The Economics of Uncertainty

Lecture 5

Econ 4905, Fall 2016

The Economics of Uncertainty

- The state of nature: s
- Realizations: $s_1, s_2, ...$
- Intrinsic Uncertainty
  - Random fundamentals
  - Examples

$$s_1 = rain, \quad s_2 = drought$$
$$s_1 = hot, \quad s_2 = cold$$

- Extrinsic Uncertainty
  - Randomness that does not effect the fundamentals, but does affect outcomes
  - Examples

$$s_1 = no\ run, \quad s_2 = run$$
$$s_1 = sunspots, \quad s_2 = no\ sunspots$$

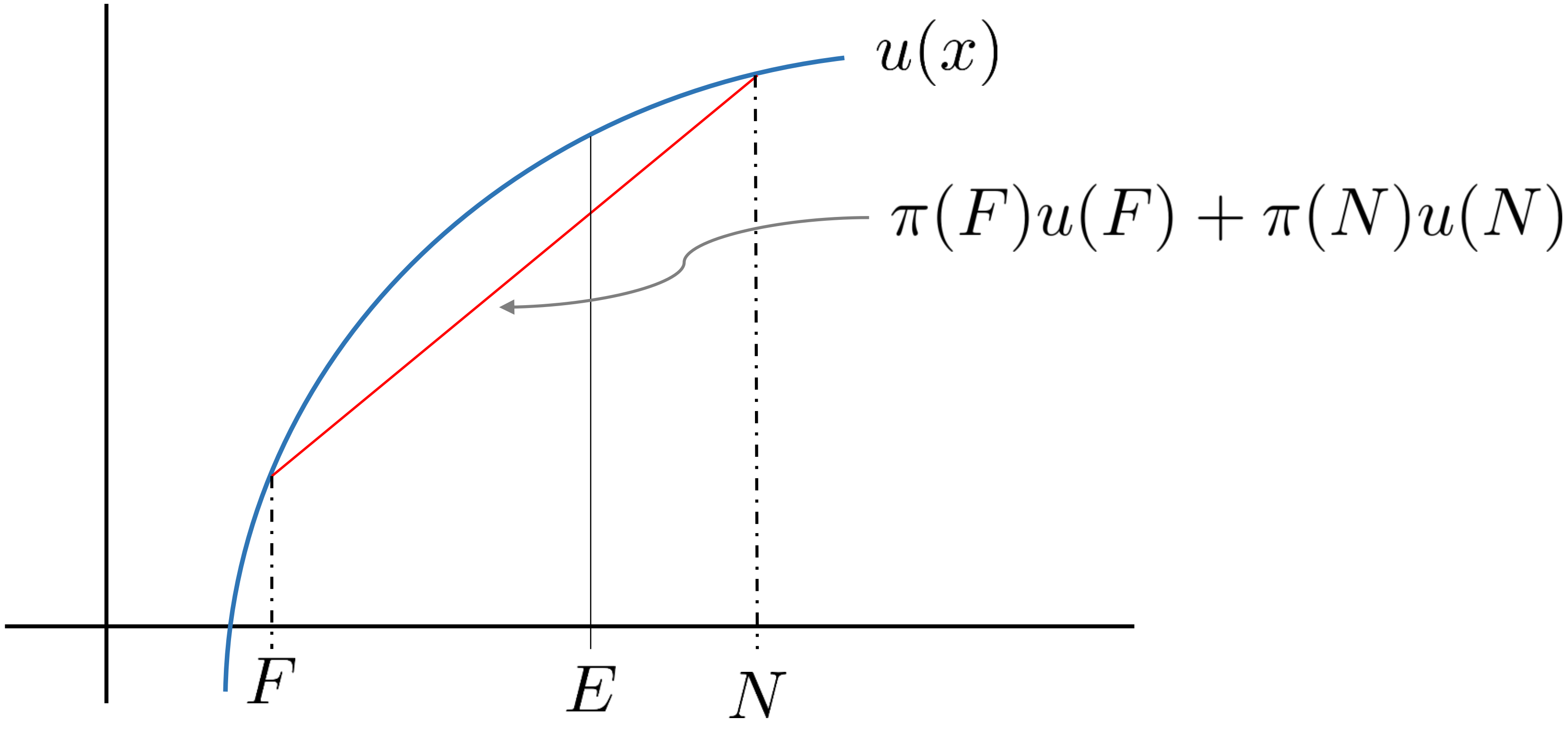
Expected Utility

- von Neumann and Morgenstern
  - Expected Utility
  - $V = \pi(s_1)u(x(s_1)) + \pi(s_2)u(x(s_2))$
  - $\pi(s_1) = 1 - \pi(s_2)$
  - $V = \int u(x(s))\pi(s)ds$
- Risk aversion:
  - $u(x)$
  - $u'(x) > 0$
  - $u''(x) < 0$ Risk-averse
- Risk-neutral
  $u''(x) = 0$
- Risk-loving
  $u''(x) > 0$

