

Social Benefits and Costs of the National Flood Insurance Program



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Outline of This Presentation

- Motivation
- Model and data
- Consumer surplus for the NFIP
- Results
- Discussion and implication

Motivation

- National Flood Insurance Program (NFIP) is the largest monoline insurer in the United States
- Created as government program in the 1960s
- The program was designed to benefit the government
- Participation is required in “high” risk areas
- Participating communities required to implement building code standards
- The NFIP is more than 24 billion dollars in debt
- The NFIP’s impacts are not evenly distributed
- Study is retrospective

The NFIP and the FMA

- FMA started in 1996
- Provides grants for flood mitigation to local communities
 - Project may be physical flood protection, such as a dam
 - Project may be to improve building, planning, or zoning codes
 - Projects must “pass” a benefit-cost test prior to award
- Mitigation to reduce claims against the flood insurance program
- Grant money drawn from flood insurance premium pool
- Programs are politically and financially linked

Research Questions

This dissertation addresses three key policy questions about the NFIP:

1. Does the NFIP have a positive net social benefit?
2. Does who gains and loses from the program change the assessment?
3. Does the NFIP save the government money?

Development of the Sufficient Statistic

- The change in the net social benefits of the NFIP, ΔS , comprises four sources:
 - The change in the consumer surplus, the benefit to consumers
 - The change in the producer surplus, the benefit to producers
 - The change in the government surplus, the benefit to government
 - The change in the external surplus, the effects of externalities
- The model is developed by finding each surplus and summing the results

	With NFIP Benefits	Costs	Without NFIP Benefits	Costs
Consumer Surplus				
consumer surplus for flood insurance	w			
payments for claims	κ			
premium payments		μ		
<i>ad hoc</i> disaster relief grant			a	
Alternative Summary	$w + \kappa - \mu$		a	
Change in Consumer Surplus	$w + \kappa - \mu - a$			
Producer Surplus				
administrative fees to insurers	$\varphi\mu$			
administrative costs to insurers		$\varphi\mu$		
Alternative Summary	$\varphi\mu - \varphi\mu = 0$			
Change in Producer Surplus	0			
Government Surplus				
administrative fees to insurers		$\varphi\mu$		
payments for claims		κ		
premium payments	μ			
NFIP expenses		ζ		
<i>ad hoc</i> disaster relief grant				a
Alternative Summary	$\mu - \kappa - \varphi\mu - \zeta$		$-a$	
Change in Government Surplus	$\mu - \kappa - \varphi\mu - \zeta + a$			
External Surplus				
environmental benefits / costs		B	β	
marginal tax burdern		$m\zeta$		ma
Alternative Summary	$B - m\zeta$		$\beta - ma$	
Change in External Surplus	$B - m\zeta - \beta + ma$			
NFIP Sufficient Statistic	$\gamma\lambda - \varphi\mu - \zeta - m\zeta + m\kappa$			

Data Sources for the Sufficient Statistic

- Most values are available directly from the NFIP's financial data
- Other data is available from government documentation and budget
- The consumer surplus for the NFIP required additional research from survey data

Data Sources for the FMA Study

- Incorporates study by Rose, et al., that finds benefit-cost ratio for FMA projects
- Used a sample of FMA projects to find 50-year net social yield
- Value found is benefit-cost ratio of 5 (estimated s.d., 1.1)
- The benefit-cost ratio can be applied to all projects for NSB of FMA program grants
- This study will use their results for the FMA element

Consumer Surplus Versus the WTP

- Consumer surplus is the net economic gain to consumers
- Comes from being able to purchase a good or service for less than consumers are willing to pay
- The consumer's values for incremental willingness to pay lie along the demand curve
- The consumer surplus is the area between the demand curve and the equilibrium price

