CHAPTER 9
ADVERSE SELECTION: THE ROTHSCHILD-STIGLITZ MODEL

Intro

- Previously, we studied:
  - Demand for insurance
    - Risk aversion but no information asymmetry
  - Akerlof's market for lemons
    - information asymmetry but no risk aversion
- The Rothschild-Stiglitz Model (1976) puts these two together.

Introduction

- Individuals
  - have different health risk
  - Are risk averse (ready to trade I_H for I_S)
- Consider health insurance markets with asymmetric information
- Questions
  - Which is the best outcome (efficiency , fairness ..)?
  - Is risk pooling desirable?
  - What contracts can be reached in the market?
  - Is there need for public intervention? Universal coverage?

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The I_H-I_S space

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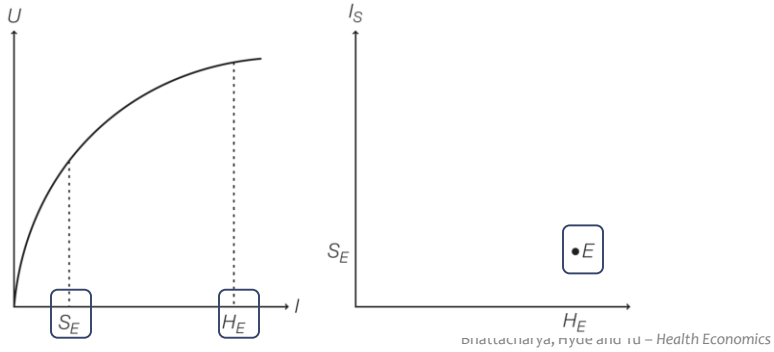
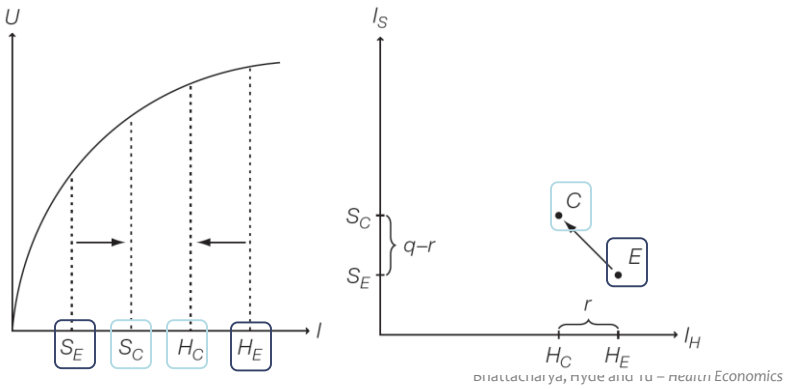
I_H-I_S space

- Recall the income-utility space
  - Take H_E and S_E points and bundle them to one point E (endowment point) in I_H-I_S space
  - Point E shows the income of an individual in both the healthy and the sick state



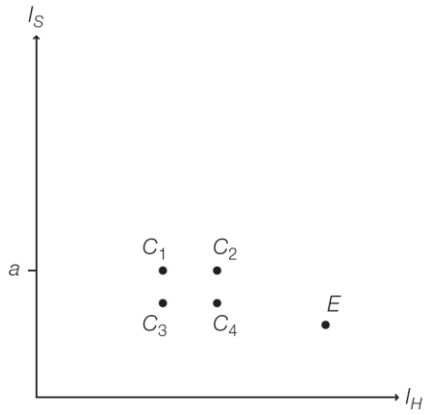
I_H-I_S space

- Point C represents a partial insurance contract
  - Horizontal shift = premium (r)
  - Vertical shift = payout if sick (q-r)



I_H-I_S space

- Given C_1, C_2, C_3, C_4, and endowment point E we can make some assumptions:
  - Individual prefers C_2 to C_1
  - Prefers C_1 to C_3
  - Cannot compare preference between C_1 to C_4
  - Cannot compare preferences to E



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INDIFFERENCE CURVES IN I_H-I_S Space

