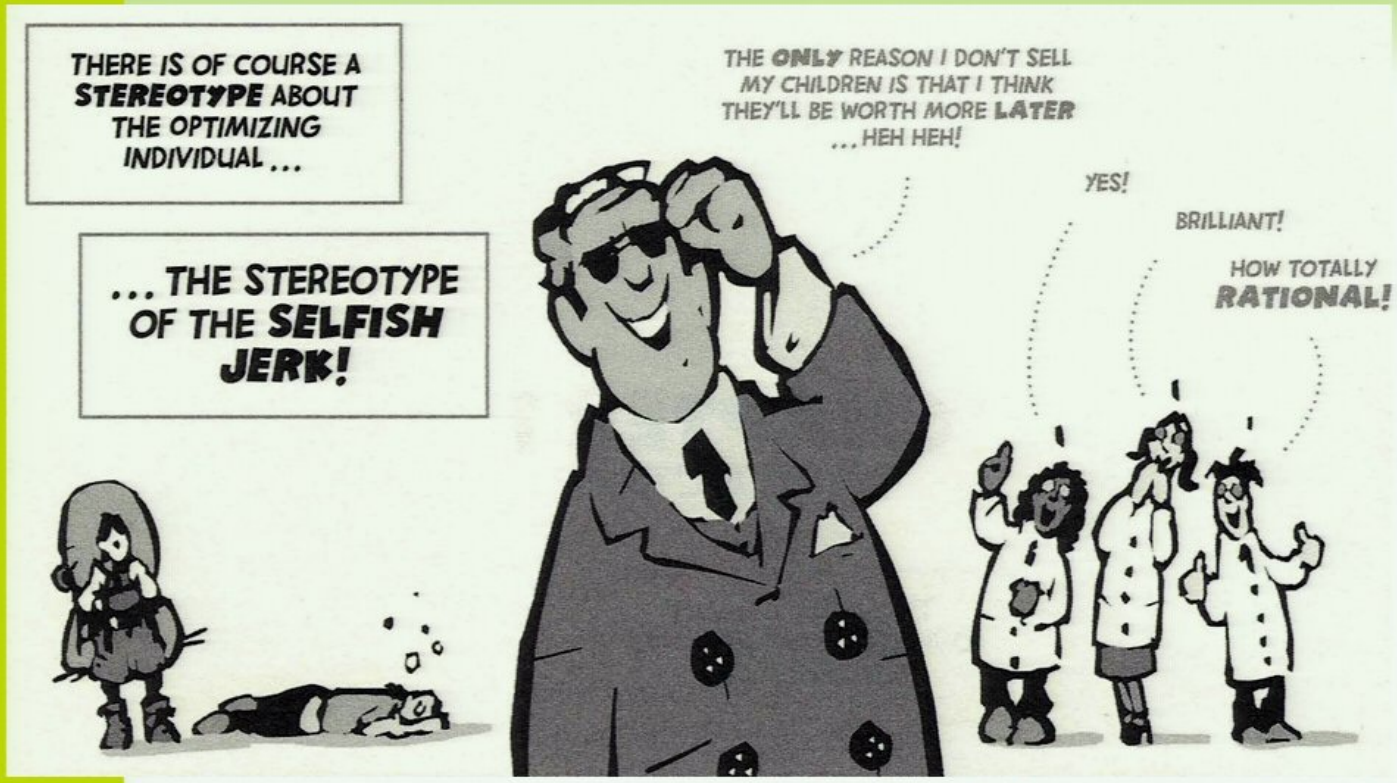
# A Defense of Rational Choice as a Meaningful Baseline in Natural Resource and Hazard Economics

**Craig E. Landry**
Department of Economics
*Institute for Coastal Science & Policy*
*Center for Natural Hazards Research*
*Center for Sustainable Tourism*
**East Carolina University**

# The Rational Economist


From: Klein & Bauman The Cartoon Introduction to Economics (2010)

# The Optimizing Individual




From: Klein & Bauman The Cartoon Introduction to Economics (2010)

# Role and Limitations of Rationality

- Behavioral models built upon individual "rational & systematic optimization" provide a normative framework for analyzing behavior
  - Predictions about behavior assuming people are well-informed and calculating
  - Testable hypotheses
  - Optimization framework can be modified to account for psychological & social factors, limited information, errors, etc.

# Outline

- **Anchors Aweigh: Field Experiments on Anchoring of Economic Valuations** (Alevy & List)
- **Changes in Implicit Flood Risk Premiums: Empirical Evidence from the Housing Market** (Bin)
- **Risk Attitudes, Risk Perception, and Flood Insurance** (Petrolia and Coble)

# Anchors Aweigh: Field Experiments on Anchoring of Economic Valuations

with Jonathan Alevy (University of Alaska)
and John A. List
(University of Chicago)

# Take the last three digits of your Social Security Number…

- Turn those numbers into a price in dollars
  - For example, 462 is $462

# Take the last three digits of your Social Security Number…

- Turn those numbers into a price in dollars
  - For example, 462 is $462
- Are you willing to pay this price for a first edition of JRR Tolkein's The Hobbit?
  - Yes or No

# Take the last three digits of your Social Security Number…

- Turn those numbers into a price in dollars
  - For example, 462 is $462
- Are you willing to pay this price for a first edition of JRR Tolkein's The Hobbit?
  - Yes or No
- Now tell me the maximum price you would pay for a first edition of The Hobbit.

