Bank Runs

See Doepke, Lehnert, and Sellgren (1999) Ch. 17.4

Trevor Gallen

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- So we'll introduce a model of banks (and bank runs)

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- Because of how banks are structured, they'll be vulnerable to **bank runs**

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- We'll tell a highly stylized story about turnips now.

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7. If you're still alive, you can eat your turnip

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  - "The second type is willing to wait if it gains her anything"

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- On your own, you get expected utility:

  $\theta \cdot \log(1) + (1-\theta) \cdot \log(1.1) = 0.5 \cdot 0 + 0.98 + 0.5 \cdot 0.095 = 0.046702$

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- We can all be better off by using insurance to smooth our consumption across states of the world

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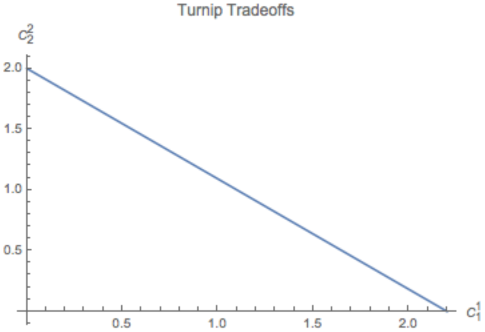
- Let's graph this, with $F = 1.1$ and $\theta = 0.5$

Budget constraint example



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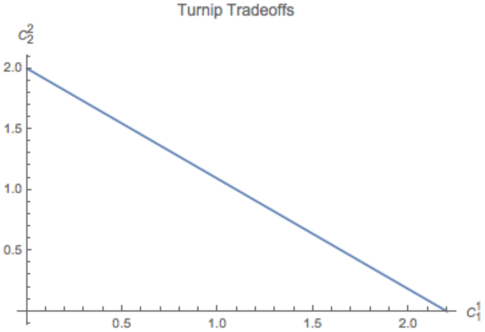

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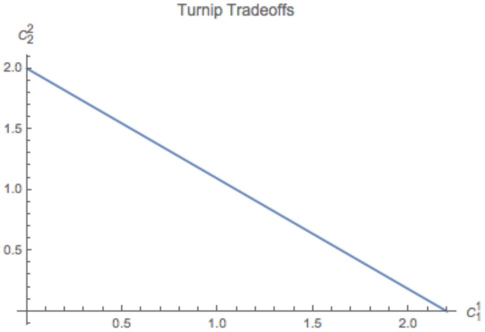

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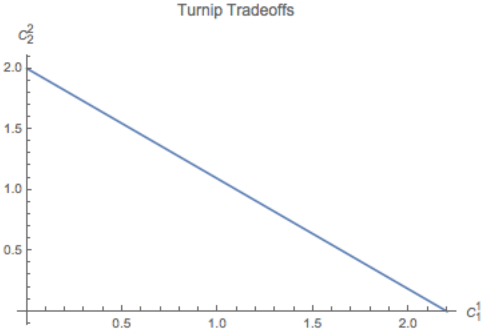

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- Or you could do something in the middle

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- Competition forces you to make the best decision for your population
- Let's write down the utility maximization problem

Insurance utility maximization

$$\mathcal{L}(c_1^1, c_2^2, \lambda) = \theta \log(c_1^1) + (1-\theta) Q \log(c_2^2) + \lambda \left(1 - \theta c_1^1 - \frac{(1-\theta) c_2^2}{F} \right)$$

- Taking first order conditions, we get:

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial c_1^1} : \quad & \frac{\theta}{c_1^1} - \lambda\theta &= \quad & 0 \\
\frac{\partial \mathcal{L}}{\partial c_2^2} : \quad & Q\frac{1-\theta}{c_2^2} - \lambda\frac{1-\theta}{F} &= \quad & 0 \\
\frac{\partial \mathcal{L}}{\partial \lambda} : \quad & \theta c_1^1 + \frac{(1-\theta)c_2^2}{F} &= \quad & 1
\end{aligned}$$

- It's easy to solve these three equations for our three unknowns, c_1^1, c_2^2, and λ

Insurance utility solution

- Solving for c_1^1, c_2^2, and λ, we get:

$$c_1^1 = \frac{1}{\theta + Q(1-\theta)} \qquad c_2^2 = \frac{QF}{\theta + Q(1-\theta)}$$

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$$c_1^1 = \frac{1}{0.5 + 0.98(1-0.5)} = 1.\overline{01}$$

