

FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

Presented by the FIG Working Week 2019,
April 22-26, 2019 in Hanoi, Vietnam

"Geospatial Information for a Smarter Life
and Environmental Resilience"



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Dynamics of Urban Utility and Urban Change: A Flood Case of New Orleans

April 23, 2018

4:00 pm

Munsung Koh, Land Surveyor / Planner

LX Korea Land and Geospatial InformatiX Corporation

Republic of Korea

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Contents

- 01_ Key findings
- 02_ Introduction
- 03_ Background
- 04_ Definition
- 05_ Models
- 06_ Results
- 07_ Simulation
- 08_ Findings
- 09_ Conclusion

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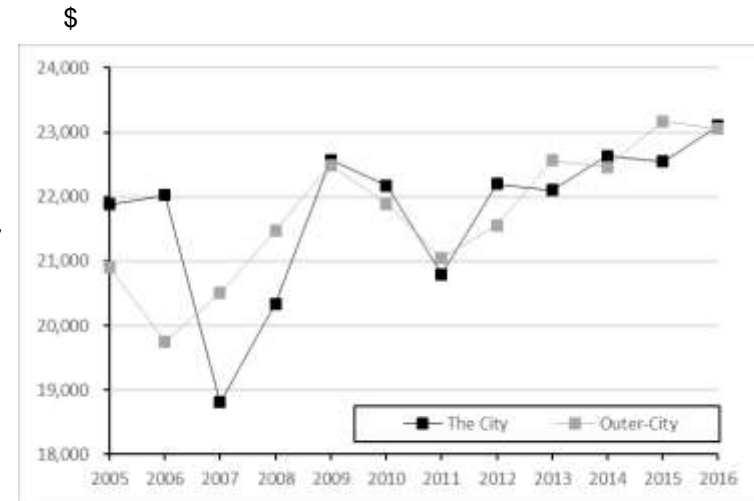
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New Orleans became a less livable city since the 2005 flood

- New Orleans shows smaller urban utility growth in Louisiana State
 - IUC (6%) v. IUS (10%) between 2005 and 2016
- Rent growth is the greatest among the components of housing costs in the state
 - Rent growth is twice higher in New Orleans
 - On the other hand, owner cost was stabilized by 'soft-second mortgage loan' in 2011
- This study negates the old belief "disaster helps city development"



Average Utility Change in the City and the outer-City between 2005 and 2016

This study identifies the relationship between flood and quality of life

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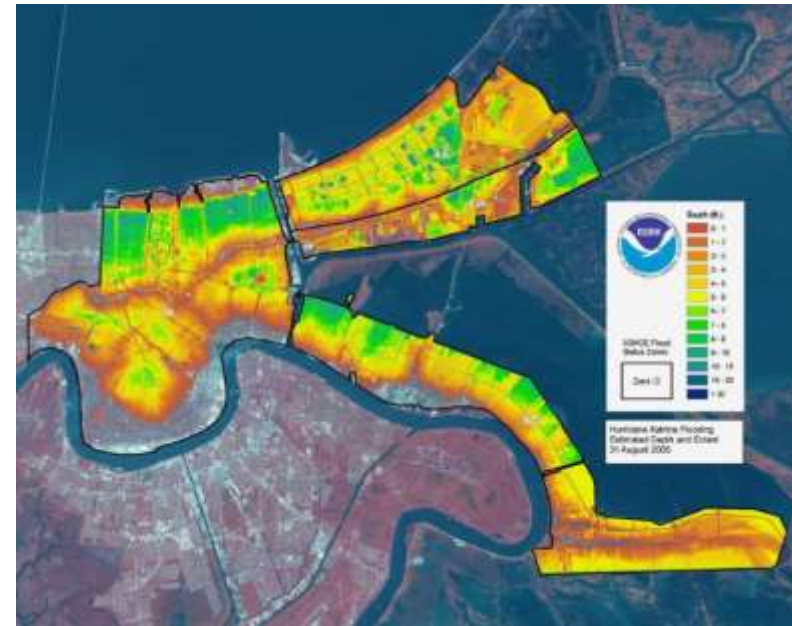


