Public Economics: Lecture 5
Social Insurance Programs

Cameron LaPoint

Columbia University

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Social insurance

- U.S. government provides many types of social insurance programs
  - Examples: retirement insurance (Social Security), unemployment and disability insurance, health insurance (Medicare/Medicaid)
  - Participation is compulsory
  - Benefit amounts depend to some extent on past contributions
  - Generosity does not depend on ability to self-insure (i.e. not means-tested)

- In this lecture we study two questions:
  1. Why do people value insurance?
  2. What is the rationale for government intervention in insurance markets?

Expected utility and insurance

- Available resources vary depending on what happens in the future
- Expected (total) utility over consumption in possible $i = 1, \ldots, N$ states of the world:

$$\mathbb{E}\Big[U(C)\Big] = \sum_{i=1}^{N} p_i u(C_i) = p_1 u(C_1) + \cdots + p_N u(C_N)$$

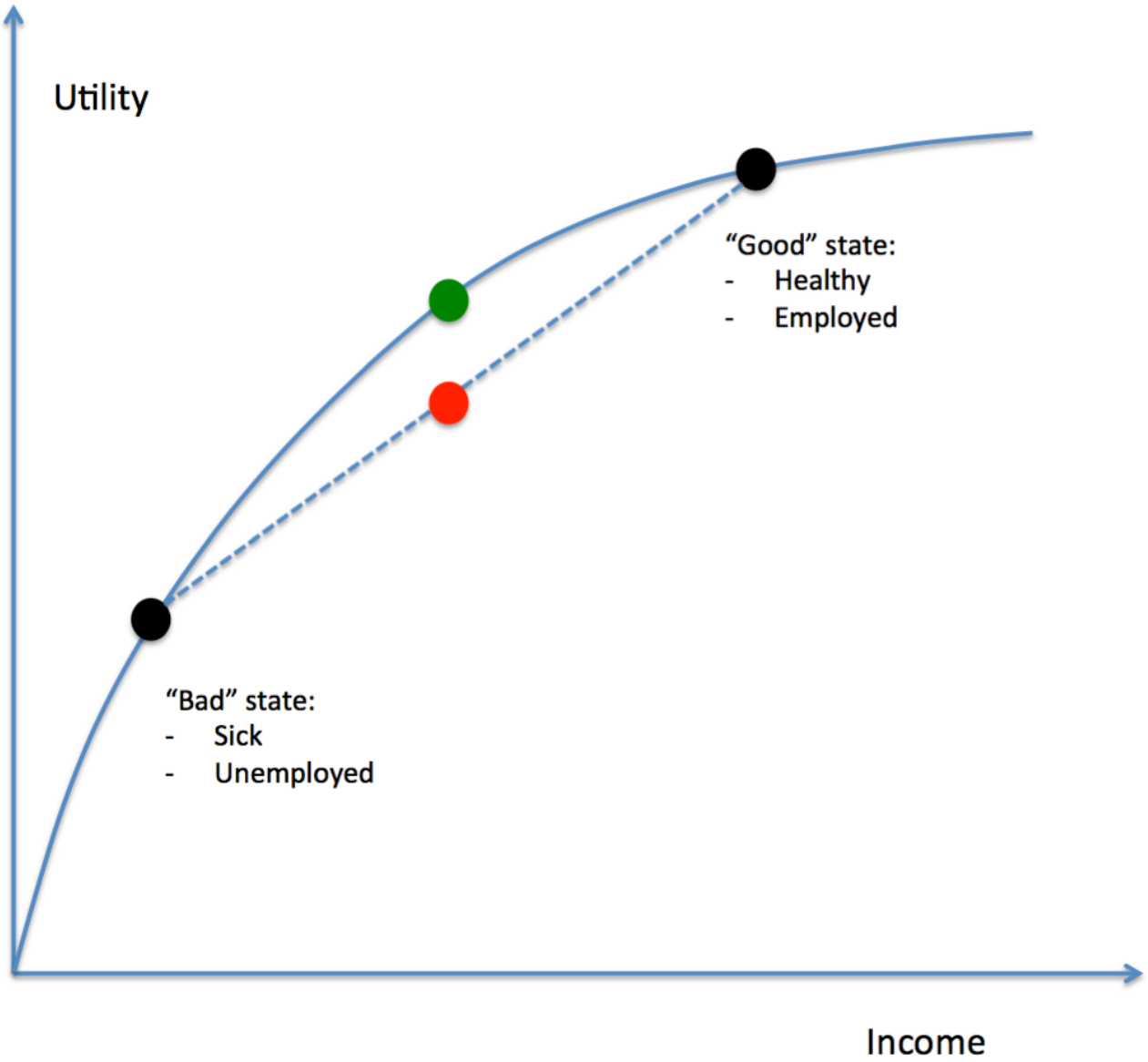
- Expected utility is average utility over all states of the world, with each state's utility weighted by the probability that the state occurs
- Simple case: there are two possible states – a good state and a bad state where the ability to consume is reduced
- Insurance has value if individuals prefer to smooth consumption across states of the world

Basic insurance framework

- Individuals receive income Y and with probability p suffer a loss of L
- Purchase an insurance contract with payout R and premium $q \cdot R$
- Consumption without a loss: $C_1 = Y$ (with prob. $1 - p$)
- Consumption with a loss: $C_2 = Y - L$ (with prob. p)
- If some insurance is purchased ($R > 0$): $C_1 = Y - q \cdot R$
  $C_2 = Y - L - q \cdot R + R = Y - L + (1 - q) \cdot R$
- Insurance allows for trade-off in consumption across the two states at relative price $\frac{1-q}{q}$
- To see this, note that we can combine the state-by-state budgets into a single budget that must hold:

$$q \cdot C_2 + (1 - q) \cdot C_1 = Y - q \cdot L$$

Value of (full) insurance



Importance of concavity

- When the utility function is concave, it is always true that:

$$u(C - p \cdot L) \geq (1 - p) \cdot u(C) + p \cdot u(C - L)$$

- Utility from consumption under full insurance is greater than expected utility without insurance

