Lab 4: House Elevation NPV Analysis

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using CSV  
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Plots.default(; margin=6Plots.mm)  
  
include("depthdamage.jl")

# 1. Depth damage function

haz\_fl\_dept = CSV.read("data/haz\_fl\_dept.csv", DataFrame) # read in the file  
desc = "two story, no basement, Structure"  
row = @rsubset(haz\_fl\_dept, :Description == desc)[1, :] # select the row I want  
dd = DepthDamageData(row) # extract the depth-damage data  
damage\_fn = get\_depth\_damage\_function(dd.depths, dd.damages) # get the depth-damage function

#132 (generic function with 1 method)

# 2. Single year function

function single\_year\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h)  
 # calculate the expected damages  
offset = 1.66   
house\_dist = GeneralizedExtremeValue(flood\_dist.μ - offset, flood\_dist.σ, flood\_dist.ξ)  
samples = rand(house\_dist, 100\_000) .\* 1u"ft"  
damages = damage\_fn.(samples)  
expected\_damages\_pct = mean(damages)  
expected\_damages\_usd = house\_value \* expected\_damages\_pct / 100  
c\_dmg = expected\_damages\_usd  
  
 # calculate the cost of elevating  
h = h .\* 1u"ft"  
c\_constr = elevation\_cost.(h, house\_area)  
  
 # return the total cost and benefit  
 return -c\_constr - c\_dmg  
end

single\_year\_cost\_benefit (generic function with 1 method)

# 3. NPV function

function npv\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h, T, discount\_rate)  
 # calculate the costs and benefits for each year, and then discount  
 # see above!  
 cost\_benefits = zeros(T)  
 for i in 1:T  
 if i== 1  
 cost\_benefits[i] = single\_year\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h)  
 else  
 cost\_benefits[i] = single\_year\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, 0)  
 end  
 end  
 npv = sum(cost\_benefits .\* (1 - discount\_rate) .^ (0:9))  
 return npv  
end

npv\_cost\_benefit (generic function with 1 method)

# 4. One SOW, several actions

flood\_dist = GeneralizedExtremeValue(5, 1, 0.1)   
elevation\_cost = get\_elevation\_cost\_function()  
house\_area = 1000u"ft^2"  
house\_value = 400000  
T = 10  
discount\_rate = 0.05  
h = 5  
  
npv\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h, T, discount\_rate)

-740427.3163989731

house\_area = 1000u"ft^2"  
house\_value = 400000  
h = 10  
T = 10  
discount\_rate = 0.05  
npv\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h, T, discount\_rate)

-751697.5912020107

house\_area = 1000u"ft^2"  
house\_value = 400000  
h = 0  
T = 10  
discount\_rate = 0.05  
npv\_cost\_benefit(flood\_dist, damage\_fn, elevation\_cost, house\_area, house\_value, h, T, discount\_rate)

-636957.2195186478

# 5. Sensitivity test

# 6. Discussion