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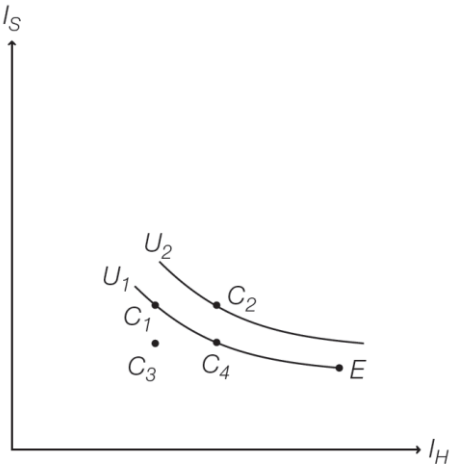
Indifference curves in I_H-I_S space

1) Downward sloping
   - Willing to give up income in one state if compensated for more income in the other state
2) Convex
   - More downward-sloping at low levels of I_H but flatter at high levels
   - I_S and I_H are imperfect substitutes
   - Result of risk aversion



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THE FULL-INSURANCE LINE

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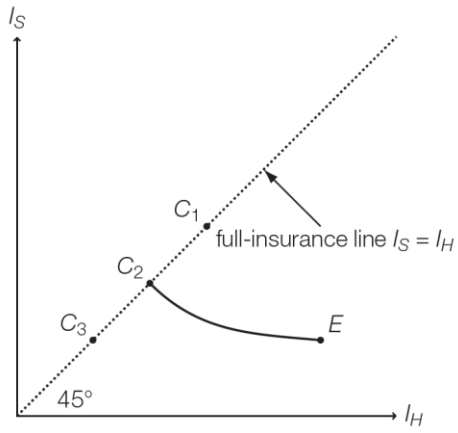
The full-insurance line



- The 45% line is the full-insurance line
- Why? What does this have to do with *state independence*?

Any point on this line represents a full insurance contract.

THE ZERO-PROFIT LINE

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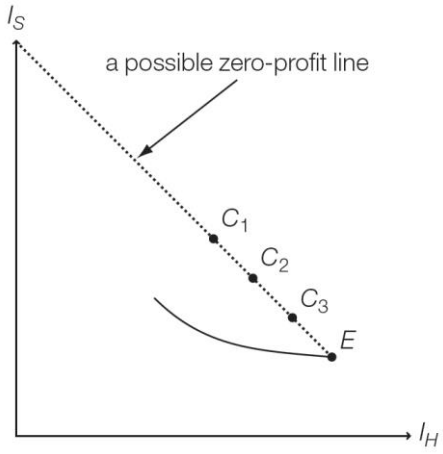
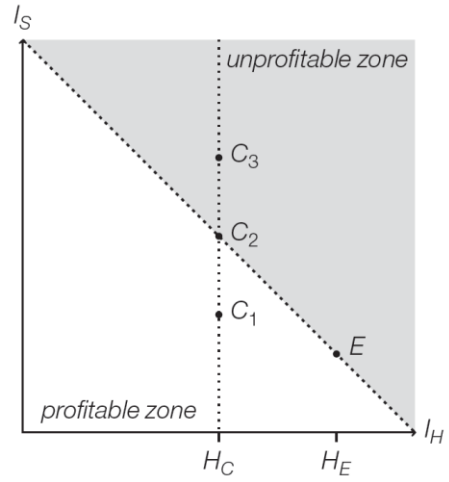
The zero-profit line



- Represents the set of contracts such that the premium is exactly the same as the expected payout (no profits for insurance company)
- Zero-profit line runs through endowment point E
- Also can be thought of as the *actuarially-fair line*

The zero-profit line divides I_H-I_S space into profitable and unprofitable zones



- C_1 lies *below* the zero-profit line and results in profits for insurance companies
- C_3 lies *above* the zero-profit line and results in a loss of money for companies
- No company will offer points above zero-profit line
- Will customers be willing to take something below the zero-profit line?

