

Resilience Bonds

A Conditional Payment Approach to
Financing Resilient Water Projects

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Resilience: a Necessity

Washington Post, November 30, 2018:

“How They Survived: owners of the few homes left standing around Paradise, Calif., took crucial steps to ward off wildfires”

- Cleared debris from roof
- Separated firewood storage
- Nonwooden fences
- Plant fire-resistant trees (aspen, oak, maple) near homes
- Used generator to pump water onto roof

Result: Cathy and Jeff Moore saved not only their own home, but also their immediate neighbors’

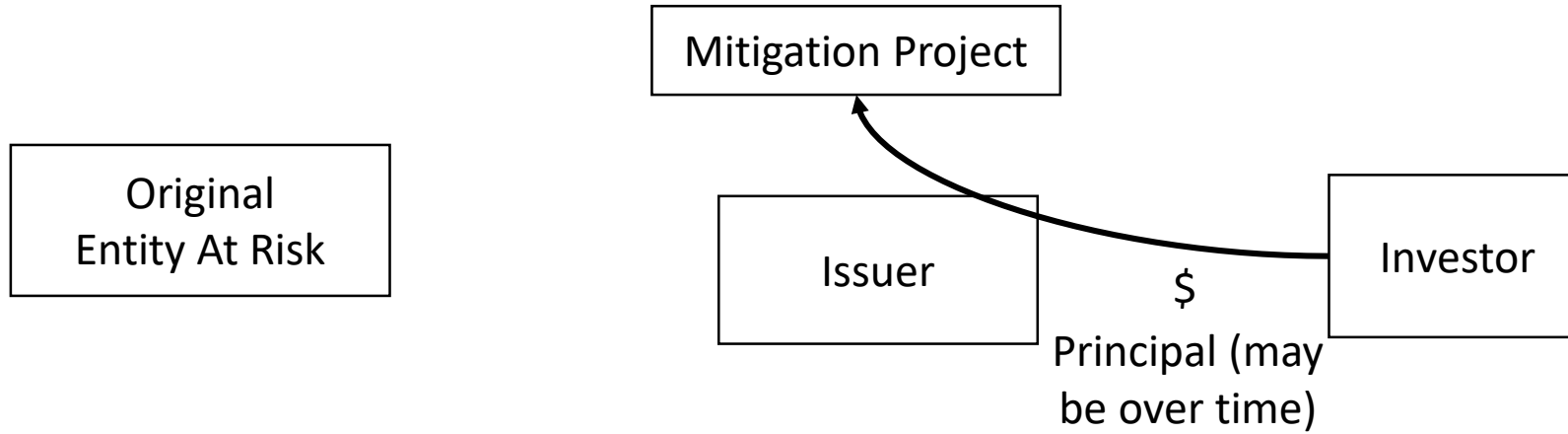
- All mitigation/preparedness projects have expected value (EV):
Chance of disaster over time * Damage prevented – Investment
- When $EV > 0$, project is a clear win

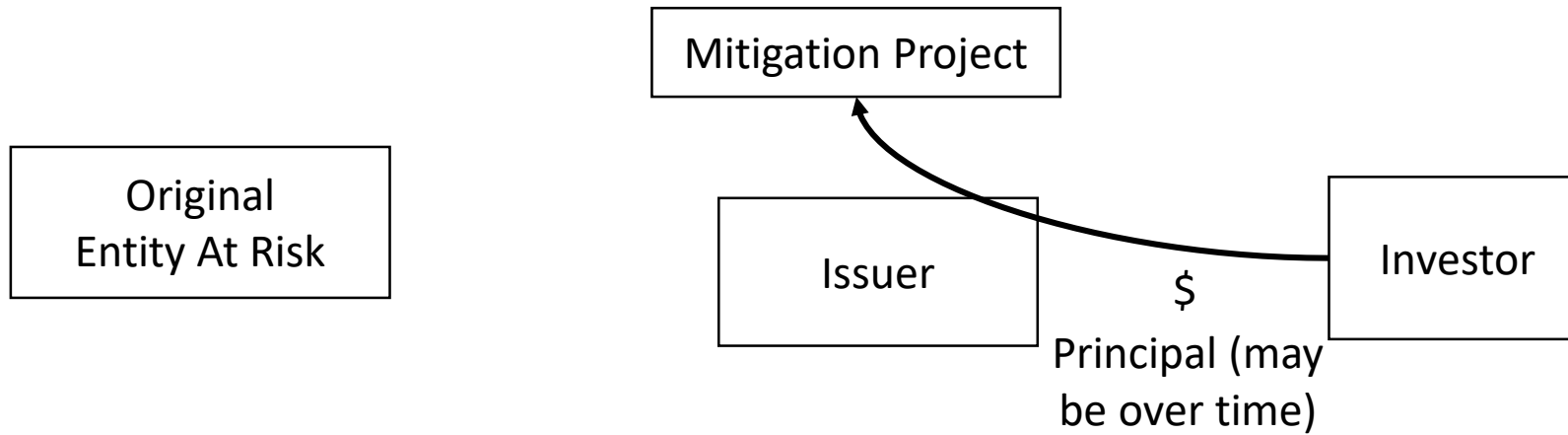
We know what to do. We just don't do it.