# Results from Psychology Literature

- Judgment and choice can be manipulated by exposure to random information (anchors)
  - Answers to factual questions, estimates of probabilities, social judgments
  - Choice over lotteries, expressed values for commodities

# Results from Psychology Literature

- Judgment and choice can be manipulated by exposure to random information (anchors)
  - Answers to factual questions, estimates of probabilities, social judgments
  - Choice over lotteries, expressed values for commodities
- Implications for welfare economics: interpretation of market surpluses, efficiency of competitive market outcomes, allocation and rationing functions of market prices

# Non-market Valuation

- Anchoring effects in stated preference to value "public goods" (air quality, water quality, beach width, public parks, hazard mitigation)
  - Unfamiliar decision environments
  - Complexity of valuation exercise (ethical, spiritual dimensions)
  - Latent preferences – values related to non-use
- Such factors can lead to preference construction

# Valuation of Market Goods

- Familiar, non-complex transactions involving primarily use values
- Evidence of anchoring for consumer items in hypothetical choice setting
- Ariely, Lowenstein, and Prelec (*QJE*) find anchoring effects with salient (monetary) incentives
  - Laboratory experiment with student subjects; measure *Willingness to Pay* for common consumer goods
  - Once anchored, subsequent responses accord with demand theory - "Coherent Arbitrariness"

# Are consumer preferences well-defined and stable?

- Evidence that value elicitation leads to preference construction
  - Role of incentives, context, experience?
- How might anchoring effects manifest in real economic contexts?
- Likely influence on market outcomes?
- Importance for other aspects of economics?

# Anchoring Protocol in the Field

- Anchoring experiment at sportscard show
  - Natural setting: rich array of subjects with various roles & levels of experience, familiar environment; subjects have a demonstrable interest in trading sportscards and sports memorabilia.
- Vary the object of valuation – expected & unexpected

# Anchoring Protocol in the Field

- Anchoring experiment at sportscard show
  - Natural setting: rich array of subjects with
    vels of experience, familiar
    ɔjects have a demonstrable
    ; sportscards and sports
- valuation – expected &

# Anchoring Protocol in the Field

- Anchoring experiment at sportscard show
  - Natural setting: rich array of subjects with
    vels of experience, familiar
    ojec le
    ; S
- va &


# Anchoring Valuation Responses

- Subjects: Card show attendees & sportscard dealers
- Endow subjects with good (cards or peanuts)
- Expose subject to random anchor derived from SSN
  - Dichotomous choice: *Willing to Accept* random price?

# Anchoring Valuation Responses

- Subjects: Card show attendees & sportscard dealers
- Endow subjects with good (cards or peanuts)
- Expose subject to random anchor derived from SSN
  - Dichotomous choice: *Willing to Accept* random price?
- Elicit economic value of good (minimum *Willingness to Accept (WTA offer)*)
  - Open-ended format with Becker-Degroot-Marschak (BDM) mechanism

# Anchoring Valuation Responses

- Subjects: Card show attendees & sportscard dealers
- Endow subjects with good (cards or peanuts)
- Expose subject to random anchor derived from SSN
  - Dichotomous choice: *Willing to Accept* random price?
- Elicit economic value of good (minimum *Willingness to Accept (WTA offer)*)
  - Open-ended format with Becker-Degroot-Marschak (BDM) mechanism
- Coin-flip determined which response was executed

# Becker-DeGroot-Marschak

- Theoretically effective mechanism for measuring value
- *WTA Offer* determines whether subject keeps or sells the good, but not transacted price
  - Random draw determines price (in event of sale)
    - *RP* = random price
  - If *WTA offer* > *RP* subject keeps good
  - If WTA *offer* <*RP* subject receives payment of *RP*
- Not testing BDM: provided subjects with optimal strategy (bid true value)

| | Sportscards | Peanuts | Row Totals |
|---|---|---|---|
| **Attendees** | Treatment 1<br>n = 34 | Treatment 3<br>n = 75 | 109 |
| **Dealers** | Treatment 2<br>n = 32 | Treatment 4<br>n = 46 | 78 |
| **Column Totals** | 66 | 121 | 187 |

**Table 1:** Experimental Design and Sample Sizes

# Results

- Split sample by median SSN: test for differences in *WTA offer* using Wilcoxson-Mann-Whitney Non-parametric test:
  - *No evidence of anchoring, except for the least experienced group valuing the unexpected commodity (attendees & peanuts; p-value = 0.061)*
  - *A statistically significant anchoring effect is observed among those subjects with the least market experience (across both subject classes and commodities ; p-value = 0.001).*
- Using regression analysis, first result is not supported, and second result is supported.

