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Statement of Mark J. Browne
"The Demand for Flood Insurance"

Before the Committee on Banking, Housing, and Urban Affairs
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Thank you Chairman Shelby and Senator Sarbanes for giving me the opportunity to be here. My name is Mark Browne. I am the Gerald D. Stephens CPCU Chair in Risk Management and Insurance in the School of Business at the University of Wisconsin – Madison. Previously, I was on the faculty of The Terry College of Business at The University of Georgia. I received my doctorate in applied economics at the Wharton School of the University of Pennsylvania.

The National Flood Insurance Program, which began in 1968, is close to 40 years old. I think it's reasonable to expect that at least several catastrophic floods will occur in the United States over the next 40 years. The impact of these events on the affected areas, the finances of the government, and the economic health of the country will depend on the risk control and risk financing methods put in place prior to their occurrence.

When the National Flood Insurance Program was enacted it had three goals. One was to protect policyholders from the devastating financial consequences of flood damage. The second was to protect lenders from potential loan defaults resulting from flood losses. Third, and perhaps most important, was to protect the Federal revenue funds of the United States by collecting money from those exposed to flood loss prior to the occurrence of the loss.

In addition, the program serves other important purposes. It facilitates real estate transactions and thus promotes homeownership, which is a societal goal. It benefits the insurance industry as it relieves public pressure to provide flood insurance coverage. Finally, it's worth noting that the National Flood Insurance Program is popular in some parts of the country, although not as popular in other parts.

The flood peril presents an important threat to the property and well being of a significant portion of the world's population. Like earthquake it has the potential to bring economic catastrophe and death to a broad geographic area. Also similar to earthquake, little coverage against the flood peril is available through the private insurance market. For example, homeowners insurance policies in Australia and the Netherlands exclude the flood peril, and in Germany flood coverage is seldom bought (*Business Insurance*, February 6, 1995). Although Graff (1999) reports that since 1991 roughly two-thirds of private insurers in Germany technically offer some coverage against flood, less than 10% of private property in that country is insured against damage from this peril. In the U.S., individuals and small businesses wishing to purchase insurance against the flood peril typically obtain it through the National Flood Insurance Program.

The National Flood Insurance Program (NFIP) was established with the passage of the 1968 Housing and Urban Development Act (Vaughan, 1997). The NFIP is divided into two phases, emergency and regular. Under the emergency phase, a flood hazard map is provided and residents are allowed to purchase limited amounts of insurance at subsidized rates. Once a flood insurance map has been drawn that divides the community into specific zones with the probability of flooding determined for each zone, and the community has agreed to adopt more stringent mitigation and land use measures, it is allowed to enter the regular phase of the program (Rejda, 1998, pp. 155-156). In the early years of the program many communities were covered under the "emergency plan." Under that plan limits for single-family dwellings were capped at $35,000 (building) / $10,000 (contents) compared with $185,000 (building) / $60,000 (contents) under the regular plan.[1] By the early 1980s the number of communities that had qualified for the NFIP regular program had leveled off at about 18,000.

The rationale for a government sponsored flood insurance program arose from the apparent failure of the private insurance market. Possible reasons for the failure of the private market were offered in an American Insurance Association study that Anderson (1974) references, *Studies of Floods and Flood Damage, 1952-1955*. The study concludes that "insurance against flood cannot successfully be written" for several reasons. First, losses are a virtual certainty in some areas. Second, flood losses can be catastrophic in nature. Third, consumers are not willing to pay premiums that are sufficiently high to cover the loss exposure. Fourth, insurers are unable to pool insureds with varying degrees of exposure to flood losses because lower risks will not purchase coverage at a pooled rate.

While not mentioned in the American Insurance Association study an additional factor contributing to market failure may be a charity hazard. Charity hazard is the tendency of an individual at risk not to procure insurance or other risk financing as a result of a reliance on expected charity from others such as friends, family, community, non-profit organizations, or a government emergency program.

The subsidized flood insurance available through the NFIP was intended to appeal to property owners who did not purchase insurance in the private market. The subsidized insurance is only made available in communities that adopt permanent land-use and control programs. Following adoption of these measures subsidized insurance is made available to residents but it is not extended to new construction. According to the U.S. General Accounting Office (GAO), in 1994 41 percent of NFIP policies were subsidized. Pasterick (1998) reports that the premiums paid on this group of subsidized policies are estimated to be less than 40 percent of the full-risk premium needed to fund losses expected in the long-run.