- Why not?
 - Those at risk fail to perceive it; risk is not properly allocatedOR
 - Preparedness is dependent on limited cash flow & sacrificed

Resilience Bond: one solution

- Four elements
 - Entity at risk of loss
 - Project that can mitigate the risk with +EV
 - Measurable trigger
 - Purchaser for the bond
- If (and only if) the disaster occurs, the original entity at risk (OEAR) pays the purchaser a large amount: more than the cost of the project, but much less than the damage that was prevented.

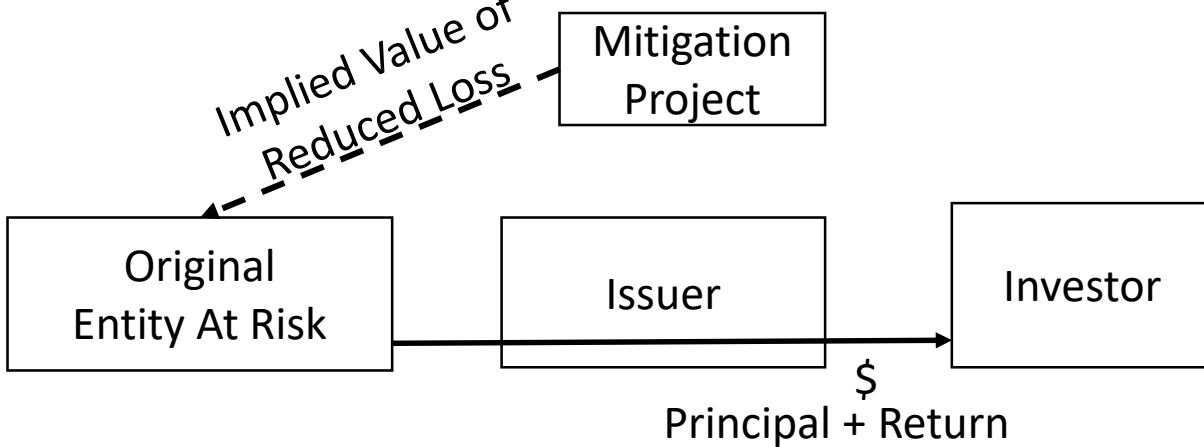


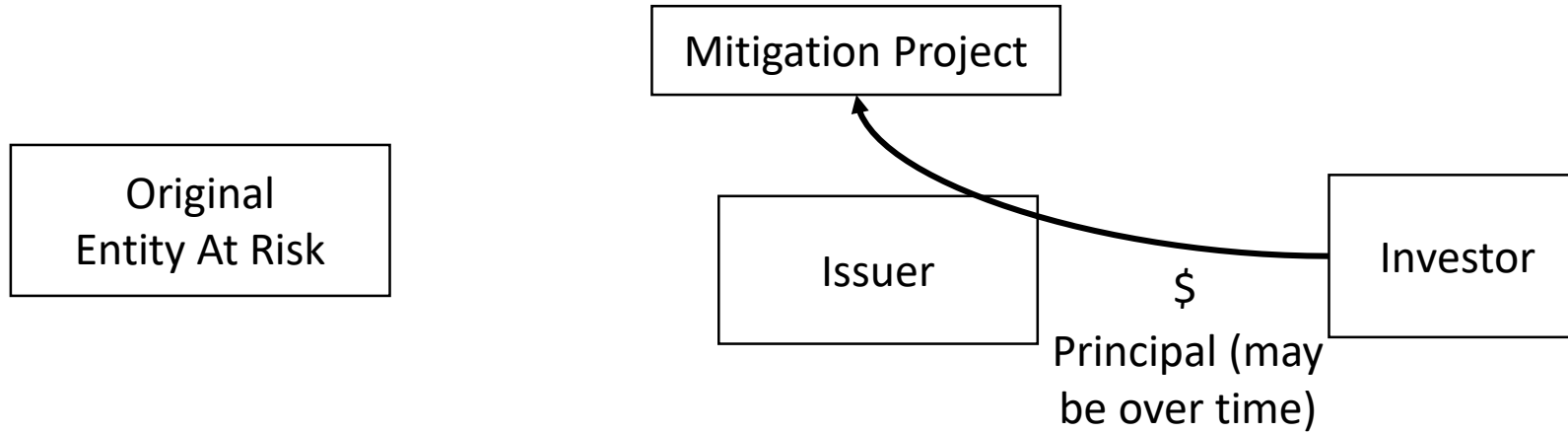


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Catastrophe Occurs

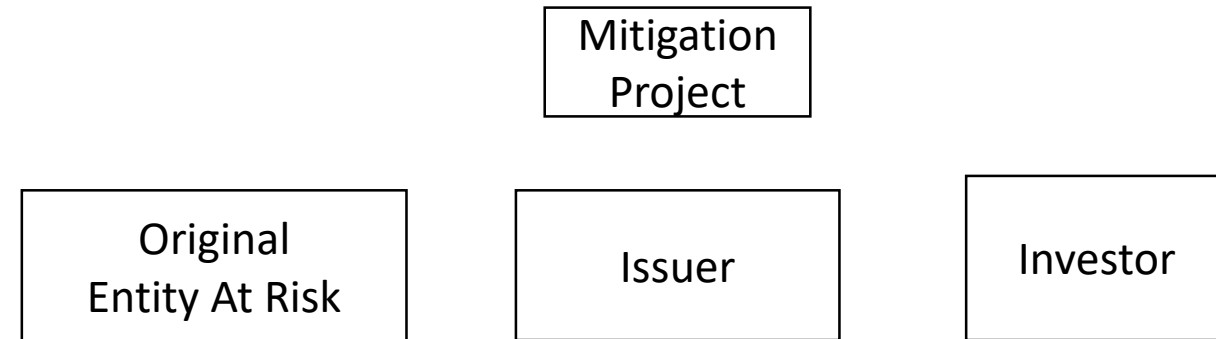
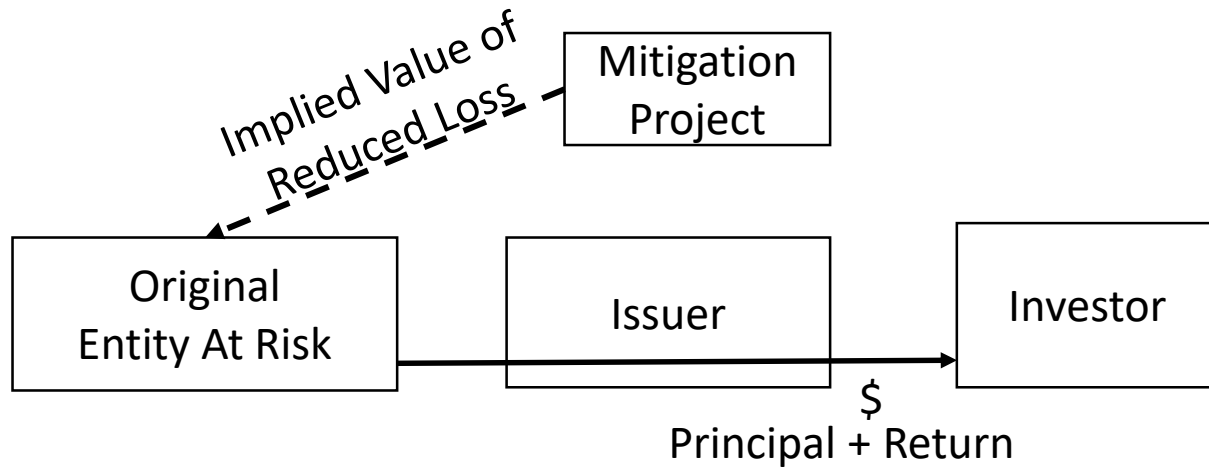
Implied Value of
Reduced Loss





1 Catastrophe Occurs

2 No Catastrophe Occurs



One example

- A large wastewater treatment plant represents perhaps \$5 billion in assets and is vulnerable to flooding
- A major flood would cause (estimated) \$1 billion in damage; chance of occurrence 1%/year
- A seawall could be built for \$25 million
- An investor could build the seawall, then if a flood hits any time in the next 40 years (total chance 1/3), the utility would make a \$200 million payment to the investor

Why does this make sense?

- For the original entity at risk (eg utility, city & residents, industrial plant)
 - Allows immediate construction of worthwhile projects
 - Eliminates chance of implied loss – that is, that protection is constructed for a disaster that never occurs
 - Reduces risk: disaster losses drop from \$1 billion to \$200 million
 - Increased property values & economic activity from reduced vulnerability
- For the investor (bank, fund, philanthropist)
 - Provides a favorable mean rate of return (high-risk/high-reward)
 - A new tradable investment instrument uncorrelated from others
 - Investment is connected to a social good

Potential Applications

- Flood: funding of seawalls, drainage, etc
 - Drought: reservoirs, irrigation infrastructure
 - Disease: treatment methods for diarrhea
 - Power outage: hospital generators
 - Many, many others
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- More useful for *mitigation* than *prevention*

Panama

- IDB Project; \$100 million of flood protection funded via loan
- Resilience bond to fund addition ~\$20-40 million fund for operations and upstream interventions
- Payments on resilience portion conditional on flood height -> provides an incentive to municipality to manage growth
- Transparent risk calculation, trigger, payout, project success

Thank You

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