# Anchoring Discussion

- Data support notion that newest market participants are affected by anchors
- Inexperienced traders appear to have more malleable preferences
  - Conceivable that they make mistakes; roles of learning & feedback

# Anchoring Discussion

- Data support notion that newest market participants are affected by anchors
- Inexperienced traders appear to have more malleable preferences
  - Conceivable that they make mistakes; roles of learning & feedback
- Additional experiments on the role of anchors in market equilibration – only transient effects found

# Anchoring Discussion

- Data support notion that newest market participants are affected by anchors
- Inexperienced traders appear to have more malleable preferences
  - Conceivable that they make mistakes; roles of learning & feedback
- Additional experiments on the role of anchors in market equilibration – only transient effects found
- Relevance of anchoring effects in valuing public goods?

# Challenge of Non-market Valuation

# Challenge of Non-market Valuation

- "familiarity, as conferred by previous choice experience, may be an important dimension influencing the convergent validity of contingent values" – Holmes and Kramer (1995)

# Challenge of Non-market Valuation

- "familiarity, as conferred by previous choice experience, may be an important dimension influencing the convergent validity of contingent values" – Holmes and Kramer (1995)
- "economic rationality is to some extent *learned* behavior, the result of experience in market transactions where the sting of monetary punishment conditions out irrational excursions. In CV studies of natural resources the linkage from response to implementation is often tenuous, and the pay-off is often remote in time and in the experience of the consumer." – Green, Jacowitz, Kahneman, and McFadden (1998)

# Outline

- **Anchors Aweigh: Field Experiments on Anchoring of Economic Valuations** (Alevy & List)
- **Changes in Implicit Flood Risk Premiums: Empirical Evidence from the Housing Market** (Bin)
- **Risk Attitudes, Risk Perception, and Flood Insurance** (Petrolia and Coble)

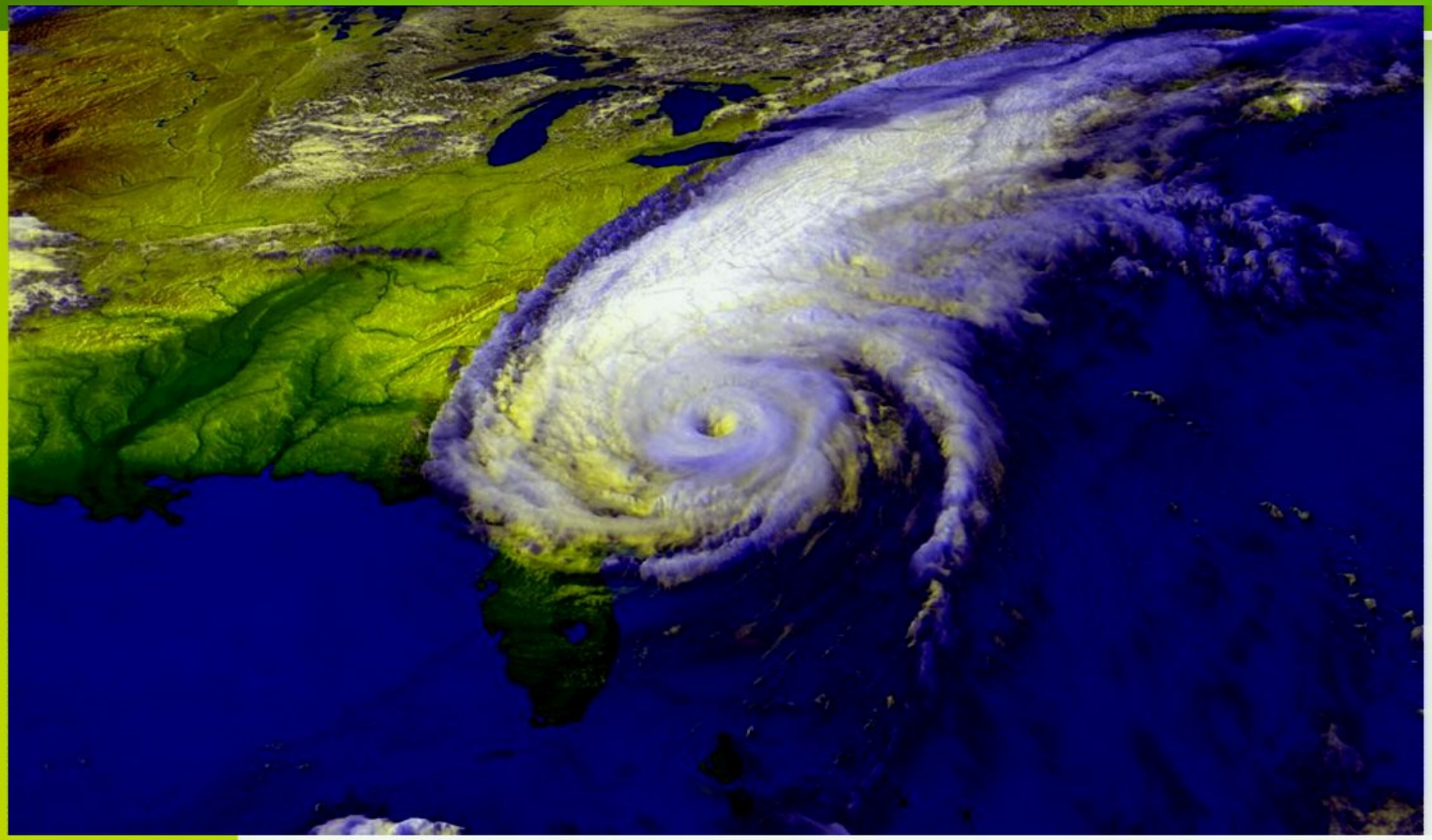
# Changes in Implicit Flood Risk Premiums: Empirical Evidence from the Housing Market