- Intuition: concavity $\implies$ diminishing marginal utility of income
  - Incentive to transfer income from the good state of the world where income is high to the bad state where income is relatively low
  - The point that maximizes utility is the full insurance point (green) where consumption is the same in each state

- Concavity also means the first dollar of insurance coverage is much more valuable (higher WTP) than subsequent dollars of insurance

Optimal insurance choice

Just like in the consumption/leisure choice problem from Lecture 1, two conditions must hold at the optimum:

1. The slope of the budget constraint and the indifference curve must be the same (tangency):

$$-\frac{p}{1-p} \cdot \frac{MU_2}{MU_1} = MRS = -\frac{q}{1-q}$$

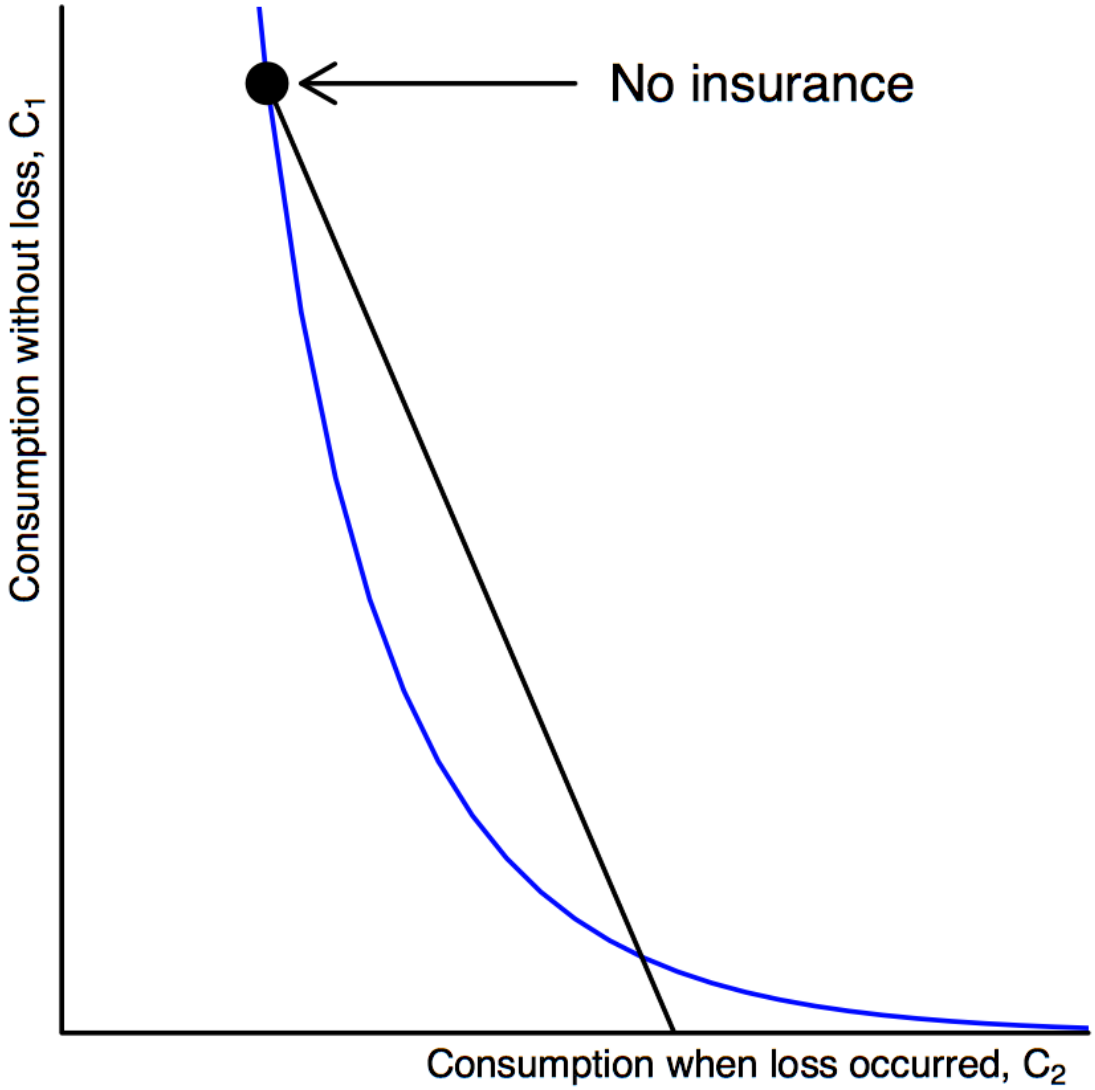
   Equivalently, the MRS must equal the relative price ratio of consumption across the good and bad states