THE FEASIBLE CONTRACT WEDGE

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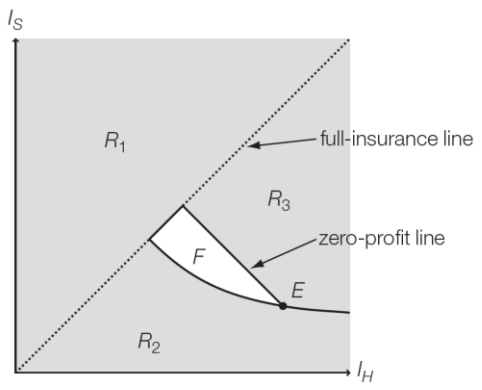
The feasible contract wedge

- R_1 = overfull insurance
  - Get more income if you are sick (implausible contract)
- R_2 = under indifference curve going through E
  - Individual prefers E to any contract offered in this region
- R_3 = northeast of zero-profit line
  - Companies will lose money on these contracts
- F = *feasible contract wedge*
  - Only area where both customers and insurance companies want to meet



FINDING AN EQUILIBRIUM

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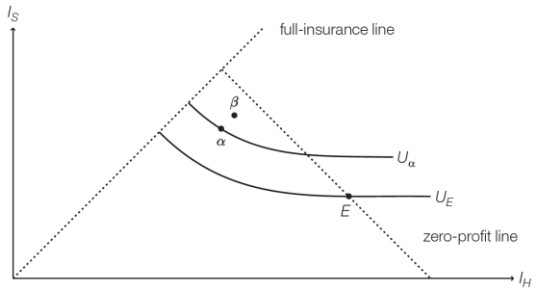
Equilibrium

A set of contracts is in ***equilibrium*** if:

1) All individuals select the contract that offers the most utility.
2) No contract in the set earns negative profits for the firm offering it.
3) There exists no contract or set of contracts outside the set that, if offered, would attract customers *and* earn at least zero profit.

Case #1: symmetric information, homogeneous customers

- Is the set {E, α} an equilibrium?
  - α lies on a higher indifference curve (satisfies equilibrium condition 1)
  - α is below the zero-profit line (satisfies condition 2)
  - *But* β can attract customers away from α and still make positive profits (condition 3 violated)



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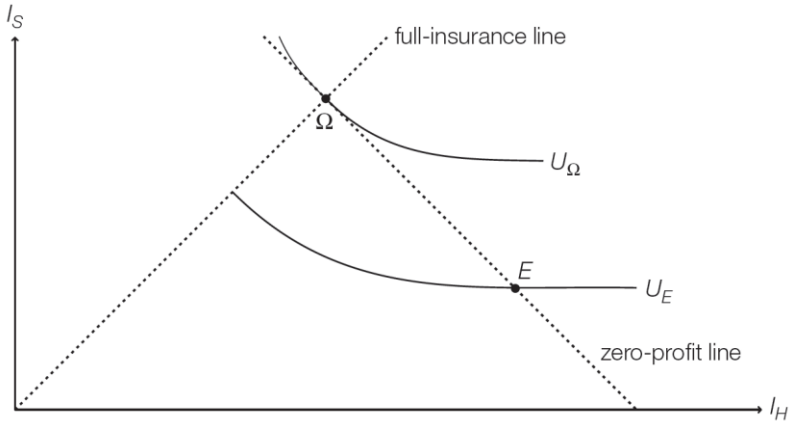
Case #1: symmetric information, homogeneous customers

- The only valid equilibrium:



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HETEROGENEOUS RISK TYPES

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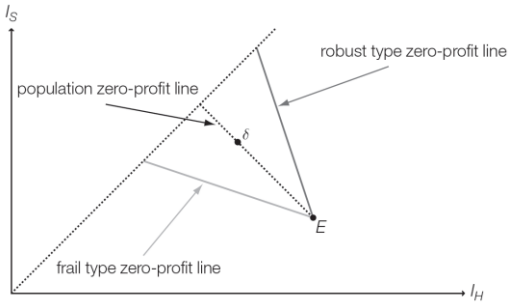
Heterogeneous risk types

- ***Robust*** types have a low probability, *p*, of getting sick
- ***Frail*** types have a higher probability of getting sick
- Slope of zero-profit line depends on probability of sickness
- Who has a steeper zero-profit line? Why?
- The population zero-profit line will fall between the frail zero-profit line and the robust zero-profit line.



