



# Promoting Resilience to Terrorism

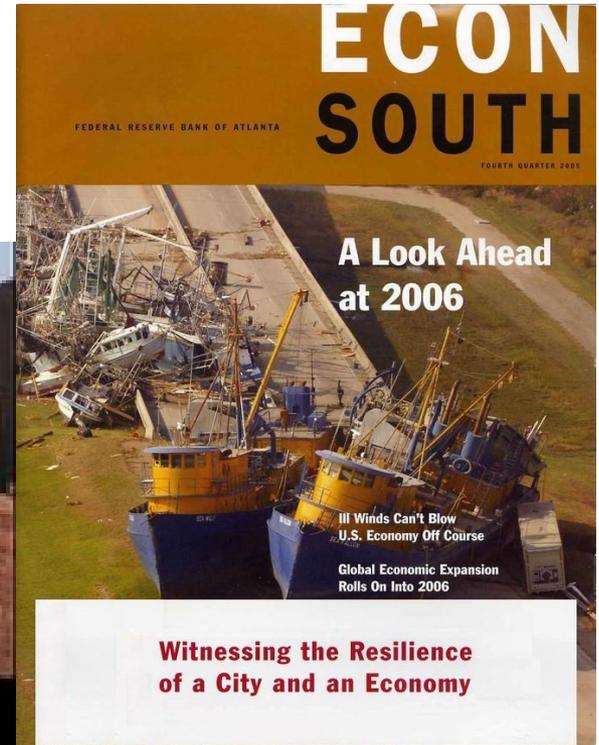
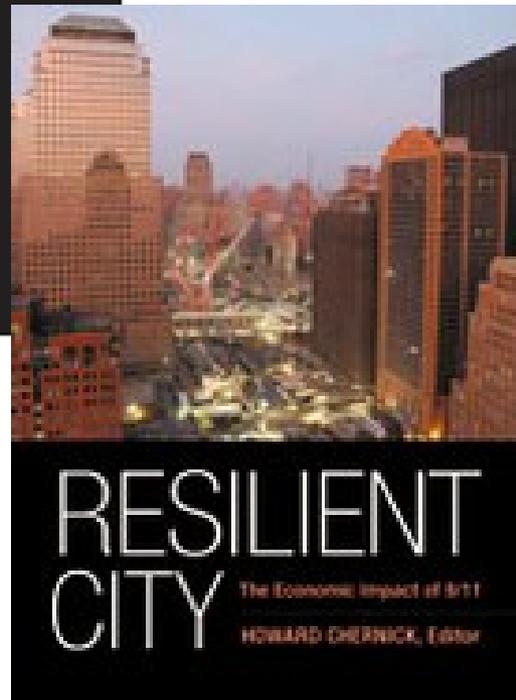
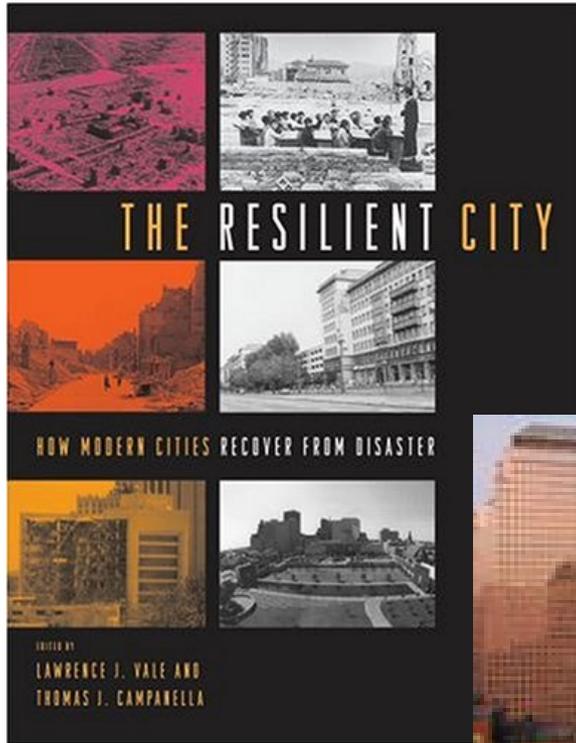
by

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# Key Questions

- Is resilience a meaningful concept?
- Is resilience multi-dimensional?
- Can resilience be rigorously defined?
- Can resilience be empirically measured?
- How effective has resilience been to date?
- Can resilience be enhanced or depleted?