2. The optimum must lie on the budget constraint

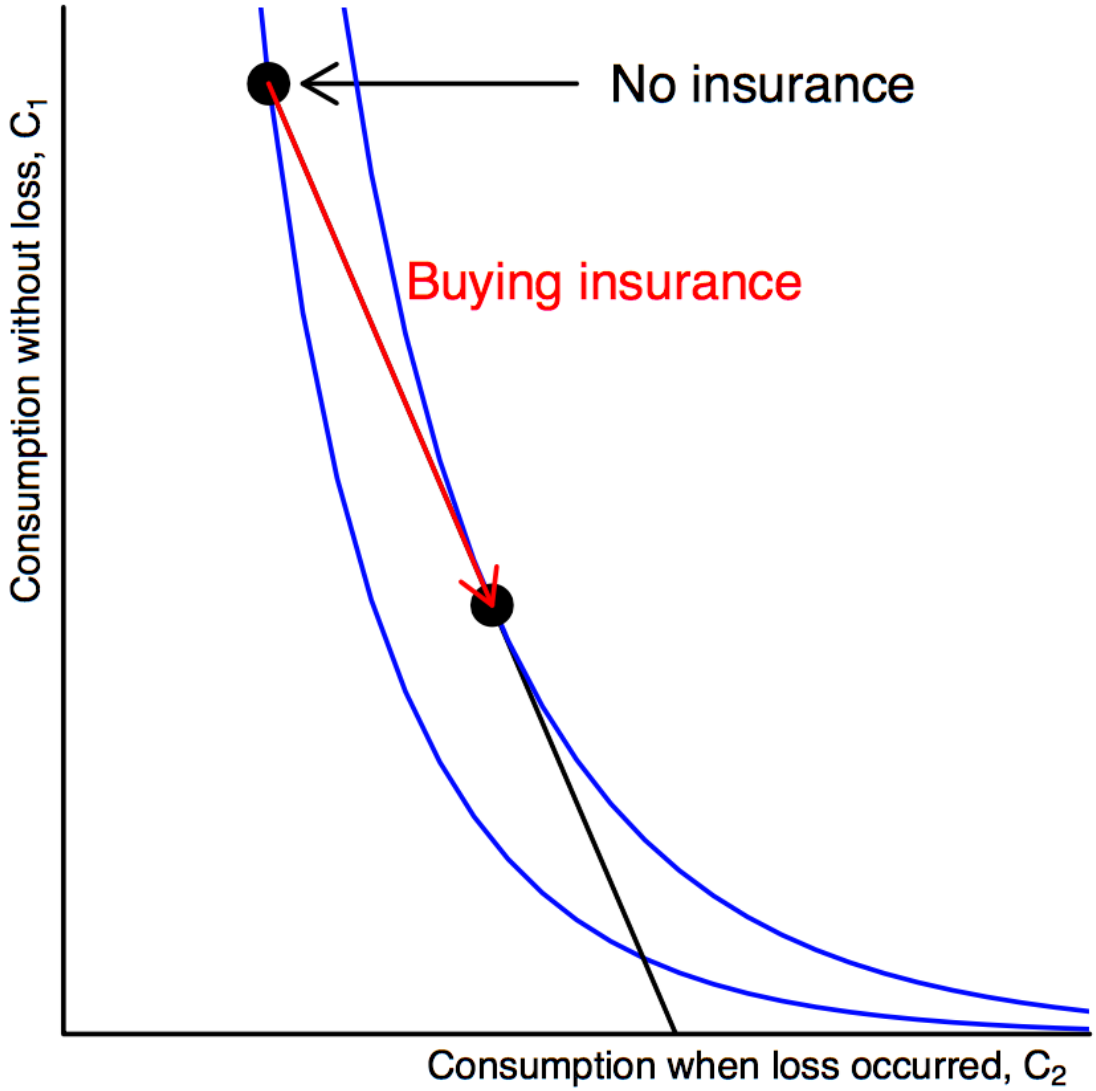
$$q \cdot C_2 + (1-q) \cdot C_1 = Y - q \cdot L$$