Hurricane Katrina and the subsequent flood

- Made a landfall August 29, 2005
 - Category 3 intensity
 - 80% of New Orleans flooded (Louisiana Geographic Information Center, 2005)

Flood damage

- Displacement of 400,000 (FEMA, 2005)
 - 200,000 from New Orleans
- Economic loss of \$62b (Park et. al., 2008)
 - Loss of 70,000 jobs (Vigdor, 2008)
- Actual funds spent of \$69b (Fessler, 2007)
 - Enacted funds of \$114.6b
- Declined quality of life
 - Significant increase in median rent by 48%



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Urban utility affects a city size

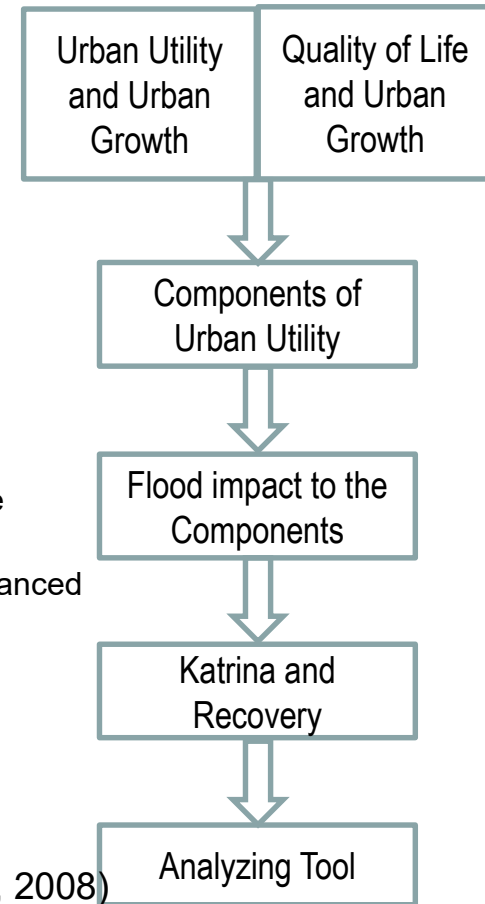
- People move to the areas which provides higher urban utility
 - Maximizing urban utility is a normal consumer behavior in a free market (Abdel-Rahman, 2003)

Components of urban utility

- Determined by earnings, housing costs and commuting cost
 - Locational decisions will maximize expected lifetime earnings subtracting lifetime commuting cost (Glaeser, 1999)
 - People select locations where the marginal savings in housing costs, exactly balanced the increase in commuting cost (Muth, 1969)

Flood affects the components

- Flood increases rent cost
 - In New Orleans, monthly median rent cost increased by 48% (Vigdor, 2008)



Roadmap of literature review

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Urban Utility and Study Area

- Urban Utility measured with benefits, subtracting housing and commuting costs (Glaeser et al, 1999)
- Benefit function: $f_B(B | \text{Earnings})$
 - The wage and salary income of workers over 16 years or more who live in the selected area* regardless of their full-time status
 - Study areas: New Orleans and Louisiana State
- Cost function: $f_C(C | \text{Rent, Owner Costs, Commuting Cost})$
 - Commuting cost is measured by value of time between home and workplace
- Study areas: New Orleans & Louisiana State
 - In population, New Orleans is 390,000 (8%) of the State's
 - In area, New Orleans is 1% of the State's (2016)



Maps of United States (up) and Louisiana State (down)
Created by Munsung Koh, ArcMap, 2018

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Regression models* for IUS

$$Y_t = I + \beta_1(X_t - X_{2001}^*)D^{2001} + \beta_2D^{2005} + \beta_3(X_t - X_{2005}^*)D^{2005'} + \beta_4(X_t - X_{2009}^*)D^{2009} + \beta_5(X_t - X_{2011}^*)D^{2011}$$

Where

Y_t = annual urban utility (dependent variable);

I = intercept

D^{2001} = **Early 2000s economic recession recovery** dummy to execute (1) if year is greater or equal to 2001

D^{2005} = **The occurrence of Katrina** dummy to execute (1) if year is greater or equal to 2005

$D^{2005'}$ = **Post-Katrina activities** dummy to execute (1) if year is greater or equal to 2005