# Economic Resilience

## General Definition:

- *static*: ability of a system to maintain function when shocked
- *dynamic*: speed of a system to recover from shock

## Types of Resilience:

- *inherent*: normal ability during crises to maintain function (input/import substitution, market reallocation)
- *adaptive*: ingenuity during crises (increased substitution possibilities, market strengthening)

# Reducing Losses

Three ways to reduce losses from terrorism:

1. Stop the terrorists before they strike
2. Protect the targets they plan to attack
3. **Minimize the consequences of an attack**
  - **recover efficiently**
  - **recover quickly**

# Motivation for Resilience

- Individual and business survival
- Need/profit—New “business continuity” industry
- Acknowledgement of interdependence:  

“Companies have started to realize that they participate in a greater ecosystem, and that their IT systems are only as resilient as the firms they rely on to stay in business.”—IBM Executive

# Examples of Resilience

- Individual Business (and Household)
  - conservation of critical inputs
  - use of inventories
  - business relocation
- Market
  - efficient allocation of resources via price signals
  - non-interruptible service premia
- Regional Economy
  - importing scarce commodities
  - information clearinghouses



## 3 cities agree to mutual-aid pact

LOUISVILLE — Louisville, Cincinnati and Indianapolis city officials have agreed to offer one another emergency resources in case of natural disasters, terrorist attacks or other catastrophic events.

# Pa. asks firms to look west

*State pitches 'Wall Street West' as alternative in case of attack on N.Y.*

By Michael Rubinkam  
The Associated Press

ALLENTOWN — Pennsylvania is trying to convince the nation's top financial services companies to establish backup operations in the state so that markets can recover quickly in the event of another terror strike on New York.

Gov. Ed Rendell has pledged more than \$30 million to "Wall Street West," an initiative to build millions of square feet of office space, improve infrastructure and install hundreds of miles of fiber-optic cable in as many as nine Pennsylvania counties.

Executives from more than

20 leading Wall Street firms are scheduled to take a 30-minute helicopter ride from Manhattan to the Pocono Mountains on Tuesday to listen to the state's sales pitch, and there are indications that at least one company is about to pull the trigger.

"I think we're so close today that maybe the trigger is already pulled and the first shot is being fired," said state Rep. John Siptroth, D-Monroe, a prime backer of the Wall Street West concept.

After the attacks of Sept. 11, 2001, the federal government recommended that financial services companies establish



AP photo/Penn Regional Business Center

**This artist's rendering shows the plans for the first of the "Wall Street West" projects, a center in Monroe County.**

backup sites and devise "business continuity" plans to safeguard their operations against terrorists — with the goal of

being able to resume the processing of financial transactions as early as two hours after an attack.

Boosters say northeastern Pennsylvania, some 80 miles west of New York, can help companies meet that goal. The region is far enough away that it would not be affected by an attack, but close enough to allow for real-time transmission of data over fiber-optic lines — a critical requirement of the financial sector.

The nine counties involved in the Wall Street West program were chosen because they could potentially be reached by 125 miles of fiber, the distance at which data transmission becomes less than instantaneous. The counties are Lehigh, Northampton, Berks, Monroe, Carbon, Pike, Wayne, Luzerne and Lackawanna.