with Okmyung Bin (ECU)

# Property Value Models and Environmental Risk

- If buyers and sellers of housing perceive spatial, environmental risk factors, the implicit price of risk can be capitalized in housing values.
- In this paper, we focus on flood risk zones.
- Previous research has shown that implicit risk prices change with hazard events.
- We want to examine what happens with multiple hazard events (hurricanes) and over longer time periods.

# Hurricane & Flooding Risk: Eastern North Carolina – Floyd (1999)



# Hedonic Property Price Models

- Property prices reflect the value of property characteristics
- P = f(**S,N,E,R**)
  - **S** = structural
  - **N** = neighborhood
  - **E** = environmental
  - **R** = risk

- With adequate variability housing attributes, a property specified hedonic price model can produce estimates of *marginal implicit prices* (Smith 1985).

# Option Value for Risk Reduction

- Utility defined over *a* = housing attributes, *y* = income: *V(a,y)*
- Let bad state utility $V_1(a,y_1)$occur w/ prob. *p* and good state utility $V_0(a,y_0)$ occur w/ prob. (1-*p*), with
- Option Value is a measure of the value of risk reduction; standard definition uses framework of *Expected Utility*.
- Option Value (*OV*) is implicitly defined as:

$$V_0(a, y_0 - OV) = pV_1(a, y_1) + (1-p)V_0(a, y_0)$$

# Theory of Hedonic Property Prices, Hazards, and Insurance

- Conditional property loss is $L \in (0, \bar{S})$, with density *f*(*L*)
- Hedonic price schedule: $R(a, p(i))$ where $i$ is information
- Insurance premium: $I(p)$
- Expected utility for homebuyers (w/ full cover *C* = *L*):

$$EU = p(i)V_1(a, y - R(a, p(i)) - I(p)) + (1 - p(i))V_0(a, y - R(a, p(i)) - I(p))$$

# Theory of Hedonic Property Prices, Hazards, and Insurance

- Conditional property loss is $L \in (0, \bar{S})$, with density *f*(*L*)
- Hedonic price schedule: $R(a, p(i))$ where $i$ is information
- Insurance premium: $I(p)$
- Expected utility for homebuyers (w/ full cover *C* = *L*):

$$EU = p(i)V_1(a, y - R(a, p(i)) - I(p)) + (1 - p(i))V_0(a, y - R(a, p(i)) - I(p))$$

- In equilibrium (MacDonald, Murdoch, and White 1987):

$$\frac{\partial R}{\partial p} = \frac{V_1(a, \tilde{y}) - V_0(a, \tilde{y})}{[1 - p(i)]\partial V_0 / \partial y + [p(i)]\partial V_1 / \partial y} - \frac{\partial I(p)}{\partial p} = -\frac{dOV}{dp} - \frac{\partial I(p)}{\partial p} < 0$$

# Study Area: Pitt County, NC

- Since Hurricane Hazel in 1954, North Carolina had enjoyed a period of relative calm – low storm activity.
- Hurricane Fran (1996) resulted in millions of dollars in property damages.

# Study Area: Pitt County, NC

- Since Hurricane Hazel in 1954, North Carolina had enjoyed a period of relative calm – low storm activity.
- Hurricane Fran (1996) resulted in millions of dollars in property damages.
- Hurricane Floyd (1999) caused record flooding.
  - $346 million in property damages (~ 1% of housing units)
  - Acquisition/rehabilitation of limited number of homes
  - Local ordinance to elevate structures in the SFHA
  - Promotion of flood hazard and insurance awareness
  - Remapping of floodplain – more parcels in SFHA


Airport

# Data: Pitt County, North Carolina

- A total of 4,799 single-family residential properties sold between Sep 1992 and Aug 2002 are used for the ***difference-in-differences*** regression analysis.
  - Pre-Fran (1992-1996) (N=1406)
  - Between Fran and Floyd (1996-1999) (N=1632)
  - Post-Floyd (1999-2002) (N=1761)