D^{2009} = **Sub-prime mortgage** economic recession dummy to execute (1) if year is greater or equal to 2009

D^{2011} = **The economic recovery** dummy to execute (1) if year is greater or equal to 2011

X_{2001}^* = time variable (1) of 2001

X_{2005}^* = time variable (5) of 2005

X_{2009}^* = time variable (9) of 2009

X_{2011}^* = time variable (11) of 2011

β = coefficient of dummy

X_t = time variable of current year (e.g. return 2 if year is 2002)

* *pseudo-panel data analysis*

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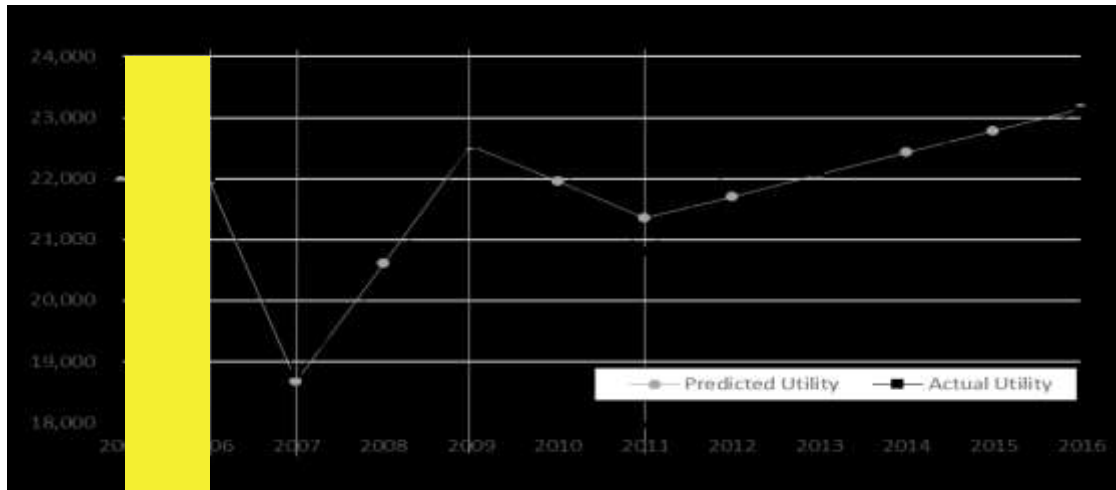
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Flooding declined Utility with 1-year delay

- Results of average utility (IUC)
 - adjusted R squares (92.2%) and all independent variables < 0.05
- Urban flooding declines urban utility between D1 and D2
- The recovery activities increase urban utility after D2
- IUC shows a year delay in the effects of flood and recovery



Note: D1 (Hurricane Katrina), D2 (Katrina Recovery), D3 (Subprime Mortgage Economic Crisis), and D4 (Economic Crisis Recovery)

Average Utility in New Orleans between 2005 and 2016

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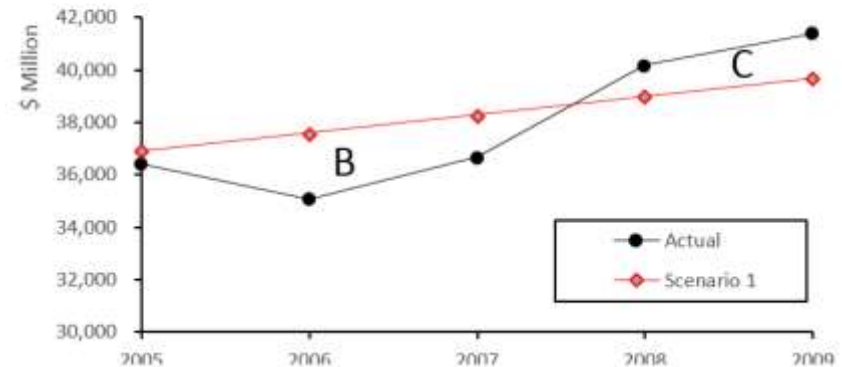
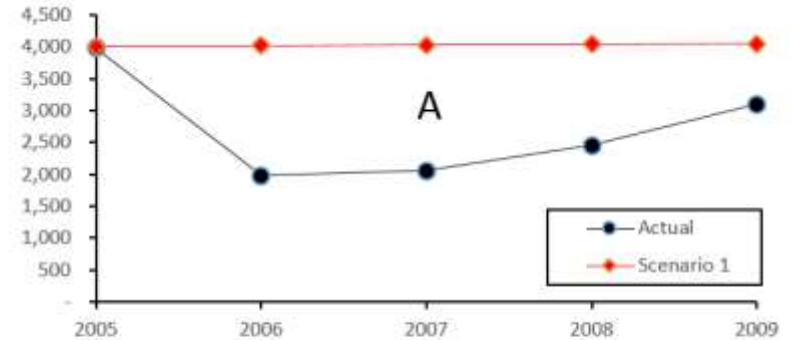
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A spillover effect in the outer-City