   Equivalently, the budget constraint *for each state* must hold

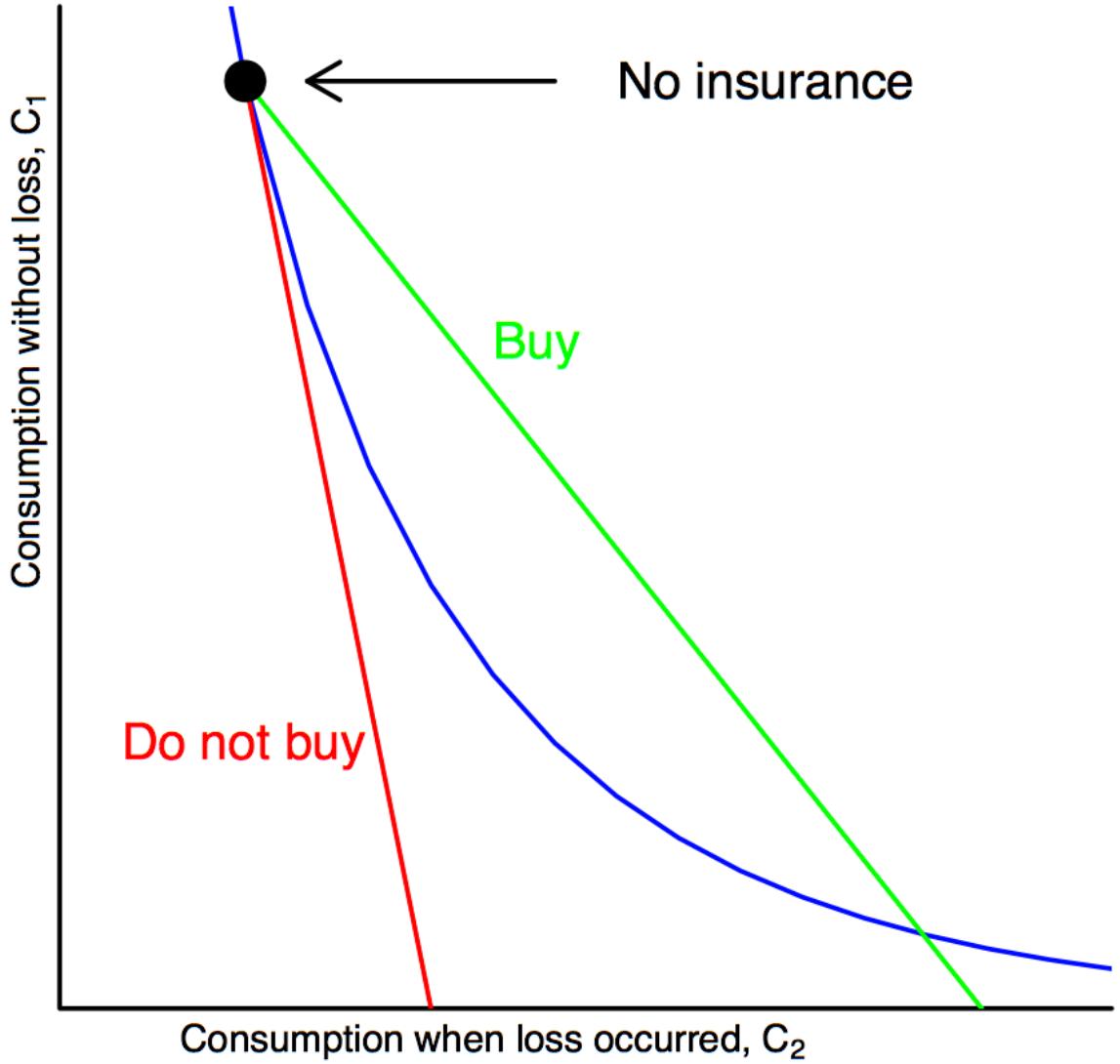
Not buying insurance – illustration



Buying insurance – illustration



Should you buy insurance?



Sample insurance problem

- Suppose you have a job paying $Y = \$2,500$ per month
- With $p = 0.1$ probability you get sick and your monthly earnings are reduced by $L = \$900$
- You spend all of your income on consumption and have no savings
- Your utility function is $u(C) = \sqrt{C}$

- Without access to insurance your expected income is your expected consumption over the healthy (H) and sick (S) states

$$\mathbb{E}[I] = (1 - p) \cdot C_H + p \cdot C_S = 0.9(2,500) + 0.1(1,600) = \$2,410$$

Sample problem: how much insurance?

- Suppose you have access to insurance at the per-dollar price $q = 1/9$
- How much coverage R ($) do you buy?
- At the optimum the MRS equals the price ratio

$$-\frac{(1/10)MU_s}{(9/10)MU_h} = -\frac{1/9}{8/9} \iff -\frac{1}{9}\sqrt{\frac{C_H}{C_S}} = -\frac{1}{8}$$

- Budget constraint in the healthy state:
  $C_H = Y - q \cdot R = 2,500 - R/9$
- Budget constraint in the sick state:
  $C_S = Y - L + (1 - q) \cdot R = 1,600 + 8R/9$
- Substitute each budget constraint into the MRS for C_H and C_S
- Solving for R, the optimal coverage is $R^* = 34,200/89 \approx \$384.27$, with total premium $q \cdot R^* = 3,800/89 \approx \$42.70$

Sample problem: how much would you pay for insurance?

- What is your maximum WTP for the first dollar of insurance?
  - Need to characterize the optimum for a consumer who is indifferent between no insurance and \$1 of insurance
  - Evaluate the MRS when $R = 0$ (no coverage):