  - Effect of Hurricane Fran on flood prone property: (B – A) – (E – D)
  - Effect of Hurricane Floyd on flood prone property: (C – A) – (F – D)

# Data: Pitt County, North Carolina

- A total of 4,799 single-family residential properties sold between Sep 1992 and Aug 2002 are used for the ***difference-in-differences*** regression analysis.
  - Pre-Fran (1992-1996) (N=1406)
  - Between Fran and Floyd (1996-1999) (N=1632)
  - Post-Floyd (1999-2002) (N=1761)

| | Pre-Fran | Fran-Floyd | Post-Floyd |
|---|---|---|---|
| Flood zone | A | B | C |
| Outside of flood zone | D | E | F |

  - Effect of Hurricane Fran on flood prone property: (B – A) – (E – D)
  - Effect of Hurricane Floyd on flood prone property: (C – A) – (F – D)

# Data: Pitt County, North Carolina

- A total of 4,799 single-family residential properties sold between Sep 1992 and Aug 2002 are used for the ***difference-in-differences*** regression analysis.
  - Pre-Fran (1992-1996) (N=1406)
  - Between Fran and Floyd (1996-1999) (N=1632)
  - Post-Floyd (1999-2002) (N=1761)

Treatment group

| | Pre-Fran | Fran-Floyd | Post-Floyd |
|---|---|---|---|
| Flood zone | A | B | C |
| Outside of flood zone | D | E | F |

  - Effect of Hurricane Fran on flood prone property: (B – A) – (E – D)
  - Effect of Hurricane Floyd on flood prone property: (C – A) – (F – D)

# Data: Pitt County, North Carolina

- A total of 4,799 single-family residential properties sold between Sep 1992 and Aug 2002 are used for the ***difference-in-differences*** regression analysis.
  - Pre-Fran (1992-1996) (N=1406)
  - Between Fran and Floyd (1996-1999) (N=1632)
  - Post-Floyd (1999-2002) (N=1761)

Treatment group

Control group

| | Pre-Fran | Fran-Floyd | Post-Floyd |
|---|---|---|---|
| Flood zone | A | B | C |
| Outside of flood zone | D | E | F |

  - Effect of Hurricane Fran on flood prone property: (B – A) – (E – D)
  - Effect of Hurricane Floyd on flood prone property: (C – A) – (F – D)

# Flood Risk Premium Results: 1992-2002

- No risk premium before Hurricane Fran
- Risk premium between Fran & Floyd:
  $\gamma_{Fran\text{-}Floyd} = -5.5\%$
- Risk premium after Floyd:
  $\gamma_{post\text{-}Floyd} = -8.4\%$
  - Damage to some structures, but no change in flood insurance costs
  - Acquisition & retro-fitting; new flood ordinance
  - Insurance promotion & remapping

# Flood Risk Premium Results: 2002-2008

- t = 1
  - $\gamma_{lin} = -0.06$
  - $\gamma_{ln} = -0.115$
  - $\gamma_{lag} = -0.202$

# Flood Risk Premium Results: 2002-2008

- t = 1
  - $\gamma_{lin} = -0.06$
  - $\gamma_{ln} = -0.115$
  - $\gamma_{lag} = -0.202$
- $\gamma \approx 0$
  - t = 21 for lag
  - t = 32 for linear and ln

# Flood Insurance in Pitt County, NC

| Year | Policies in Force | Coverage | Premium | Payouts |
|---|---|---|---|---|
| 1998 | 747 | $65,982,000 | $257,724 | $54,181 |
| **1999** | **1182** | **$120,000,000** | **$420,530** | **$26,000,000** |
| 2000 | 3239 | $260,200,000 | $970,683 | |
| 2001 | 3139 | $267,200,000 | $957,388 | $116 |
| 2002 | 1827 | $257,000,000 | $710,238 | $440 |
| 2003 | 1786 | $262,900,000 | $692,919 | $131,944 |
| 2004 | 1828 | $290,900,000 | $733,821 | $39,270 |
| 2005 | 1865 | $313,500,000 | $755,775 | $11,078 |
| 2006 | 1968 | $361,900,000 | $827,294 | $183,260 |
| 2007 | 1967 | $379,000,000 | $907,755 | |
| 2008 | 1956 | $380,700,000 | $935,542 | $675 |

# Flood Risk Discussion

- Overall pattern of findings:
  - No difference in property values in different flood risk zones after 40 years of relative calm
  - Price differentials arise in the wake of two major storms; implicit risk premiums increase with the number and damage level of storms
  - Once relative calm is restored the price differentials decay and disappear – **despite insurance requirements!**

# Flood Risk Discussion

- Overall pattern of findings:
  - No difference in property values in different flood risk zones after 40 years of relative calm
  - Price differentials arise in the wake of two major storms; implicit risk premiums increase with the number and damage level of storms
  - Once relative calm is restored the price differentials decay and disappear – **despite insurance requirements!**
- Risk perceptions influenced by the **availability heuristic**?
  - Judgments of probability are reflective of the availability of information or recall of specific events related to hazard.