The region also is served by a different power grid

See Wall Street, Page B6

## Office space planned for 'Wall Street West'

# Mathematical Definition: Direct Economic Resilience

$$DER = \frac{\% \Delta DY^m - \% \Delta DY}{\% \Delta DY^m}$$

where

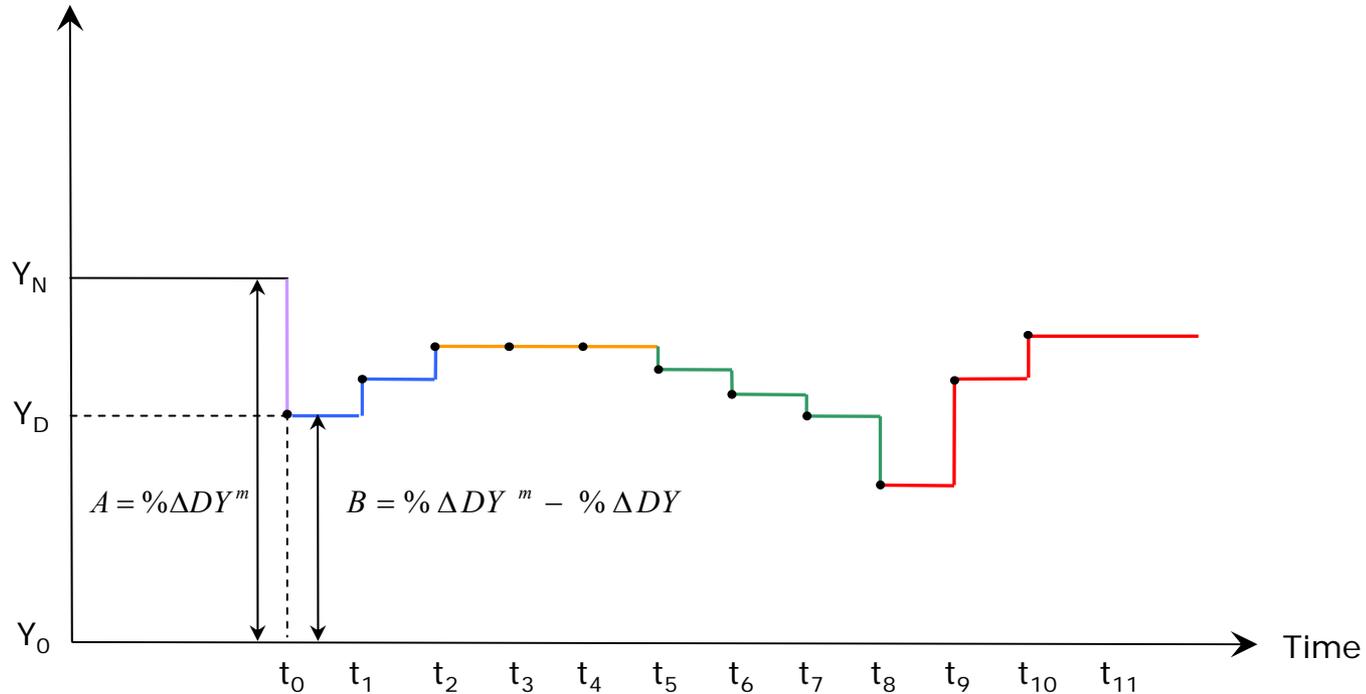
$\% \Delta DY^m$  is the maximum percent change in direct output

$\% \Delta DY$  is the estimated percent change in direct output

In essence, *DER* is the % avoidance of a maximum disruption to a given shock

# Static & Dynamic Resilience

Regional  
Economic  
Output



- Initial drop in customer output due to electricity outage
- Productivity improvements by customers
- Upper limit of customer resilience
- Erosion of customer resilience
- Repair & reconstruction of electricity system

# Features of the Definition

- Focus on flows after the initial shock
- Dynamics of recovery has 2 aspects:
  - rebuilding of the capital stock
  - restoring loss of function

# Overall Effectiveness

- Northridge Earthquake – Electricity: 77-95%
- Portland Earthquake – Water: 89%
- LA Terrorist Attack – Electricity: 86%

# Individual Resilience Options

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Resilience Factor	Water	Electricity
Conservation	1.0	6.1
Adaptive Substitution	1.6	3.9
Inventories/Storage	3.0	—
Alternative Sources	—	28.1
Importance	58.7	28.7
Production Rescheduling	75.5	79.4
Total	91.0	89.6

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# Changing Resilience

- Enhancement
  - investment
  - information dissemination
  - planning & drills
- Erosion with size & duration of disaster
  - difficulty in sustaining resilience
  - interdependent infrastructure
  - finite capabilities

# Future Directions

- Conceptual -- incorporate resilience into various models
  - I-O (input & input substitution, relocation, rescheduling)
  - Econometric (cull out inherent; add adaptive)
- Conceptual -- analyze resilience of households
  - HH production function
  - market & non-market (waiting time, inconvenience)
- Empirical -- estimate cost-effectiveness
  - historical experience & simulation
  - functions rather than factors (adjust severity & duration)

# Integrated Network of Centers Project on Econ & Community

- Smith/ Mansfield (CREATE): private-public complementarities in resilience & mitigation
- Epstein (PACER): behavioral epidemiology
- Mohtadi/ Kinsey (NCFPD): supply-chain
- McCarl (FAZD): animal populations & their mgt
- Greenbaum (START): relocation
- Norris et al. (START): community resilience
- Gordon et al. (CREATE): interregional resilience
- Rose (CREATE): modeling framework

# Conclusion

- Resilience is a worthy *second line of defense*
  - it is effective
  - it is low cost
  - it is self-motivated
- Resilience is yet another way we can *all* contribute to reducing the threat of terrorism