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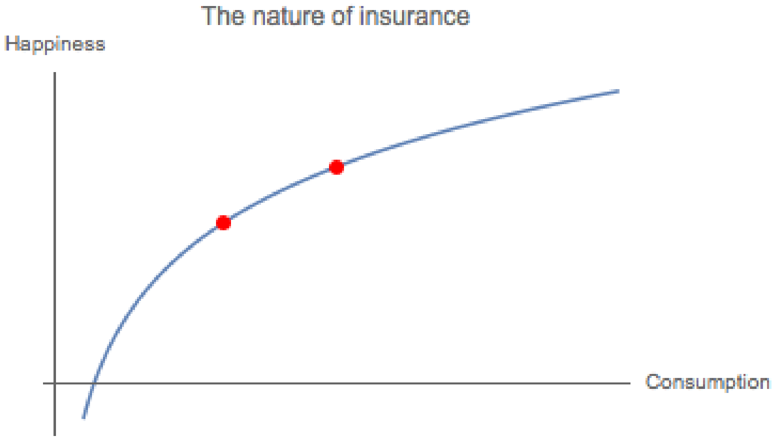
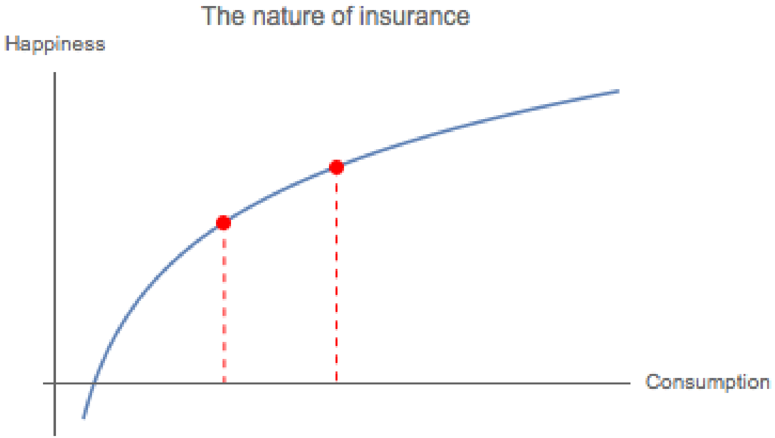
- We did it! Improved utility slightly.

Insurance?



INSURANCE?



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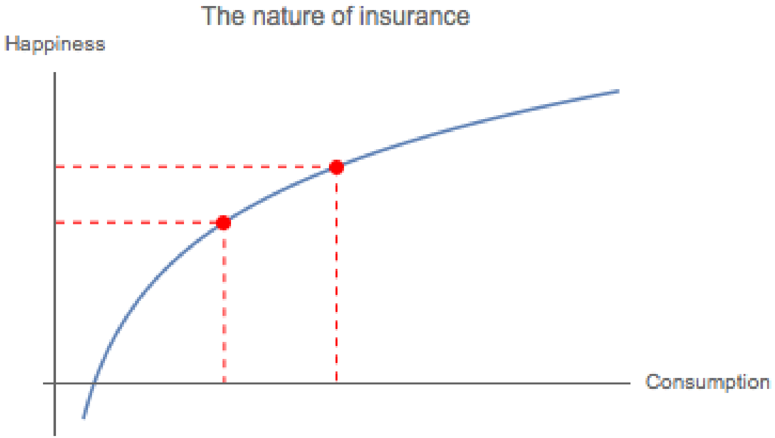

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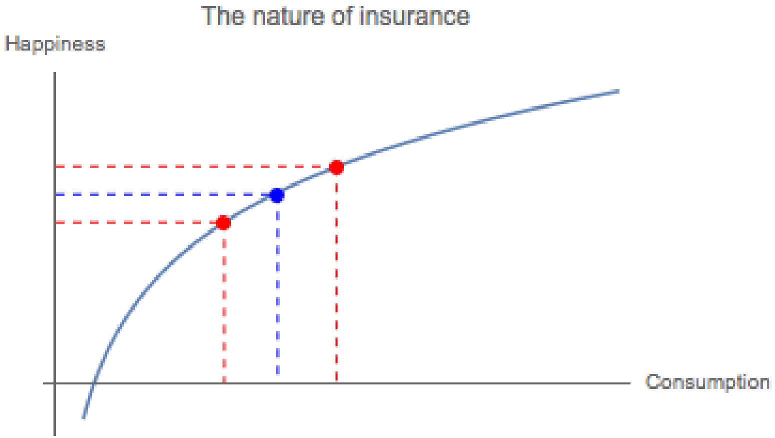

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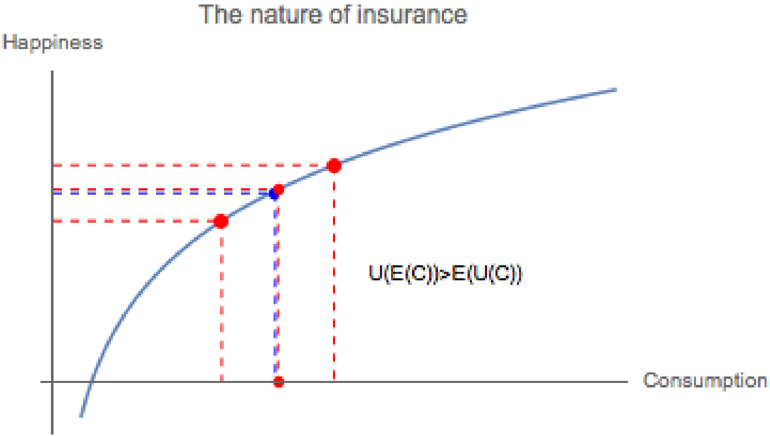

Utility of expected consumption preferred to expectation of utility.