# Flood Risk Discussion

- Overall pattern of findings:
  - No difference in property values in different flood risk zones after 40 years of relative calm
  - Price differentials arise in the wake of two major storms; implicit risk premiums increase with the number and damage level of storms
  - Once relative calm is restored the price differentials decay and disappear – **despite insurance requirements!**
- Risk perceptions influenced by the **availability heuristic**?
  - Judgments of probability are reflective of the availability of information or recall of specific events related to hazard.
- Potential role of migration; results suggest ignorance of flood risk and insurance when bidding on housing

# Outline

- **Anchors Aweigh: Field Experiments on Anchoring of Economic Valuations** (Alevy & List)
- **Changes in Implicit Flood Risk Premiums: Empirical Evidence from the Housing Market** (Bin)
- **Risk Attitudes, Risk Perception, and Flood Insurance** (Petrolia and Coble)

# Risk Attitudes, Risk Perception, and Flood Insurance

## with Dan Petrolia and Keith Coble (Mississippi State)

# Flood Hazard in the U.S.

- Floods are one of the most common and widespread of natural hazards in the U.S.

# Flood Hazard in the U.S.

- Floods are one of the most common and widespread of natural hazards in the U.S.
- National Flood Insurance Program (NFIP)
  - Require floodplain management regulations
  - Require flood insurance for mortgaged residential properties in the SFHA (100-year flood zone)
    - Lax enforcement in the 1990s (Dixon et al. 2006; Landry and Jahan-Parvar (2011)) – low individual participation
    - U.S. Dept. HUD guidelines (2009) stipulate that lenders bear responsibility for enforcing this measure

# Flood Hazard in the U.S.

- Floods are one of the most common and widespread of natural hazards in the U.S.
- National Flood Insurance Program (NFIP)
  - Require floodplain management regulations
  - Require flood insurance for mortgaged residential properties in the SFHA (100-year flood zone)
    - Lax enforcement in the 1990s (Dixon et al. 2006; Landry and Jahan-Parvar (2011)) – low individual participation
    - U.S. Dept. HUD guidelines (2009) stipulate that lenders bear responsibility for enforcing this measure
  - **Why is participation low?** Risk perception, risk experience, information, risk attitude, charity hazard, wealth

# Gulf Coast Survey

- Combine information on flood insurance with experimentally derived **risk attitude data** and **subjective risk perception data**
  - Risk preferences elicited over loss and gain domains using real monetary incentives
  - Risk perceptions of storm frequency, conditional loss, expectations of disaster assistance, reliability of insurance providers
- Utilize a unique sample of *Knowledge Networks* panelists living in coastal counties in Alabama, Florida, Louisiana, Mississippi, and Texas

# Theoretical Framework

- Subjective expectation of utility for individual *i* is:

$$EU_i^j = U(\tilde{p}, \tilde{L}, \lambda, H, w, \pi(p); \alpha, m)$$

  - where *j* = *P*, *NP* (the purchase and non-purchase of flood insurance, respectively)

$\tilde{p}$

$\tilde{L}$

# Theoretical Framework

- Subjective expectation of utility for individual *i* is:

$$EU_i^j = U(\tilde{p}, \tilde{L}, \lambda, H, w, \pi(p); \alpha, m)$$

  - where *j* = *P*, *NP* (the purchase and non-purchase of flood insurance, respectively)
  - $\tilde{p}$ is the subjective perception of the likelihood of flooding due to coastal storm
  - $\tilde{L}$ is the expected loss in the event of a flood

# Theoretical Framework

- Subjective expectation of utility for individual *i* is:

$$EU_i^j = U(\tilde{p}, \tilde{L}, \lambda, H, w, \pi(p); \alpha, m)$$

  - where *j* = *P*, *NP* (the purchase and non-purchase of flood insurance, respectively)
  - $\tilde{p}$ is the subjective perception of the likelihood of flooding due to coastal storm
  - $\tilde{L}$ is the expected loss in the event of a flood
  - $\lambda$ is the perceived likelihood of insurance payoff
  - *H* is the expected disaster assistance

# Theoretical Framework

- Subjective expectation of utility for individual *i* is:

$$EU_i^j = U(\tilde{p}, \tilde{L}, \lambda, H, w, \pi(p); \alpha, m)$$

  - where *j* = *P*, *NP* (the purchase and non-purchase of flood insurance, respectively)
  - $\tilde{p}$ is the subjective perception of the likelihood of flooding due to coastal storm
  - $\tilde{L}$ is the expected loss in the event of a flood
  - $\lambda$ is the perceived likelihood of insurance payoff
  - *H* is the expected disaster assistance
  - *w* is household wealth level
  - $\pi(p)$ is the price of insurance, which depends upon observable objective risk factors, *p*
  - $\alpha$ indexes level of risk aversion, and *m* is a binary indicator for whether flood insurance has been deemed "mandatory" for individual *i*.

