

## What is Risk Aversion? (Basics)



Choice A: \$70 guaranteed

Choice B: 70% chance of \$100 and 30% chance of \$0

The “**expected value**” of B is  $0.7*\$100 + 0.3*\$0 = \$70$   $E(x) = \sum p_i x_i$

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You are **risk-averse** if you prefer A)

You are **risk-loving** if you prefer B)

You are **risk-neutral** if you are indifferent

*\*We can measure **how** risk-averse you are by how much extra we have to add to the expected value of a gamble to make you indifferent.*

Change the gamble to: 70% chance of \$105 and 30% chance of \$0

The “**expected value**” of B is  $0.7*\$105 + 0.3*\$0 = \$73.50$

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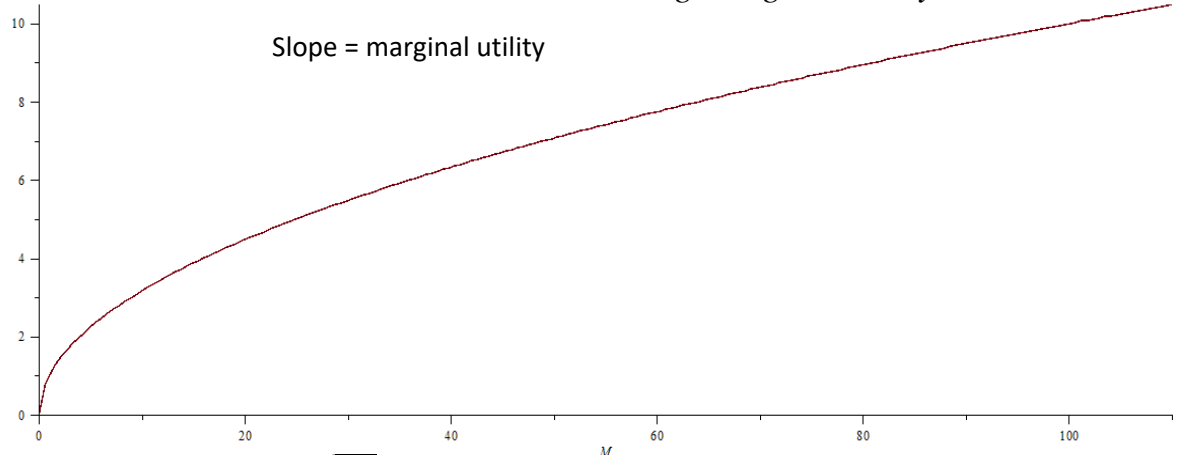
**Why might someone be risk-averse?** *Main reason: Diminishing marginal utility.*

Suppose  $U = \sqrt{M}$

Expected Utility:

$$.7*\sqrt{100} + .3*\sqrt{0}$$

$$E(U) = 7 + 0 = 7$$



**What if we just had \$70 for sure?**  $U = \sqrt{70} = 8.367$ .

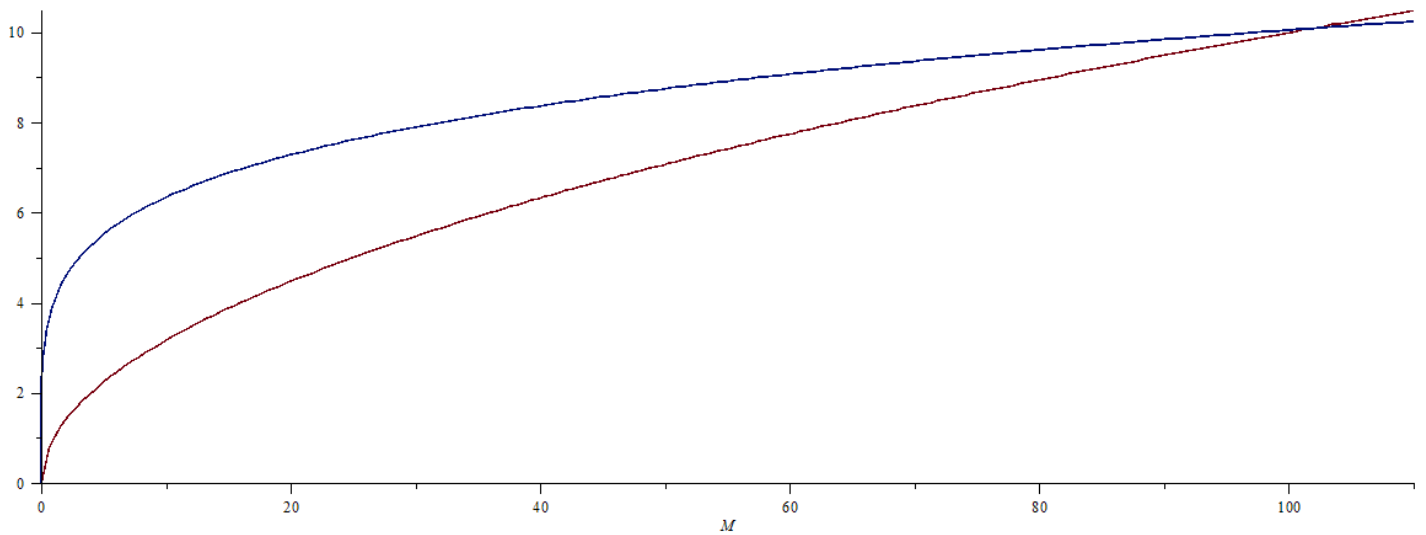
Removing the risk would make me happier! (Adding the risk makes me less happy!)

**This explains why people use insurance companies!**

**This person would pay to remove the risk. How much?**

## The amount of Risk Aversion is related to the “Curvature” of the utility function

If  $U=M$  (straight line), risk-neutral!



Red:  $U=\sqrt{M} = M^{.5}$

Blue:  $U= 4M^{-2}$

Arrow-Pratt measure of Absolute Risk Aversion:  $\frac{-U''(M)}{U'(M)}$

$$\text{Red: } -\frac{\frac{-.25}{M^{1.5}}}{\frac{.5}{M}} = \frac{.5}{M}$$

$$\text{Blue: } -\frac{\frac{-.64}{M^{1.8}}}{\frac{.8}{M^{-3}}} = \frac{.8}{M}$$

$U=M^{1.5}$

Risk Loving!