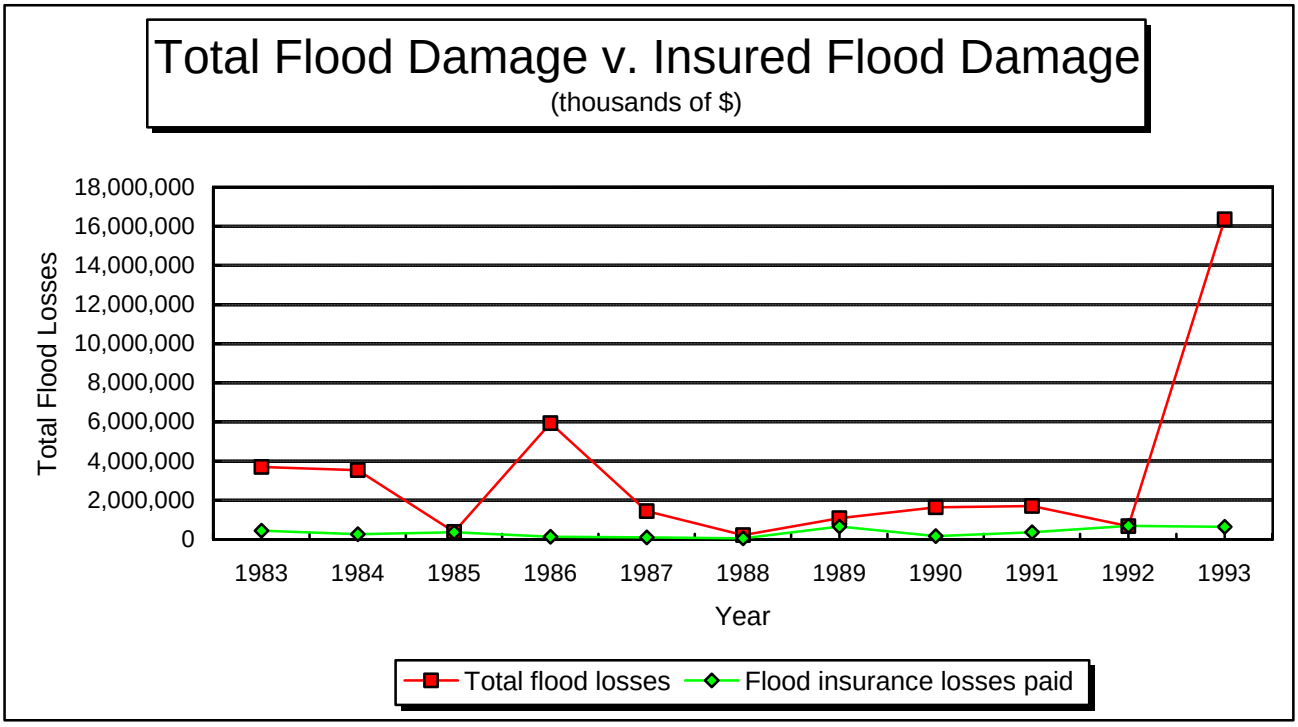
Loss statistics from two major storms inflicting flood damage in years following the creation of the NFIP indicate that significant amounts of property remain

[1] The limits were raised in 1994 by the National Flood Insurance Reform Act.

uninsured against the flood peril. Kunreuther (1984) reports that flood damage from Tropical Storm Agnes in June of 1972 exceeded $2 billion. Total damages paid by the NFIP were approximately $5 million. In 1993 the greatest single flood event in the United States occurred. Eleven million acres of farmland in the Midwest were inundated when the Mississippi River flooded, resulting in more than 50 deaths and causing $12 billion in total damages. Of the $12 billion in damages, less than $1 billion was covered by federal flood insurance. Only about $600 million of the total was covered by private insurance, mostly through commercial difference-in-condition (DIC) policies.[2] While it is not yet known what the dollar value of losses from Hurricane Katrina will be, it is likely that the expenses of the NFIP will account for no more than 10% of the total.