# Survey Design
# Risk Perceptions

- Based on your experience, **how many Category 3 hurricanes** (with winds of 111-130 mph) **do you expect to directly strike your community** *over the next 50 years*?
- **Suppose a Category 3 hurricane** (wind speeds of 111-130 mph) **did directly strike your community**. **How much damage** (expressed as a percentage of total structure value) **do you think your home would most likely suffer**?

# Survey Design
# Payoff Expectations

- On a scale from 1 (no confidence) to 5 (full confidence), **how much confidence do you have that insurance companies will actually pay the full amount of storm damage claims** made by residents in your community if a major storm occurs?
- **If a major storm struck your community and the federal government set up a program to provide disaster payments <u>for home damage</u>, how likely do you think that you would be eligible**? (Indicate how likely, with 1 being very <u>un</u>likely and 5 being very likely.)

# Survey Design
# Risk Preferences – Loss Domain

| Choice | A – "Safe" | Mean(A) | s.d.(A) | B – "Risky" | Mean(B) | s.d.(B) |
|---|---|---|---|---|---|---|
| 1. Loss | 10% $5<br>90% $4 | $4.10 | $0.30 | 10% $9.50<br>90% $0.50 | $1.40 | $2.70 |
| 2. Loss | 30% $5<br>70% $4 | $4.30 | $0.46 | 30% $9.50<br>70% $0.50 | $3.20 | $4.12 |
| 3. Loss | 50% $5<br>50% $4 | $4.50 | $0.50 | 50% $9.50<br>50% $0.50 | $5.00 | $4.50 |
| 4. Loss | 70% $5<br>30% $4 | $4.70 | $0.46 | 70% $9.50<br>30% $0.50 | $6.80 | $4.12 |
| 5. Loss | 90% $5<br>10% $4 | $4.90 | $0.30 | 90% $9.50<br>10% $0.50 | $8.60 | $2.70 |

[same structure for gain domain]

# Survey Administration

- 96 coastal counties in AL, FL, MS, LA, and TX
- *Knowledge Networks* - Knowledge Panel®
  - 18 years or older and homeowners.
  - Probability-based sample for online research panel that is representative of U.S. population
  - Households provided internet access and hardware if necessary.
- Knowledge Networks identified 1,536 panelists meeting our criteria; of these, 1,070 agreed to participate.
- With item non-response & bad addresses, we have 805 observations for analysis

# Survey Respondents

# Flood Insurance

Table 4. Proportion of flood policyholders by state and SFHA status

| | *SFHA* | | *Non-SFHA* | | *Total* | |
|---|---|---|---|---|---|---|
| | **Obs.** | **Proportion with Policies** | **Obs.** | **Proportion with Policies** | **Obs.** | **Proportion with Policies** |
| Alabama/ Mississippi | 2 | 0.50 | 30 | 0.27 | 32 | 0.28 |
| Florida | 78 | 0.74 | 417 | 0.20 | 495 | 0.28 |
| Louisiana | 23 | 0.78 | 73 | 0.37 | 96 | 0.47 |
| Texas | 19 | 0.95 | 163 | 0.46 | 182 | 0.51 |
| **Total** | **122** | **0.78** | **683** | **0.28** | **805** | **0.36** |

# DATA

**Table 5. Variable descriptions and summary statistics (805 observations)**

| Variable | Type | Description | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| Policy (dep. var.) | binary | = 1 if holds flood insurance policy; = 0 otherwise | 0.36 | 0.02 | 0 | 1 |
| Future storms | count | expected number of future Cat 3 or greater storms over next 50 years | 6.86 | 10.39 | 0 | 90 |
| Future damage | proportion | Expected damage to home given Cat 3 storm; ranges from 0 (no damage) to 100 (total loss) | 33.8 | 22.5 | 0 | 100 |
| Risk averse (Gain) | continuous | Number of instances where low-variance risk was chosen over *gain domain*; ranges from 0 (risk loving) to 5 (risk averse) | 2.96 | 1.43 | 0 | 5 |
| Risk averse (Loss) | continuous | Number of instances where low-variance risk was chosen over *loss domain*; ranges from 0 (risk loving) to 5 (risk averse) | 2.93 | 1.36 | 0 | 5 |
| Disaster Assistance | binary | = 1 if perceived likelihood of eligibility for post-disaster payments is ≥ 3 on 1 – 5 scale | 0.58 | 0.02 | 0 | 1 |
| Insurer Credibility | binary | = 1 if confidence level that insurance co. will pay full amount of claims in event of major storm is ≥ 3 on 1 – 5 scale | 0.67 | 0.02 | 0 | 1 |