Arrow-Debreu

- Isomorphism
  - Contingent-claims
  - Securities

Lecture 5, Slide 5



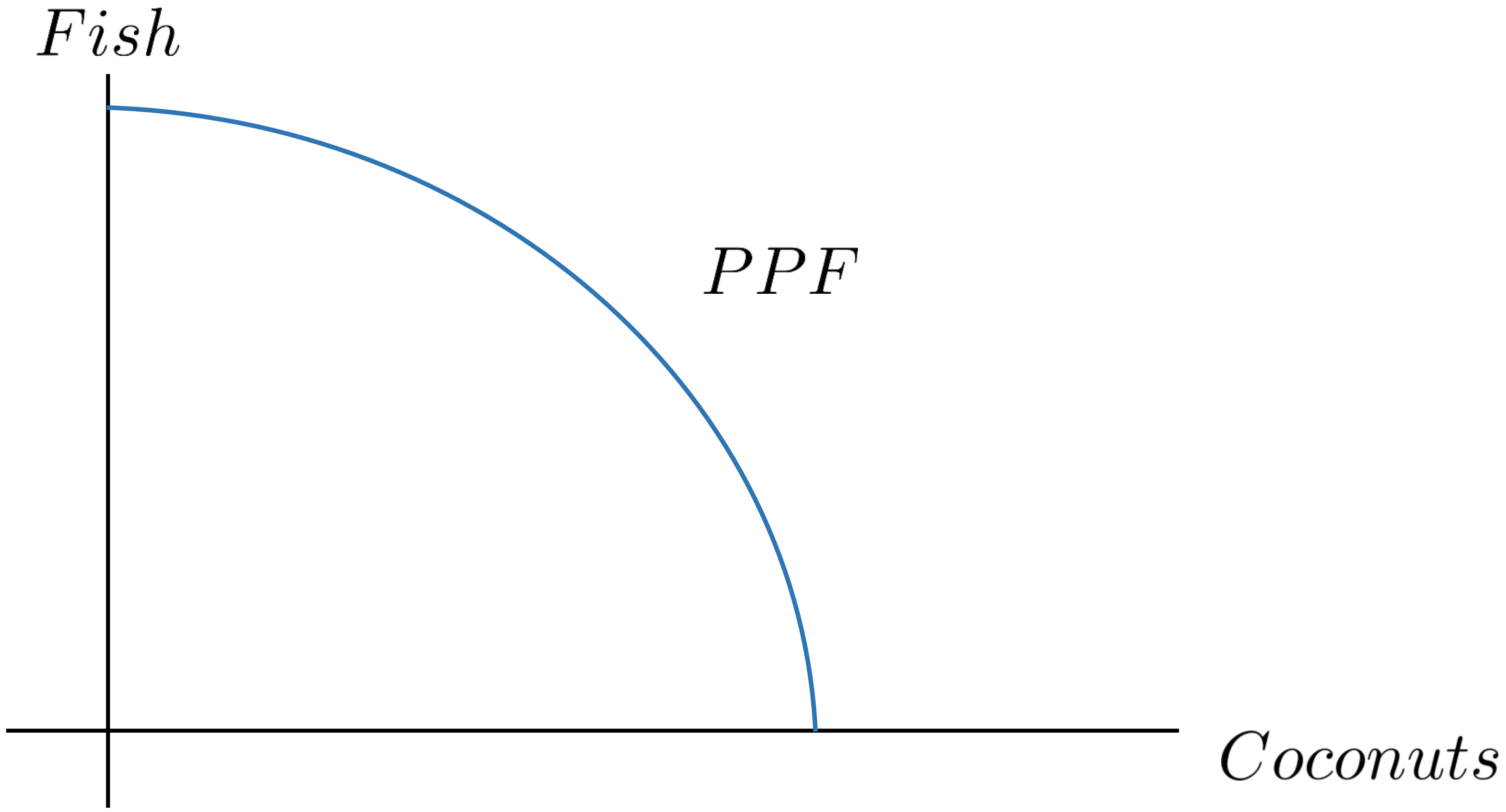
F – Fire, N – no fire, E – expected value