Consumer Surplus Model: Primary Research

- A censored regression model can find the consumer surplus, e.g., Tobit
- Censored model useful because some people don't have to buy insurance and there is a cap
- The model is a GLM where the dependent variable is the amount purchased
- An explanatory variable is the price
- For Tobit models, a simple transformation of the coefficient on price yields the consumer surplus per consumer

Consumer Surplus Regression

- Variables capture risk without being substitutes for insurance
- The variable $fprem$ is the price paid for insurance
- $CS = \int_{P_0}^{P_c} (\beta_0 + \beta_1 P) dP = -\frac{y^2}{2\beta_1}$
- β_1 is the coefficient for $fprem$
- y is the amount of insurance purchased

	High Premium	Low Premium
(Intercept)	-1842.98 (317.03)***	-1503.55 (311.15)***
fprem	-564.95 (59.67)***	-1032.06 (84.75)***
log(income)	574.22 (55.71)***	568.45 (54.72)***
Brevard County	-853.53 (234.11)***	-1040.19 (231.20)***
Brunswick County	369.15 (218.72)	275.89 (217.83)
Dare County	-153.98 (223.35)	-400.65 (221.75)
Galveston County	-7.59 (218.27)	-36.20 (217.01)
Georgetown County	1348.26 (265.65)***	1105.89 (262.08)***
Glynn County	102.61 (271.37)	-178.29 (268.82)
Lee County	201.31 (259.88)	-41.16 (257.10)
Sussex County	-445.61 (211.14)*	-647.38 (209.96)**
ocean	831.61 (90.35)***	787.84 (88.75)***
vacant	-255.10 (92.78)**	-191.04 (91.51)*
subsidy	-530.15 (95.64)***	-364.48 (93.18)***
Log(scale)	7.40 (0.03)***	7.37 (0.03)***
AIC	15502.85	15415.52
BIC	15575.64	15488.30
Log Likelihood	-7736.43	-7692.76
Deviance	1130.84	1115.91
Total	946	946
Left-censored	222	222
Uncensored	601	601
Right-censored	123	123

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Consumer Surplus Results

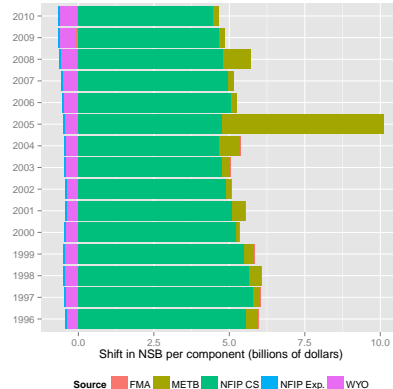
	High Premium		Low Premium	
	1998	2010	1998	2010
Adjusted for year				
Consumer surplus (fitted demand)	590.85	790.92	352.27	471.55
Sampled SE	1239.13	1658.72	695.92	931.57
Consumer surplus (observed demand)	1165.19	1559.75	637.83	853.81
Sampled SE	1755.47	2349.90	960.95	1286.34

Social Discounting and Retrospective Analysis

- Financial impacts over time so aggregation is necessary
 - Present value for prospective analysis is based on inverting future value
 - Retrospective study uses future value formula to calculate FV in year of interest, 2010
- Social discounting represents economic cost of not using funds for other purposes
- Selecting a discount rate is not straightforward
- There is little guidance on selecting a rate for retrospective analysis
- This analysis uses the government borrowing rate
 - Government might not otherwise borrow the funds for other purposes
 - Easily observable since the constantly yield rate is well known
 - Only 10-year borrowing rate used since study period included period where 30-year bonds were not issued
- Social discounting can also accommodate changes in value due to inflation

Retrospective Results

- The change in net social benefits is 78.28 billion dollars
- The net social benefits are driven by the consumer surplus for the NFIP and the METB gains
- Hurricanes Katrina and Rita are reason for larger than average benefits in 2005
- Largest cost component is WYO fee to private sector to administer policies