Insurance problem: summary

- We have a problem in which people can invest and earn interest
- But sometimes some people want their money now
- Think of mortgages like planted turnips
- Banks will allow people to withdraw whenever
- People can benefit by participating in this "insurance" system, where we're insuring your liquidity needs
- Now we'll reframe this as a bank problem, but with one difference (what?)
  - People can withdraw at any time! (No proof of type)

Bank problem

- Banks have the same problem as insurance companies, with a small twist:

    1. They'll make promises in period 0 about how much you can receive if you withdraw in period 1 or period 2

    2. They then have to keep those promises no matter how many people actually do withdraw in period 1

- The point:

    - If too many people withdrew in period 1, then there would be nothing left in period 2!

    - If I fear too many people are going to withdraw in period 1, then I'll withdraw in period 1 even if I'm of type 2

- Bank run!

Bank problem

- Banks face the same basic problem: choose an interest rate r_1 for type 1 and then whoever withdraws in period 2 gets the rest:

$$c_1^1 = 1 + r_1$$

$$c_2^2 = F\frac{1 - \theta(1 + r_1)}{1 - \theta}$$

- If for some reason θ, the proportion that withdraw in period 1, is very high, then c_2^2 goes down.
- If c_2^2 ever slips below c_1^1, then all the type 2's should run on the bank.
- How should a bank choose r_1?
- Maximize utility

Bank maximization problem

- Banks must maximize consumer expected utility, plugging in for c_2^2:

$$\theta \log(1 + r_1) + (1 - \theta) Q \log \left(F \frac{1 - \theta(1 + r)}{1 - \theta} \right)$$

- You can notice that this is the exact same problem as the insurance company faced, with $1 + r_1 = c_1$ and the budget constraint plugged in:

- Consequently, it has the same maximization solutions:

$$1 + r_1 = \frac{1}{\theta + Q(1 - \theta)}$$

- The bank chose the interest rate so everything is exactly the same as the insurance problem.

- If all goes according to plan, type 1 will get $1.0\overline{1}$ and type 2 will get $1.0\overline{8}$

- Type 2's won't want to run on the bank if nobody else is

Bank runs

- What if for some reason I fear that too many people are withdrawing?
- Bank pays them out and I get the residual. I should get $1.0\overline{8}$ if 50% of population withdraws
- What if 80% withdraws? Then I only get
$$c_2^2 = F\frac{1-\theta(1+r)}{1-\theta} = 1.1\frac{1-0.6\cdot 1.0\overline{1}}{1-0.6} = 1.05$$
- Then I don't want to run
- What if 89% withdraws? Then I get:
$$c_2^2 = F\frac{1-\theta(1+r)}{1-\theta} = 1.1\frac{1-0.89\cdot 1.0\overline{1}}{1-0.89} = 1.001$$
- If I fear that 89% of the population should withdraw, then I'll withdraw too!
- That means that (say) 90% of the population is withdrawing, the heat is turned up for others who aren't withdrawing
- Self-fulfilling Bank run!

Bank runs: the story

- If everyone is doing what they're supposed to, then there's no problem, everyone is happier and the economy is better than if there were no banks
- But if I *fear* too many people are withdrawing at once, then I should withdraw, creating a self-fulfilling bank run
- This happens because banks make promises that they are able to keep only when people think they're able to keep them
- Pro and con of banks:
  - On the one hand, they improve utility
  - On the other hand, they're vulnerable to bank runs
- Is there a way to avoid bank runs?

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  3. Mutual funds
  4. Lender of last resort
- Let's talk about each in turn

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- This method fails if you don't know θ in advance! It would be a bad day for many of the type 1's if the government declared that only 25% of the population can withdraw!

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- This method can be expensive, because it insures both *illiquid* and *insolvent* banks!

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- This method works, unless you decide that mutual funds really have promised implicitly (which is what happened in the financial crisis to MMMF's)

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- This is called **Bagehot's Rule**: in times of crisis, lend without limit, to solvent firms, against good collateral, at high rates.

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- After 1913, we've had 2 (1 every $\sim$ 50 years)
- We know how to solve! Flood the system with liquidity.