$$MRS(2,500, 1,600) = -(1/9)\sqrt{2,500/1,600} = -5/36$$

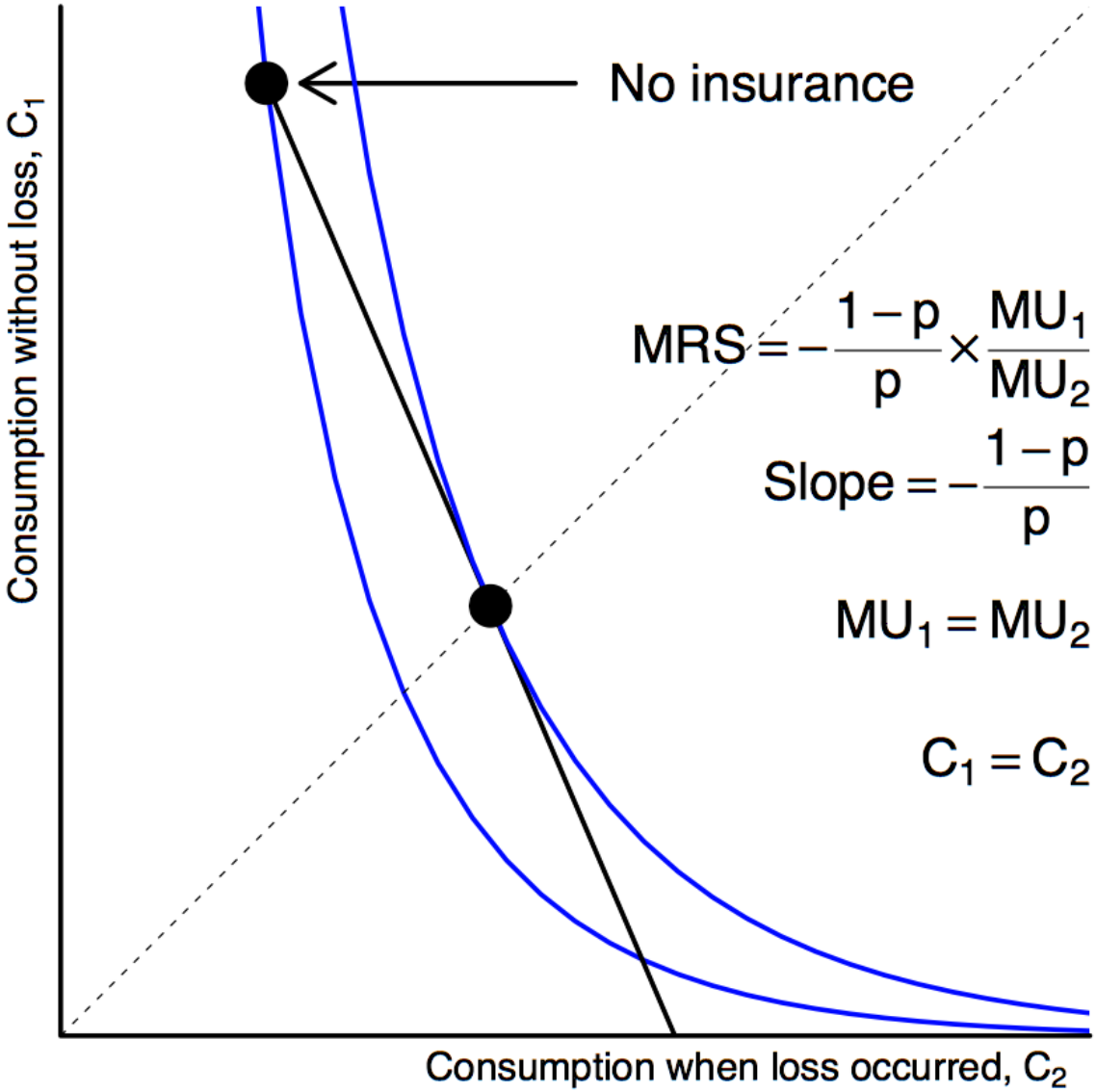
$$-5/36 = -\frac{q}{1-q} \implies q^* = 5/41$$

- What is your maximum WTP for full insurance?
  - Compute the premium m that renders you indifferent between no insurance and full insurance
  - EU under no insurance:
    $(1-p)\cdot\sqrt{C_H} + p\cdot\sqrt{C_S} = 0.9\sqrt{2,500} + 0.1\sqrt{1,600} = 49$
  - EU under full insurance: $\sqrt{2,500-m}$
  - After setting $\sqrt{2,500-m} = 49$ we obtain
    $m = 99 \implies q^{full} = m/L = 11/100 < q^*$

Actuarially fair insurance

- An insurance contract is actuarially fair when the insurance premium is equal to the expected value of insurance claims
- Insurance will be fairly priced if...
  - The market is perfectly competitive – insurers expect to earn zero profits due to free entry and exit
  - There is symmetric information
- Premium is $m = q \cdot R$, where q is the per-dollar price of coverage
- Expected profits of insurers are $\mathbb{E}[\pi] = m - R \cdot p = 0 \implies q = p$
- Per-dollar price of coverage set equal to the accident probability

Buying actuarially fair insurance



Asymmetric information in insurance markets

- Our basic framework for the optimal insurance choice assumed symmetric information
- When there is asymmetric information, one party (typically the customer in an insurance market) knows more than the other
- Two types of problems that arise in insurance markets with asymmetric information:
  1. Adverse selection (AS): the customer knows more about their risk profile than the insurance company does
  2. Moral Hazard (MH): an individual's decisions while they are insured increase the probability or magnitude of potential losses
- AS operates before insurance is purchased, while MH operates *after* the customer is already insured (unobserved actions)

Adverse selection – a simple model

- Assume firms earn zero profits (perfect competition)
- There are two types of customers – high and low-risk types ($i = L, H$)
- **Symmetric information benchmark**
  - Insurance firm knows the type of each customer
  - Offers separate and actuarially fair contracts to each type
  - Premia: $m_H = R \cdot p_H$ and $m_L = R \cdot p_L$
  - Since $p_H > p_L$, H types get charged more for same level of coverage
- **Asymmetric information**
  - Insurance firm cannot observe each customer's type
  - Strategy 1: assume customers are honest and charge them according to the type they report
  - Strategy 2: offer insurance at an average price based on the average accident probability $\bar{p}$

Adverse selection model – two strategies

- Strategy 1: high-risk types have an incentive to lie
  - Expected profits earned from low-risk types:
    $\mathbb{E}[\pi_L] = m_L - R \cdot p_L = R \cdot p_L - R \cdot p_L = 0$
  - Expected profits from high-risk types:
    $\mathbb{E}[\pi_H] = m_L - R \cdot p_H = R \cdot (p_L - p_H) < 0$

- Strategy 2: do average cost pricing using $p_H > \bar{p} > p_L$
  - Insurance is a good deal for the H types but a bad deal for the L types
  - At this price the low-risk types might not want to buy any contracts
  - Total expected profits are negative when only high-risk types buy:
    $\mathbb{E}[\pi] = \bar{m} - R \cdot p_H = R \cdot (\bar{p} - p_H) < 0$

- In both cases overall expected profits can be negative, so the firm is better off not providing any insurance – the market "unravels"

How might we test for adverse selection?