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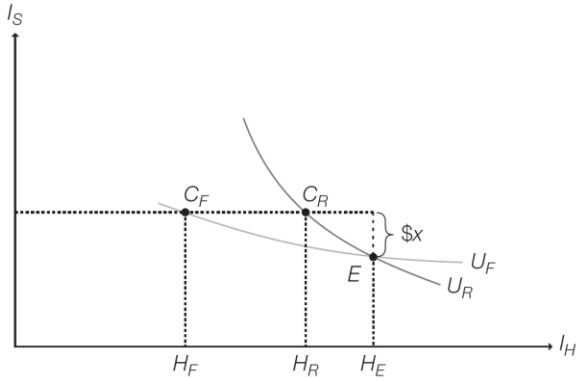
Heterogeneous risk types: indifference curves

- How do the indifference curves vary for robust and frail individuals?
- Who values I_S more relative to I_H?



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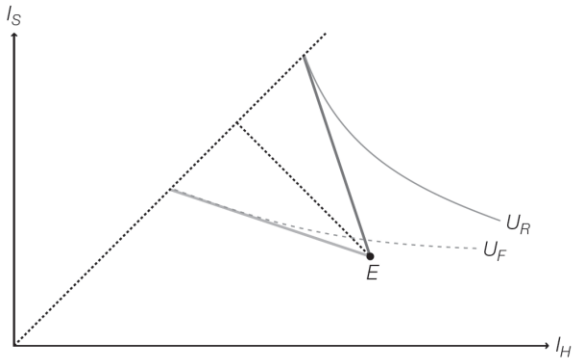
Case #2: symmetric information, heterogeneous customers

- Ideal contract point lies on an individual's respective zero-profit line
- Indifference curves lie tangent to zero-profit line
- These contracts are offered when firms can tell frail and robust individuals apart and can legally exclude certain risk types from certain contracts
- This ideal contract is called the "symmetric information equilibrium"



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For next time

- Exercise 12 a, b, c

INFORMATION ASYMMETRY AND THE POOLING EQUILIBRIUM

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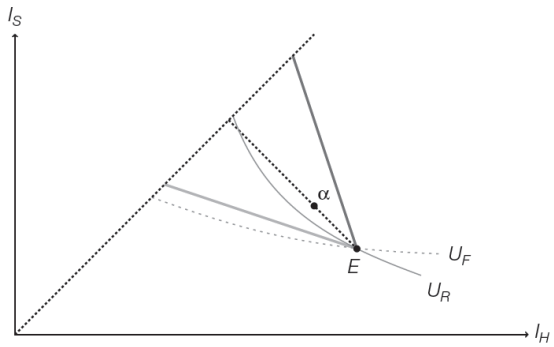
Pooling equilibrium

Definition– a contract that attracts both robust and frail individuals while also satisfying equilibrium conditions

Why is this desirable?

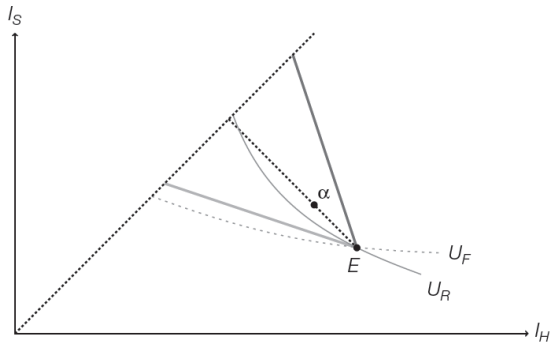
Case #3: asymmetric information, heterogeneous customers