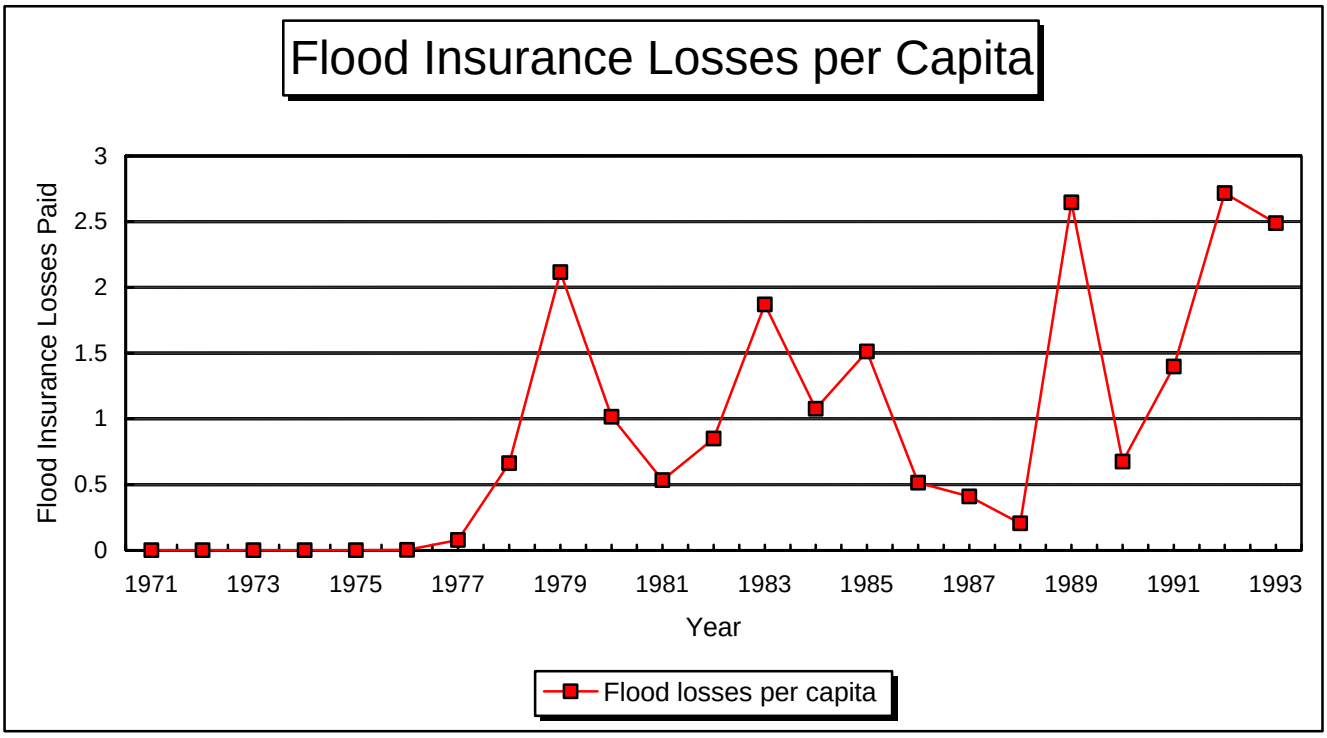
Figure 1 shows by year both total flood damage and insured flood damage for the period 1983 through 1993. The figure indicates that the percentage of flood losses that are insured varies considerably from year to year and that for the decade as a whole a large portion of flood damage was uninsured. The variation in the level of insured flood losses per capita by year is presented in Figure 2.

Figure 1



[2] A program which is similar in many respects to the NFIP was established by the Federal Crop Insurance Act of 1980. The intent of this act was to replace federal disaster assistance payments to farmers with federal crop insurance. However, in 1993 participation levels even with an average premium subsidy of 30 percent were only about 35 percent of eligible acres (Barnett and Skees, 1995).

Figure 2



Various explanations have been offered for why the NFIP does not insure a larger portion of flood losses. Kunreuther (1984) provides several possible reasons for individuals' failure to purchase flood insurance. These include the perception by some that the flood peril is less threatening to their property than it actually is. Individuals may underestimate the probability that they will suffer flood damage as a result of having little or no past experience with the peril. Others are unaware that they can purchase flood insurance coverage. Another possible explanation is that consumers feel the price of flood insurance, even when subsidized, is still too expensive. Additionally, Lewis and Nickerson (1989) posit a model for expenditures to mitigate the effects of natural disasters when individuals are partially insured against financial loss by a public relief program (e.g., disaster loans, grants, etc.). Their model suggests that underinvestment in loss mitigation and insurance, that is, reduced incentives to spend personal resources on loss mitigation and insurance, are a consequence of the limited liability provided by government programs of disaster relief.