- Positive correlation test of Chiappori & Salanié (2000)
  - Compute the correlation of the probability a given group purchases insurance with the number of insurance claims filed by that group
  - People who have a high-risk profile are more likely to purchase insurance, and thus more likely to file claims
- Finkelstein & Poterba (2004) apply this test to annuity markets in the U.K. – what does an annuity insure against?
  - Annuitants with a longer life expectancy are more likely to purchase back-loaded annuities
  - Those with a shorter life expectancy are more likely to purchase annuities with guarantees
  - See Problem 1 of Problem Set 3

Limitations to the positive correlation test

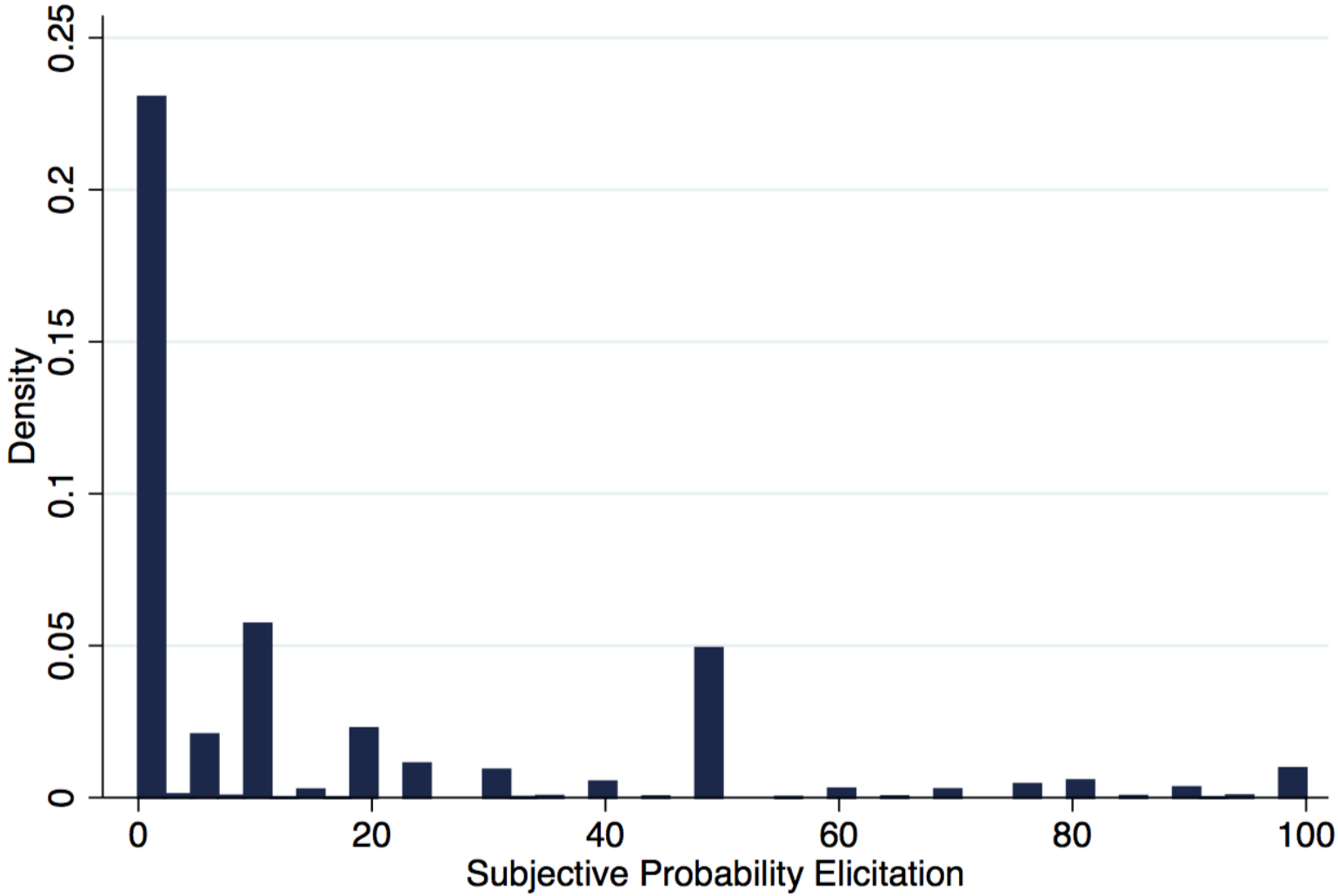
- People who buy insurance might be more likely to file claims due to a moral hazard problem, not adverse selection
  - Example: those with health insurance might use health services more because they pay lower out-of-pocket costs than the uninsured
- Positive correlation could be due to advantageous selection
  - Risk-averse individuals are more likely to both purchase insurance and file more claims
  - Behavior is due to a preference for preventing risk and not due to a high underlying accident risk
- The test can only be applied to insurance markets that exist!
  - Public insurance programs such as UI have no private counterpart
  - When participation is compulsory there is no adverse selection problem

Why no private market for unemployment insurance (UI)?