- Based on regression model, the simulations allow to control specific events, such as flood and recovery
 - Scenario 2: if there is no flood
- New Orleans never received any utility gain
- The outer-City shows a utility gain since 2008
 - The outer-City experienced only 30% more flood effect, but received 400% more recovery effect than the City



Loss of Aggregate Utility (\$ million) due to Katrina in New Orleans (above) and the outer-City (below) between 2005 and 2009

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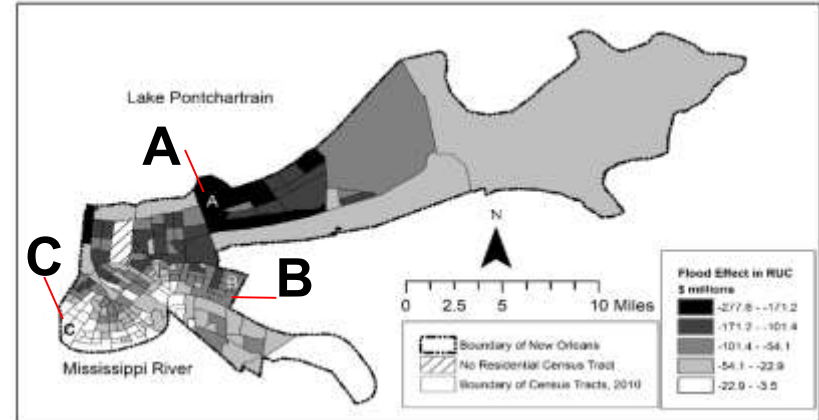
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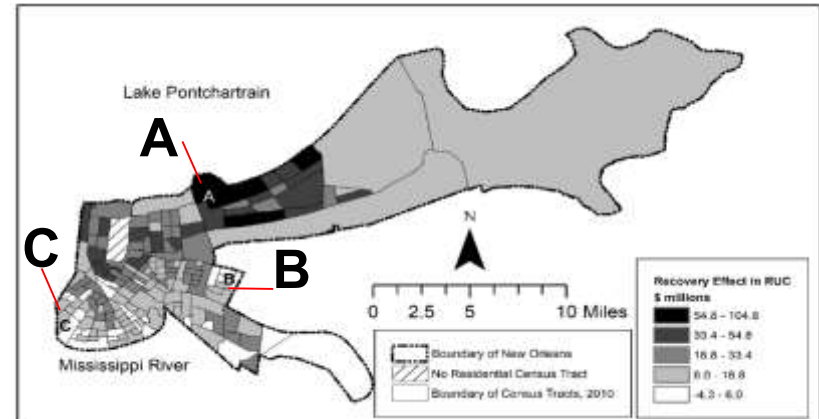


Unbalanced recovery effects

- Mostly, higher recovery effect follows higher flood effect
- Some areas received unbalanced recovery effects
 - B received relatively smaller recovery effect
 - C received relatively higher recovery effect



Flood Effect (\$m) by Census Tract in the City (2006 and 2009)



Recovery Effect (\$m) by Census Tract in the City (2006 and 2009)

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Urban flooding dynamically changes urban utility

- Urban flooding decreases urban utility
- The recovery activities increases urban utility
- New Orleans became a less livable city due to less utility increase than the outer-City

Significance of urban utility concept in urban development

- Flood management positively affects quality of life, which determines urban growth
- Spatial analyses in urban utility enable balanced urban development

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