To understand the low rates of flood insurance purchase, it is important first to consider demand for insurance in general. Theory underpinning the demand for insurance has received considerable scholarly attention. An extensive review goes beyond the aims of this discussion, but a cursory review of some of the major work in this area is of value. As both individuals and businesses purchase

flood insurance, we consider the factors motivating the purchase of insurance by each.

The Demand for Insurance by Individuals

Smith's (1968) theoretical model of the demand for property insurance by individuals implicitly assumes that individuals are able to form correct estimates of the probabilities associated with all possible loss outcomes. In his analysis, factors which are important determinants of insurance consumption include wealth, the probability of loss, the price of insurance, the value of the item exposed to risk, and the utility function of the individual considering the purchase of insurance. Smith finds that when the price of insurance per dollar of coverage is less than one and the probability of no loss is greater than zero the optimal insurance purchasing decision may entail either purchasing or not purchasing coverage. In this context, self-insuring may be optimal. Other things equal, self-insurance will be optimal the less risk-averse an individual is and the greater the probability of loss. Self-insurance will also be optimal the greater one's wealth, assuming the individual's utility function is characterized by decreasing absolute risk aversion. Given a particular price of insurance, utility maximization suggests that an individual is more likely to self-insure the lower the probability of loss. In contrast, given a fixed probability of loss an individual is more likely to insure the lower the price of insurance. Insurance purchases are also theorized to be positively linked to the value of the item at risk, other things equal.

As mentioned above, the probability of loss parameter in Smith's model is assumed known to both insureds and insurers. This assumption is frequently made by researchers who model the demand for insurance. See for instance, Raviv (1979), Mossin (1968), Borch (1960), and Gould (1969). The adverse selection literature is based on the assumption that insureds form more accurate estimates of the probability of loss parameter than insurers. See for instance, Rothschild and Stiglitz (1976), Wilson (1977), and Miyazaki (1977). These models, while leading to different results in some aspects, all find that low risk insureds will purchase less insurance in a market with adverse selection than in a market free of adverse selection.

In contrast to the adverse selection literature which posits that insureds are better informed about their actual probability of loss than insurance companies, Kunreuther's (1984) contention, that property owners may not purchase flood insurance because they underestimate their true probability of loss, suggests just the opposite. Kunreuther's suggestion points to a possible second difference between the flood insurance market and those insurance markets characterized by adverse selection. In the adverse selection literature the market is composed of high risk and low risk insureds, each with different probabilities of loss. The high risks estimate that their probability of loss exceeds the insurance company's estimate. The low risks perceive that their probability of loss is less than that estimated for them by the insurance company. In the case of flood insurance, Kunreuther's suggestion is that without distinction to risk class insureds

underestimate their loss probability. From the perspective of an individual who underestimates the true probability of loss and must make the decision whether or not to purchase insurance as modeled by Smith, the price of insurance quoted by the insurer would seem high. If the insured underestimates the actual loss probability, subsidized insurance rates may even seem expensive.

An alternative, or in some cases complement, to insurance is an investment in reducing the likelihood or severity of the loss. The federal government makes considerable investments each year in flood loss mitigation. Although mitigation can reduce the probability and severity of flood losses, it may also produce a sense of security which results in further development in floodplains and reduces the perceived value of flood insurance (Pasterick, 1998, p. 125). We do not have direct information on how finely NFIP reflects changes in flood risk in its premium pricing structure. However, the continued high level of subsidy in the program suggests that prices are unlikely to fully reflect changes in risk resulting from mitigation. If this is the case, then increased expenditures on mitigation would decrease the demand for flood insurance. Additionally, Pynn and Ljung (1999) surveyed residents in Grand Forks after the severe flooding in 1997 and asked them to evaluate the importance of 18 factors in influencing their decision not to purchase flood insurance. The respondents ranked as number 2, "I believed the dikes and other flood control devices would protect me from experiencing flood damage." Number 1 was the "National Weather Service did not predict the river to crest so high." This result provides a rather compelling argument for the expectation of a negative relation between mitigation and flood insurance demand.

Finally, to the extent that individuals expect to be eligible for other forms of disaster assistance after suffering flood losses, their incentives to purchase federal flood insurance will be reduced. This assistance could come in the form of disaster loans, grants and other aid.