- Hendren (2017): a private market for UI would be too adversely selected to function ("unraveling")
  - If such a market existed, costs would be so high that no one would be willing to pay the UI premia
  - Evidence: elicit beliefs about probability of future unemployment
  - Health and Retirement Study asks: "*What is the percent chance (0-100) that you will lose your job in the next 12 months?*"
  - Find that subjective beliefs predict future unemployment status within groups of workers with similar demographics and jobs

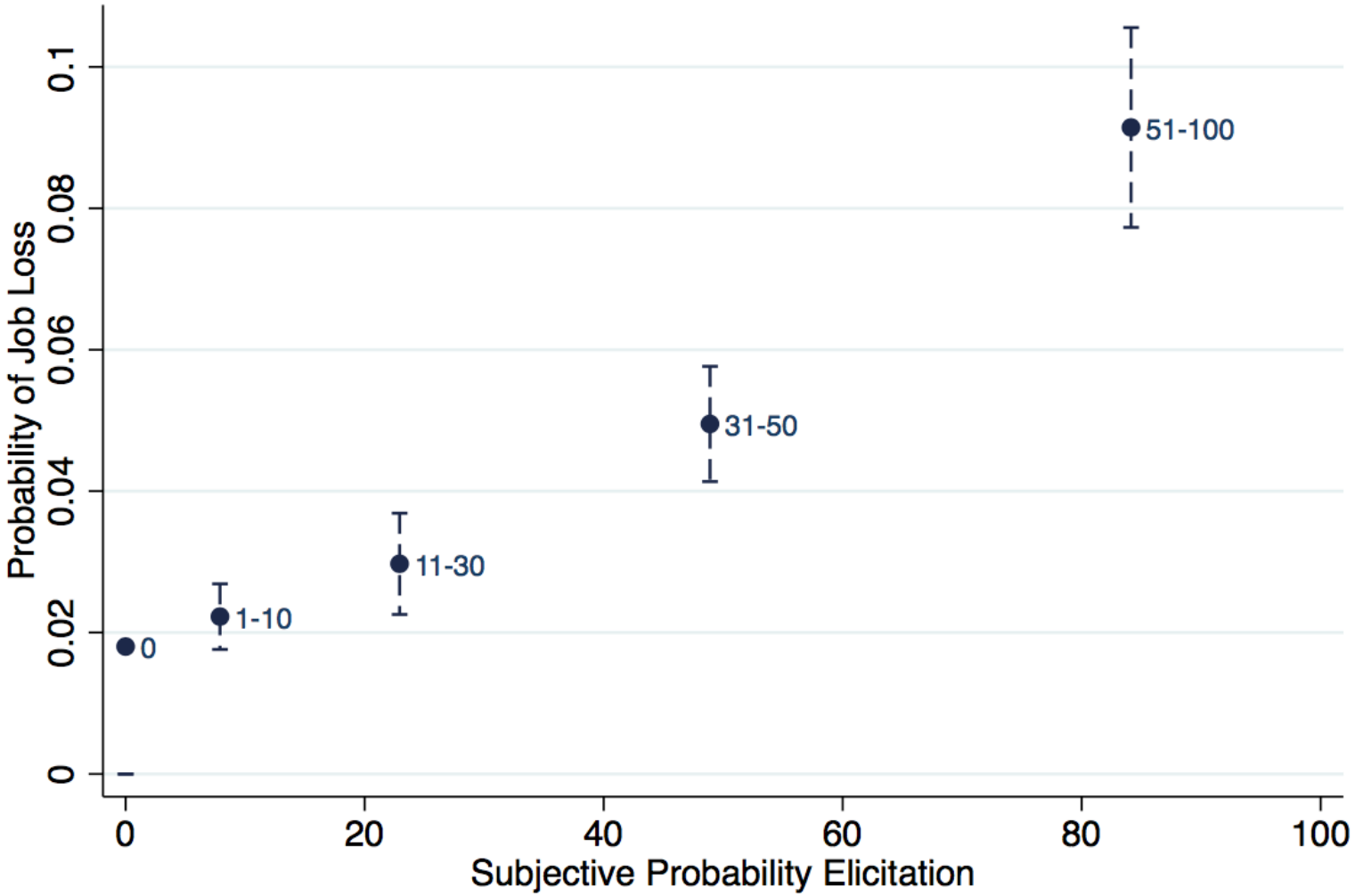
- Extension of the positive correlation test to environments where the private market doesn't exist
  - Looking at correlation between ex post risk and beliefs about whether you would benefit from insurance

People's beliefs about future unemployment



Source: Hendren (2017), "Knowledge of Future Job Loss and Implications for Unemployment Insurance," forthcoming *American Economic Review*

Adverse selection in unemployment insurance



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Role of government in providing insurance

- If the AS problem is severe enough, a private market for insurance may not be able to exist
- Government can coerce everyone to participate in a social insurance program either through a mandate or direct provision
  - Example: Minimum Essential Coverage provision of the ACA
  - 2016-17 penalty for not being covered equal to the max of 2.5% of your income or $695 per adult plus $347.50 per child
  - Those who can't afford private coverage get subsidy from the government or qualify for Medicaid/Medicare
- This does not mean that everyone benefits from social insurance
  - Individuals who would opt out in the private market are worse off if they are forced to participate and charged average cost