- Any possible pooling equilibrium must be on the population zero-profit line
  - If to the right of zero-profit, firm loses money
  - If to the left of zero-profit, then other firms can enter the market



Case #3: asymmetric information, heterogeneous customers

- Contract α:
  - Both frail and robust individuals choose α over E
  - Firm makes zero profits because α is on the zero-profit line



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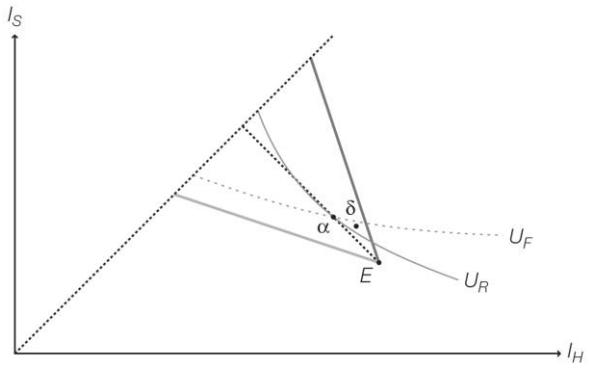
Case #3: asymmetric information, heterogeneous customers

- Contract α:
  - Both frail and robust individuals choose α over E
  - Firm makes zero profits because α is on the zero-profit line
  - However, because robust and frail indifference curves are different slopes, other insurance firms can enter the market at δ and appeal to the robust individuals



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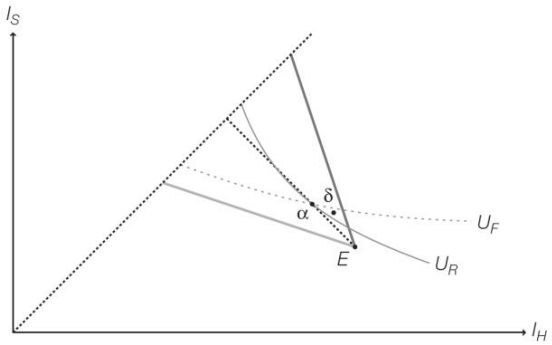
no pooling equilibrium can exist!

- δ creates adverse selection
  - Only attracts the robust individuals
  - Good for firm offering δ because expected payout is low and firms can expect positive profits
  - Bad for firm offering α because left with frail individuals and can expect to lose money due to increased payouts
  - You can find a δ to spoil any pooling equilibrium anywhere on the zero-profit line



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FINDING A SEPARATING EQUILIBRIUM (SOMETIMES)

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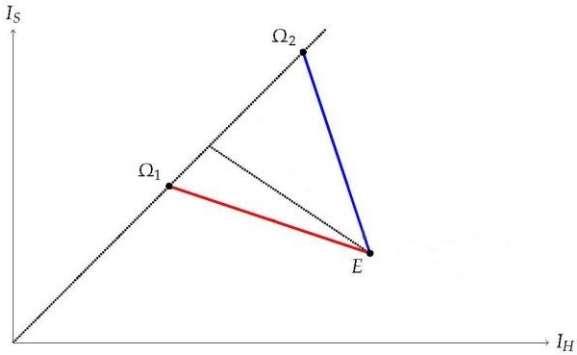
Separating equilibrium

- **Definition:** a set of contracts where one attracts frail individuals and the other attracts robust individuals, while satisfying equilibrium conditions

Separating equilibrium

- Recall: Ω_1 and Ω_2 cannot co-exist because frail individuals will move to Ω_2 from Ω_1
- Need a contract Ω_3 that will not tempt frail individuals to leave Ω_1