- **CRRA**
  - Kenneth Arrow
  - John Pratt
  - $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$
    - For $\gamma = 1, \text{ define } u(c) = \log(c)$
  - $u'(c) = \left(\frac{1-\gamma}{1-\gamma}\right) c^{-\gamma} = c^{-\gamma} > 0$
  - $u''(c) = -\gamma c^{-\gamma-1} < 0$
  - Risk-aversion
  - $-\frac{cu''(c)}{u'(c)} = \frac{\gamma c^{-\gamma-1} \cdot c}{c^{-\gamma}} = \frac{\gamma c^{-\gamma}}{c^{-\gamma}} = \gamma$

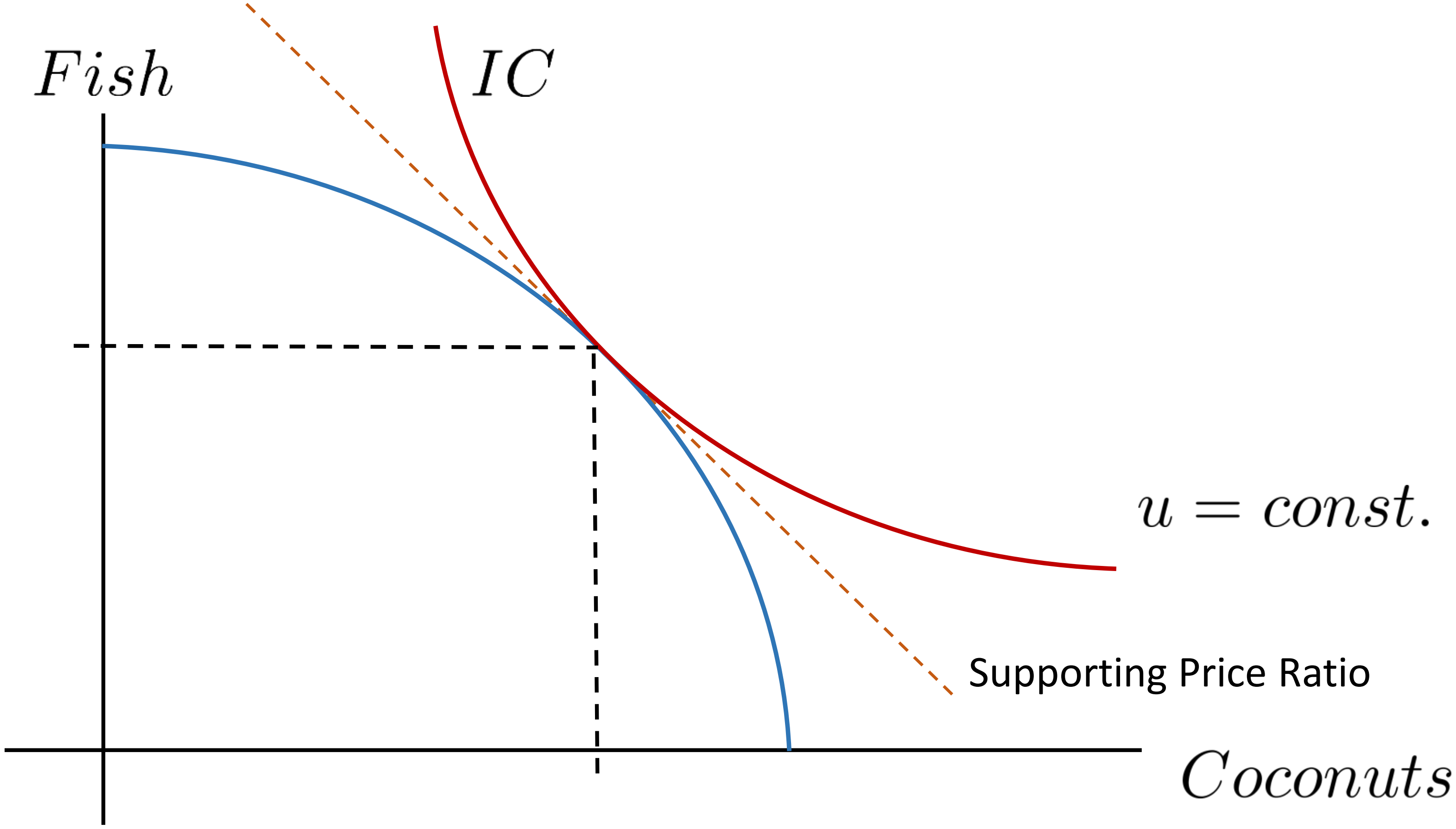
Profit Maximization

- **NOT** an axiom
- Theorem, requiring assumptions
- Perfect markets

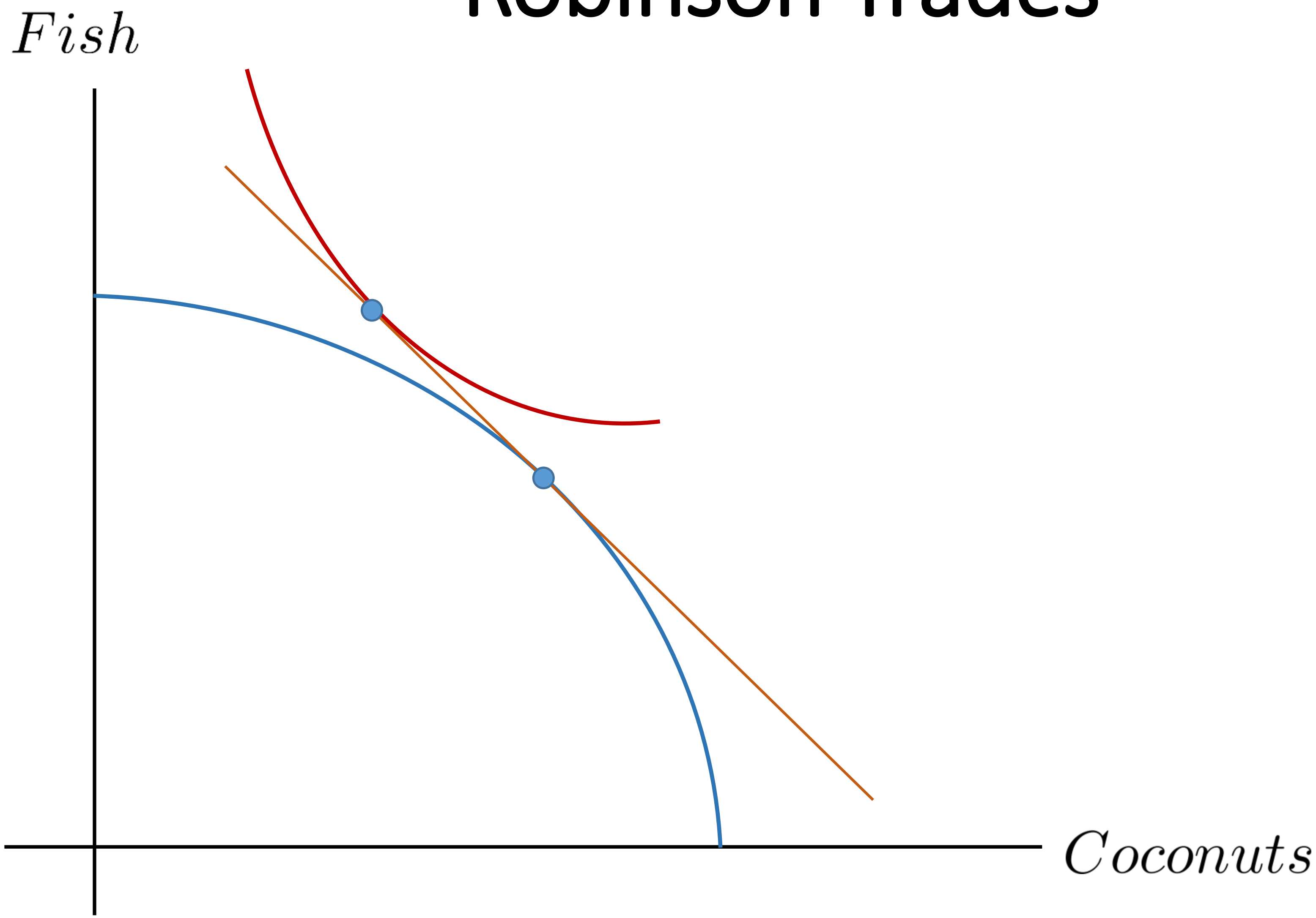
Robinson Crusoe



Robinson Crusoe



Robinson Trades



- Produces to market. Profit max
  - In order to max utility
- Dynamic extension
  - Max PDV
  - If borrowing and lending are perfect
- Uncertainty extension
  - Max contingent-claim profit
  - If insurance is perfect