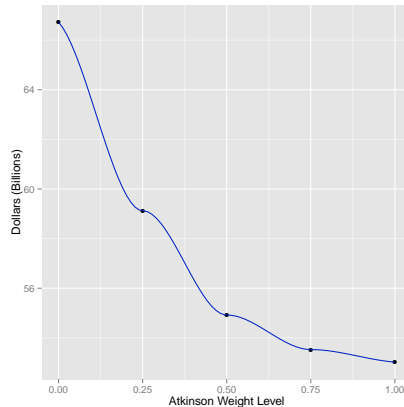


Summary of Retrospective Results

Value in year	2010	Forecast to 2060
Base analysis	78.28	81.18
Excluding 2005	68.63	71.42
Excluding METB	68.30	71.20
Excluding the NFIP Consumer Surplus	2.34	5.25
Sensitivity analysis mean	52.72	55.63
Sensitivity analysis mean (excluding 2005)	45.05	47.85
Sensitivity over <i>ad hoc</i> payments	76.57	79.38
Sensitivity over the producer surplus	81.62	84.53
Sensitivity over the PS (excluding 2005)	72.40	74.55

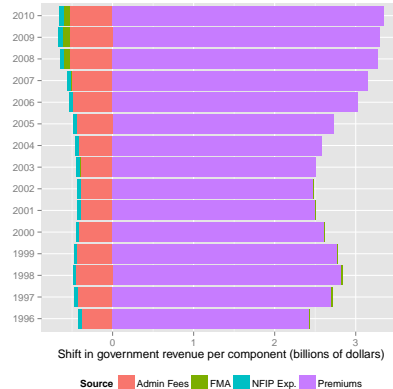
Distributionally Weighted Results

- The net social benefits decrease as the Atkinson weight level increases
- As the Atkinson weight level increases, the aversion to income inequality increases
 - At higher weight levels, lower income counts for more and higher income counts less
- Accordingly, the NFIP and FMA programs must be regressive
 - The net benefit is flowing to wealthier households
 - Shown by the decrease in NSB at higher Atkinson weights



Government Income Results

- The change in government revenue is 34.62 billion dollars
- The premiums paid into the NFIP are a significant benefit to the government's bottom line
- The claims amounts are excluded from the summary since the claims amounts are assumed paid even in the absence of the NFIP
- The administrative fees and expenses are a small portion of the NFIP from a government finance perspective



Summary of Government Income Results

Value in year	2010	Forecast to 2060
Base analysis	34.62	36.89
Excluding 2005	32.38	34.56
Sensitivity analysis mean	34.61	36.84

Key Findings

- The overall net social benefit of the NFIP is positive
- This is driven primarily by the consumer surplus for the NFIP
- There is a slightly regressive effect of the NFIP
- The program has saved the government money compared to the baseline

Changes From August

- There's a substantial change since August, in both sign and magnitude
- Due to misinterpretation of the Tobit analysis results
- Originally interpreted as the willingness-to-pay
- The value should be consumer surplus
- By implication, the insurance premiums were subtracted twice which is now corrected
- The effect swings the consumer surplus in the model substantially

Limitations of this Analysis

- Model structure a strength and weakness
 - Makes assumptions explicit and yields what is the first synthesized analysis of the program
 - Further research could change results
- Ecological impacts of the program
 - Not enough known to quantitatively analyze
 - Here assumed to be equal with and without program
- Government behavioral response could be more complex than an equal amount of *ad hoc* grants without the NFIP
- The consumer surplus estimate uses a relatively small sample in high risk areas

Contributions and Policy Implications

- Major contributions
 - Developed first model of integrated assessment of NFIP and FMA
 - First research on the consumer surplus of the NFIP
 - First quantitative results on monetized NSB, distributional impacts, and change in government revenue
- Policy Implications
 - Shows consumers, producers, and government are better off with the NFIP
 - Influenced by the baseline selected
 - Does not attempt to find an optimal premium to maximize NSB
 - There is a large consumer benefit due to the program