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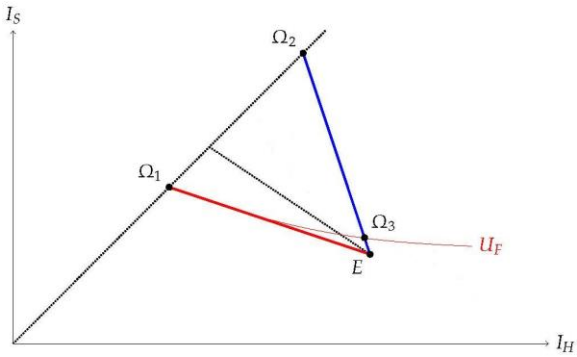
Separating equilibrium

- Ω_3 lies on the same indifference curve as Ω_1 for frail individuals but most likely choose Ω_1



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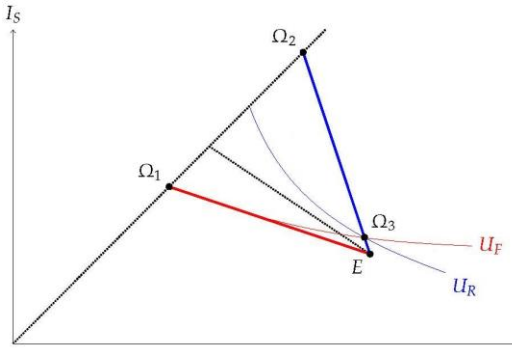
Separating equilibrium

- Ω_3 lies on the same indifference curve as Ω_1 for frail individuals but most likely choose Ω_1
- Robust individuals prefer Ω_3 to Ω_1
- Thus both robust and frail individuals are maximizing their utility



Who is harmed?

- When firms cannot tell frail or robust individuals apart, frail customers still receive full insurance at an actuarially fair price
- The robust receive inferior insurance contracts that are not as full as they like – the robust are *quantity constrained*
- Does this suggest the robust and the frail could make a pareto-improving trade?

CAN MARKETS SOLVE ADVERSE SELECTION?

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Solving adverse selection

- Full disclosure (free check ups → no private info)
  - → different premiums
  - Is it fair?
  - If morbidity with costly healthcare → either no insurance or too high premium
- But there could be market solutions, under one crucial assumption:

  Health differences between robust and frail only appear over time as customers age.

Solving adverse selection

- Lifetime insurance contract
  - Two customers pool together at age 18 and make a lifelong, contractually-binding commitment
  - By age 50, one is robust and one is frail
- This "solves" adverse selection but creates antagonistic relationships and may be legally unenforceable.

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Solving adverse selection

- Guaranteed renewable contract
  - Premiums are *frontloaded* so that robust and frail both want to remain in the contract voluntarily
  - But still a problem: customers can't switch insurers so there is *no competitive pressure*
- Cochrane lifetime contract
  - Insurers also provide *premium insurance*
  - Example: If someone is diagnosed with cancer, they get a windfall payment to afford future health insurance premiums that will be very high

Cochrane (1995) Time-Consistent Health Insurance *The Journal of Political Economy*,

- Currently available health insurance contracts often fail to insure long-term illnesses: sick people can suffer large increases in premiums or denial of coverage. I describe insurance contracts that solve this problem. Their key feature is a severance payment. A person who is diagnosed with a long-term illness and whose premiums are increased receives a lump sum equal to the increased present value of premiums. This lump sum allows him or her to pay the higher premiums required by any insurer. People are not tied to a particular insurer or a group, and the improvement is free: insurance companies can operate at zero economic profits, and consumers can pay exactly the same premium they do with standard contracts.

Solving adverse selection

- Group plan (usually paid by employer)
  - Cheaper as they pool risk
  - But what if a person looses its job or retires? (→ Government)
- Mandatory insurance (or universal coverage)
  - Government forces everyone to buy the contract at the intersection of the full-insurance line and the population zero-profit line
  - Provides risk pooling and redistribution
- Subsidize insurance coverage
- Regulation that imposes restrictions on price discrimination by characteristics

Conclusion

- The Rothschild-Stiglitz model makes two major predictions
  - Pooling equilibria cannot exist
  - If a separating equilibrium exists, robust individuals will be *quantity constrained*
- Does the empirical evidence support this?
- What if insurance market is non competitive (question 18)