# DATA (CONT.)

| Table 5 continued. | Type | Description | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| No. flood events | count | number of flood events experienced in past | 0.09 | 0.47 | 0 | 7 |
| Coastal tenure | count | number of decades living on the Gulf or FL Atlantic coast | 2.86 | 1.86 | 0 | 8 |
| Distance | continuous | distance (kilometers) from nearest shoreline | 16.34 | 18.25 | 0 | 172 |
| Mortgage | binary | = 1 if home is mortgaged, = 0 otherwise | 0.64 | 0.48 | 0 | 1 |
| SFHA | binary | = 1 if A or V zone; = 0 otherwise | 0.15 | 0.36 | 0 | 1 |
| Mortgage x SFHA | binary | = 1 if home is mortgaged AND in A or V zone; = 0 otherwise | 0.09 | 0.29 | 0 | 1 |
| Pre-FIRM | binary | = 1 if pre-FIRM; = 0 otherwise | 0.42 | 0.49 | 0 | 1 |
| Income | ordered cat. | income categories; 19 levels from "less than $5000", in $2500 increments, up to "$175,000 or more" | 12.18 | 3.93 | 1 | 19 |
| Other property | binary | = 1 if owns other non-coastal property in excess of $100K, = 0 otherwise | 0.06 | 0.25 | 0 | 1 |

# Probit Regression Findings
## SFHA & Mortgage

- **SFHA** - largest impact on probability of holding flood insurance, particularly strong for mortgaged houses
  - Average **non-mortgaged household in the SFHA** is 25.4 percent more likely to hold flood insurance.
  - **Mortgaged households in the SFHA** are 71.5 percent more likely to hold flood insurance.
  - 76 percent of mortgaged properties in SFHA are covered by flood insurance in our dataset.

# Probit Regression Findings
## Perceptions & Expectations

- **Expected Storms:** not significant; **Expected Damages:** 1.4 percent increase in probability of holding flood insurance for a one percent increase in expected damages (as a proportion of structure value)

# Probit Regression Findings
## Perceptions & Expectations

- **Expected Storms:** not significant; **Expected Damages:** 1.4 percent increase in probability of holding flood insurance for a one percent increase in expected damages (as a proportion of structure value)
- **Flood Experience:** Increase of one past flooding event increases the probability of holding flood insurance by 11.6 percent.

# Probit Regression Findings
## Perceptions & Expectations

- **Expected Storms:** not significant; **Expected Damages:** 1.4 percent increase in probability of holding flood insurance for a one percent increase in expected damages (as a proportion of structure value)
- **Flood Experience:** Increase of one past flooding event increases the probability of holding flood insurance by 11.6 percent.
- **Insurer Credibility:** having at least some confidence in insurers' willingness and ability to pay claims has a positive and statistically significant effect on flood insurance demand, with a marginal effect of 7.1 percent.

# Probit Regression Findings
## Perceptions & Expectations

- **Expected Storms:** not significant; **Expected Damages:** 1.4 percent increase in probability of holding flood insurance for a one percent increase in expected damages (as a proportion of structure value)
- **Flood Experience:** Increase of one past flooding event increases the probability of holding flood insurance by 11.6 percent.
- **Insurer Credibility:** having at least some confidence in insurers' willingness and ability to pay claims has a positive and statistically significant effect on flood insurance demand, with a marginal effect of 7.1 percent.
- **Disaster Assistance:** Respondents who perceive eligibility for disaster assistance to be at least somewhat likely were also ***more likely*** to choose to purchase a flood policy, with a marginal effect of 7.3 percent.

# Findings
## Risk Preference

- **Risk aversion** has a positive impact on flood insurance demand, but the effect is only significant for the **loss domain**.
  - Those that choose an additional low-risk lottery over the loss domain in the Holt-Laury instrument are 2.8 percent more likely to hold flood insurance.
  - Choice of **low-risk lotteries** defined over the **gain domain** was not statistically significant.

# Flood Insurance Discussion

- Mortgage requirements in the SFHA
- Risk perceptions (damage), flood experience, and insurer credibility

# Flood Insurance Discussion

- Mortgage requirements in the SFHA
- Risk perceptions (damage), flood experience, and insurer credibility
- *Charity Hazard* - more complicated than anticipated!
  - Examination with survey data requires careful consideration of potential bias in responses

# Flood Insurance Discussion

- Mortgage requirements in the SFHA
- Risk perceptions (damage), flood experience, and insurer credibility
- *Charity Hazard* - more complicated than anticipated!
  - Examination with survey data requires careful consideration of potential bias in responses
- Convergent validity for the Holt-Laury instrument and role of risk attitudes in flood insurance
  - Risk preference measures in both gain & loss domain

# Conclusions

- "Rational" choice models – systematic analysis of individual optimizing behavior: people doing the best they can given their perceived objective and constraints
- Conceptualizing and analyzing choice as "quasi-rational" can provide insight into behavior, choice, and values
- Experimental, Natural Resources, and Hazards Economics are examples of areas where this kind of work is happening.

# Thank you.
# Ideas/Questions/Complaints:
# landryc@ecu.edu