The Demand for Flood Insurance by Businesses

The National Flood Insurance Program makes insurance available to businesses as well as individuals. Since businesses do not have utility functions, standard utility maximization arguments do not provide an explanation for their purchase of insurance. Mayers and Smith (1982) argue that profit maximization provides a rationale for the purchase of insurance by businesses. They contend that the purchase of insurance may result in greater profitability if it leads to more favorable terms in a variety of different transactions. Examples include lower interest rates on debt, and better relationships with suppliers, buyers, and employees. The business's decision to purchase insurance coverage therefore depends not on its own utility function but that of the parties with which it enters into different transactions.

While the economic rationale for purchasing insurance is different for businesses than it is for individuals, the same set of factors are important – price, the probability of loss, the amount of loss. In the case of a business, the income, wealth, and shape of the utility functions of parties to transactions are determinants of insurance purchases. Just as in the case of demand for flood insurance by individuals, an incorrect estimate of the probability of loss may result in the business choosing not to purchase flood insurance.

A colleague of mine, Dr. Robert E. Hoyt of the Terry College of Business at The University of Georgia, and I used data supplied by the National Flood Insurance Program to study what factors influence individuals' and businesses' purchase of flood insurance. We found that income is positively related to the amount of flood insurance purchased. Individuals with greater financial resources are more likely to take advantage of the government's flood insurance program. An important question that could be raised is whether or not insurance is the best approach to providing disaster protection to the low-income segment of the population. The low levels of participation in the NFIP and our finding that income matters suggest that perhaps this is not the best approach.

Our empirical results indicated that the price of flood insurance, measured as written premiums per $1,000 of flood insurance in force in the state, is negatively correlated with flood insurance purchases. Our analysis suggests that if the government decreased the price it charges for flood insurance, more insurance policies would be sold and the amount of flood insurance in force would increase. However, the demand for additional policies is relatively price inelastic.

Our study provided evidence consistent with Kunreuther's (1990) hypothesis that risk perceptions influence insurance purchasing behavior and Viscusi's (1991) Bayesian learning model. We found that the number of flood insurance policies sold during a period is positively correlated with flood losses during the prior period. Similarly, Palm et al. (1990) report that surveys taken of property owners before and after the Loma Prieta earthquake of 1989 revealed that the percent of respondents who felt earthquake insurance was unnecessary after the earthquake was significantly less than the number who held that belief before the earthquake. If, as our evidence and that of others indicates, perceptions of the risk of flood loss are an important determinant of insurance purchases, informational materials directed at increasing the public's awareness of the danger posed by the flood peril may be an effective means of increasing the purchase of flood insurance.

Our study used economic data to explore the reasons why individuals purchase flood insurance. A number of interesting questions that we were not able to address await future research. We know relatively little about how people form estimates of the likelihood of suffering flood damage. The relationship between the recent occurrence of flood damage and the decision to purchase coverage emerges in our data analysis. While it is plausible that the government could increase sales of flood insurance by modifying individuals' perceptions of

potential loss, how this could be best done and the cost are open questions. Similarly, as mentioned above, our analysis supports the hypotheses that income and price are important determinants in the flood insurance purchasing decision. This suggests that vouchers to purchase flood insurance may be an effective means of increasing coverage. Analysis of household level data likely would yield more accurate estimates of price and income elasticities than we were able to derive. Such an analysis would help to determine what the potential costs of increasing participation in the flood insurance program through a voucher program would be.

Our data showed that a large portion of flood losses is not insured by the National Flood Insurance Program. Information on how individuals do pay for flood losses may shed light on why individuals choose not to purchase flood insurance.

A final point to consider is that the FHA requires the purchase of flood insurance by those seeking FHA-backed mortgages in flood zones. This requirement serves as a powerful incentive for the purchase of flood insurance. Other things equal this requirement will result in increased purchases of flood insurance. We included the number of FHA mortgages per 1,000 population in our analysis to control for this effect. As FHA backed mortgages and flood insurance are essentially complimentary goods as a result of the FHA's requirement, we hypothesized a positive relationship between the two. Kunreuther (1996) has questioned whether FHA requirements are easily avoided. He cites a study by the GAO (1990) that reports that 79 percent of victims of a major flood in Texas in 1989 that were required to purchase flood insurance were not insured. The implication he makes is that it would not be surprising if many of these individuals bought flood insurance when they received their mortgage and later dropped the coverage.

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