right) \times \% \tag{2}$$

From above equation, LE designates local economy.

$$\left(\frac{MFDC + MAFDC}{2}\right) \times NDP \tag{3}$$

Where: MFDC is Minimum Flood Damage Costs
MAFD is Maximum Flood Damage Costs
NDP is Number of Damaged Properties

5. Data

This study uses data from British Insurers and the Environment Agency along with extensive academic literature. Data from these organisations were supplemented by information from UK Government Reports. While, this study divided properties into grades (G1 G2, G3 and G4 – Table 1) and also quotes the types of residential and commercial properties to evaluate fiscal damage with the novel flood cost assessment tool. Consequently, results were compared with statistics published by the British Insurers and Environment Agency and differences identified. Subsequently, new assessments of flood damage costs are derived.

Table 1
Grades of Property and Types of Residential and Commercial Properties

Grading of Properties				
PROPERTY TYPE	GRADE 1	GRADE 2	GRADE 3	GRADE 4
Residential ⁱ	Very high income	High income	Medium income	Low income
Commercial ⁱⁱ	Very high value	High value	Medium value	Low value
Heritage ⁱⁱⁱ	Very high value	High value	Medium value	Low value
<i>Property Description</i>				
ⁱ Residential Detached, Semi-detached, Terraced, Bungalows., Apartments and Cottages				
ⁱⁱ Commercial Academic, Industry, Public transport infrastructure				
ⁱⁱⁱ Heritage Museums, Art galleries etc.				

6. Results and Discussion

Data analysis showed that England is a major contributor to UK GDP and in 2013 was estimated at £1.35 trillion: this was calculated on UK regional GVA (Gross Value Added) figures (ONS, 2013). Subsequently, equation 3 was considered alongside minimum and maximum costs for various household items and flood scenarios as shown in Table 2.

Table 2. Flood Damage Assessment to Residential and Commercial properties

Structural and property components	Damage Costs for Residential and Commercial properties (Minimum to Maximum)
Carpet\Wooden Floor	£1,300 to £3,100
Electrical Appliances	£2,600 to £5,500
Doors & Windows	£1,800 to £4,500
Living\ Dinning\ Kitchen\ Bed room Furniture\ Infra structure	£9,700 to £ 23,200
Personal Items	£2,800 to £4,400
Cleaning and Repairs	£4,900 to £8,280
Hidden Costs	£2,800 to £5,250

Table 2 demonstrates cost implications for commercial and residential properties and show a range between £1,300 and £23,200, depending on the item damaged/lost. Based on data from Table 2, cumulative damage costs might range from a minimum of £25,900 to a maximum of £54,230. However, according to the Environment Agency (2013) flood damage costs for property are £1 Billion, and the Association of British Insurers (ABI) (2010) estimates are between £20,000 (minimum) and £40,000 (maximum) for a single property. Subsequently, flood damage costs for commercial and residential properties were compared with aforementioned organisations evaluations and differed and offered new estimations.

However, flood events are not an every year phenomenon and their generation is highly uncertain. Typically, an average of 40,000 properties (estimated on previous flood events) are affected by very severe floods, which results in England's average annual destruction costs for commercial and residential properties being > £1.6 Billion, as follows:

$$\left(\frac{£25,900 + £54,230}{2} \right) \times 40,000 \Rightarrow £1.6 \text{ Billion}$$

It should be noted that indirect and secondary costs were not included in this assessment and the work does not distinguish between tangible and non-tangible aspects such as time lost from work, lives lost, emotional stress, etc. Consequently, the true costs could be much higher, but this is beyond the scope of this work.

7. Damage Cost Impacts on UK and English Economies

It has been shown that commercial and residential property flood damage costs in England are > £1.6 Billion and therefore, the anticipated impact on GDP is assessed using equation 1:

$$\left(\frac{1602600000}{1600000000000} \right) \times \% = 0.10\%$$

Therefore, £1.6 Billion represents 0.1% of UK GDP and consequently its effects at the macro scale is not significant. Moreover, analysis of impact of flood damage costs on local GDP and economies are determined accordingly:

$$\left(\frac{1602600000}{1300000000000} \right) \times \% = 0.12\%$$

At the English scale flood damage costs represent 0.12% of GDP, and again is relatively insignificant. However, major infrastructure damage and environmental degradation are not included and these could have a more significant effect on national GDP. Future research will look into these scenarios.

8. Conclusion

Research on fiscal flood damage evaluation for properties in England has assessed two different approaches to cost assessment. Results suggest that the Environment Agency and British Insurers flood damage estimates are optimistic and secondly, a more considered in-depth evaluation for commercial and residential properties should be undertaken. This research established a systematic framework to address these deficiencies and achieved a more realistic estimate of flood damage costs. This new approach differentiated flood levels by using a measurement tool, which is colour, coded and represented at cm and m scales. English flood damage costs exceed £1.6 Billion, which was shown to be a fraction of UK and English GDPs (0.1%). However, at a community level this remains a significant amount to local economies. Therefore, if flood adaptation processes are not enhanced, fiscal costs could ultimately negatively impact on future GDP.

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