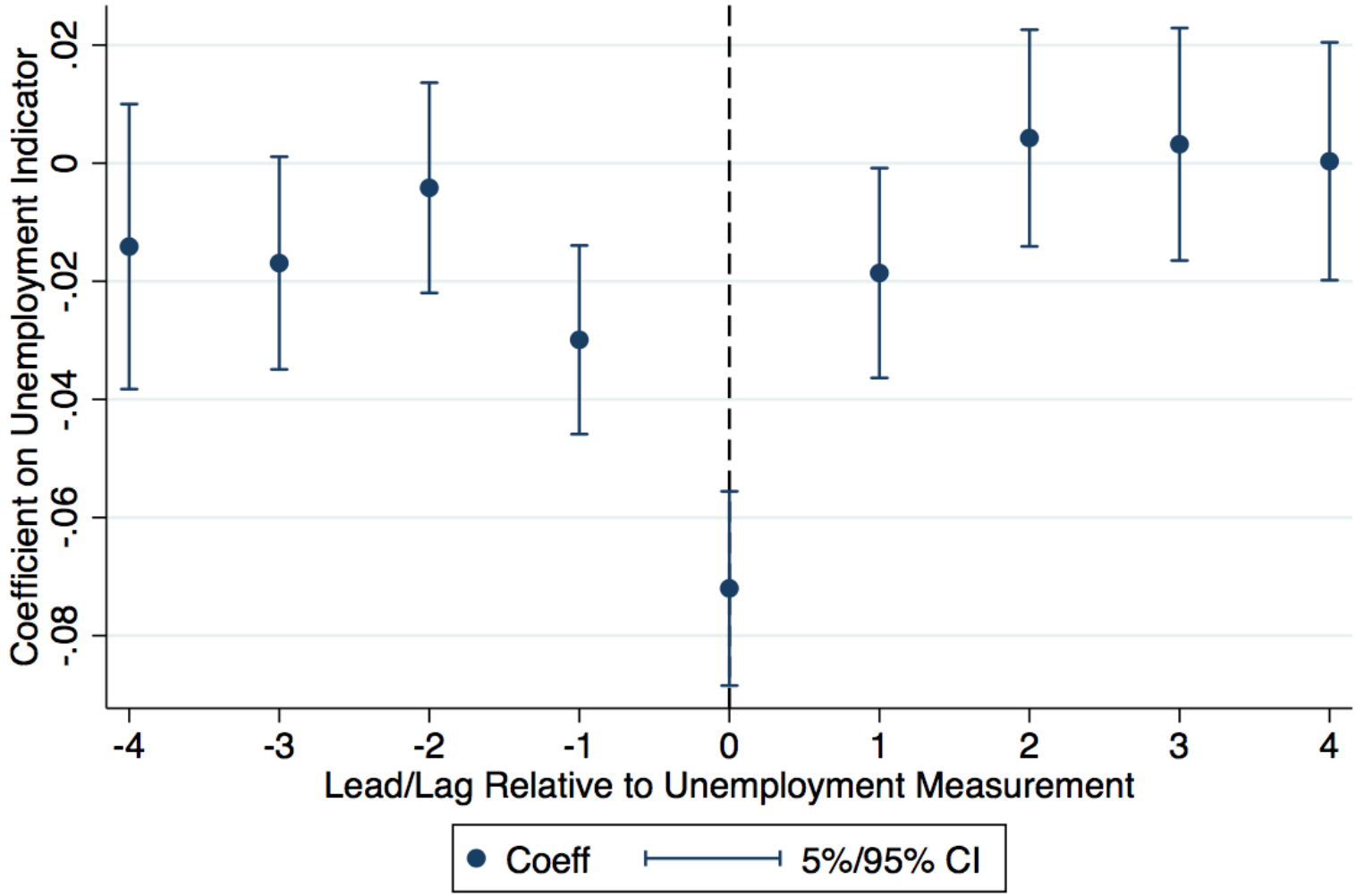
Examples of moral hazard

- Increasing the generosity of UI benefits leads unemployed people to search less for a new job
- Homeowners insurance leads to increased construction of houses in tornado prone areas
- Workers compensation and disability insurance programs encourage fake injury/disability claims
- Those with health insurance overuse medical care services
- Seasonal employment insurance (e.g. in Canada) incentivizes seasonal layoffs if the system is imperfectly experience rated

Social insurance and moral hazard

- Government has no major advantage in dealing with MH through insurance provision
- But other types of interventions may help with MH arising from private insurance
  - Examples: tickets for speeding, penalties for fraudulent insurance claims
- Because public provision of insurance can generate MH just like private insurance, government faces a cost-benefit trade-off
  - Benefit: insurance helps individuals smooth consumption across good and bad states
  - Cost: insurance encourages individuals to take actions with adverse consequences (MH)
- Optimal social insurance sets marginal benefit from consumption smoothing equal to marginal cost from MH

Drop in consumption growth around unemployment



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Other motivations for social insurance

- Redistribution: in private markets high-risk types get charged higher insurance premia than low-risk types
  - Part of this is due to uninsurable pre-existing conditions
  - Social insurance redistributes from low-risk to high-risk types
  - Can be thought of as ex-ante insurance (e.g. difficult to know whether you are at risk for Huntington's disease)

- Aggregate shocks: when the economy performs poorly everyone is in the "bad" state at the same time
  - Need to do intergenerational risk-sharing via taxes or borrowing
  - Contrast to private insurance markets which rely on cross-sectional risk-sharing
  - Private insurers may not have the liquidity to insure everyone during a recession

Other motivations continued

- Externalities: one person's lack of insurance can exert a negative externality on others
  - Example: paid sick leave can be thought of as a type of insurance against having to work while ill
  - An employee without sick pay might go to work while contagious and infect other employees
- Individual failures: people may not appropriately insure themselves without government provision (e.g. due to present-bias)
- Administrative costs/economies of scale
  - Social insurance has lower administrative costs – fixed costs of providing any insurance are divided over a larger number of claims
  - Higher private costs $\implies$ higher premia, so less risk averse consumers may be priced out of the market

Summary

- Asymmetric information simultaneously supports and limits arguments for government intervention in insurance markets
- If the private market is adversely selected, insurance may not be provided in the absence of government intervention
- On the other hand, government provision of insurance generates moral hazard $\Longrightarrow$ need to limit the generosity of public insurance benefits
- Next several lectures explore these issues in specific markets: old-age retirement, unemployment, disability, and health insurance