Connecting Theory to Data in Analyzing Social Insurance

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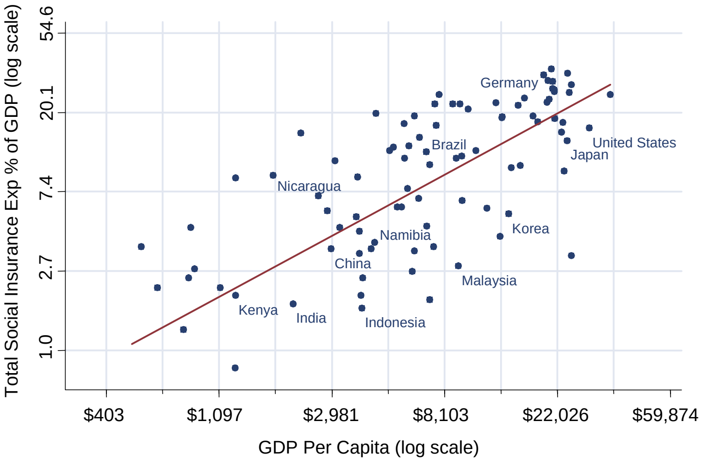
Introduction

- Social insurance has emerged as one of the major functions of modern governments over the past century

- Governments in developed countries insure a broad variety of risks
  - unemployment
  - health
  - disability
  - retirement
  - work injury



Source: International Labour Organization

Introduction

- Research on social insurance can be divided into the analysis of two broad questions

    1. When should government intervene in insurance markets?
    2. If the government intervenes, what is the optimal way to do so?

- Traditional work can be divided into two methodological strands

    1. Normative theoretical literature
    2. Positive empirical literature

Introduction

- Over the past two decades, researchers have made progress in connecting theory to data
- This chapter reviews and synthesizes this literature
    - Selective overview of models and evidence
- Survey is divided into two parts: motivations and optimal policy

Part 1: Motivations for Social Insurance

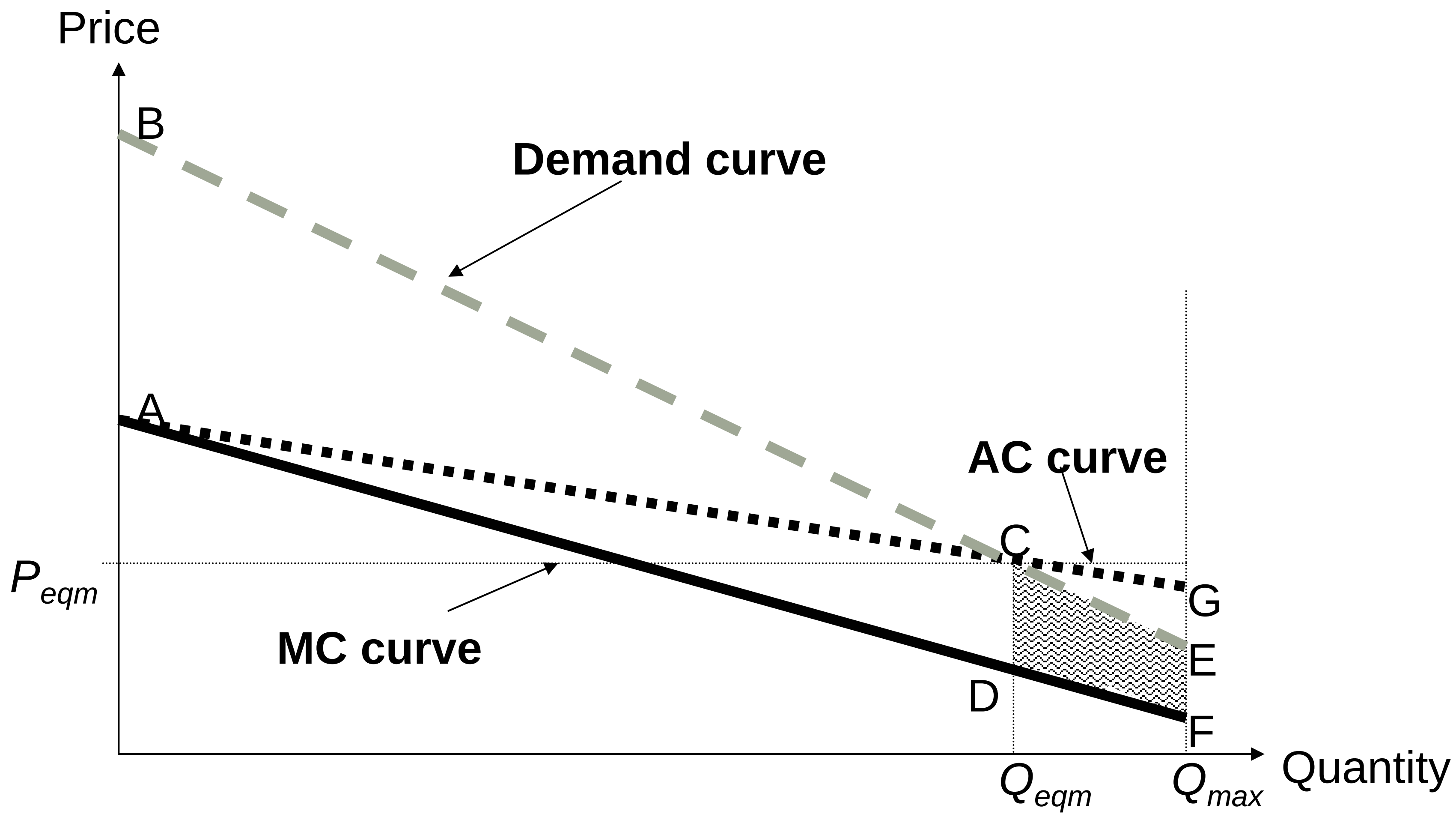
- Many motives for social insurance (Diamond 1977)
  - Market failures: externalities, asymmetric information
  - Paternalism
  - Redistribution (see chapters on taxation)

- Primary focus of recent literature: market failures due to adverse selection

Adverse Selection as a Motive for SI

- Seminal theoretical work from 1970s (Akerlof; Rothschild and Stiglitz...)
- Key lessons for social insurance
  - Competitive insurance equilibrium may not be efficient (sub-optimally low insurance coverage)
  - Potential welfare gains from government intervention in private insurance markets (mandates, subsidies)
- Two empirical questions motivated by theory
  - Testing: does selection exist in a particular insurance market?
  - Quantifying: welfare consequences of selection

Adverse selection: Textbook case



Source: Einav and Finkelstein (2011)

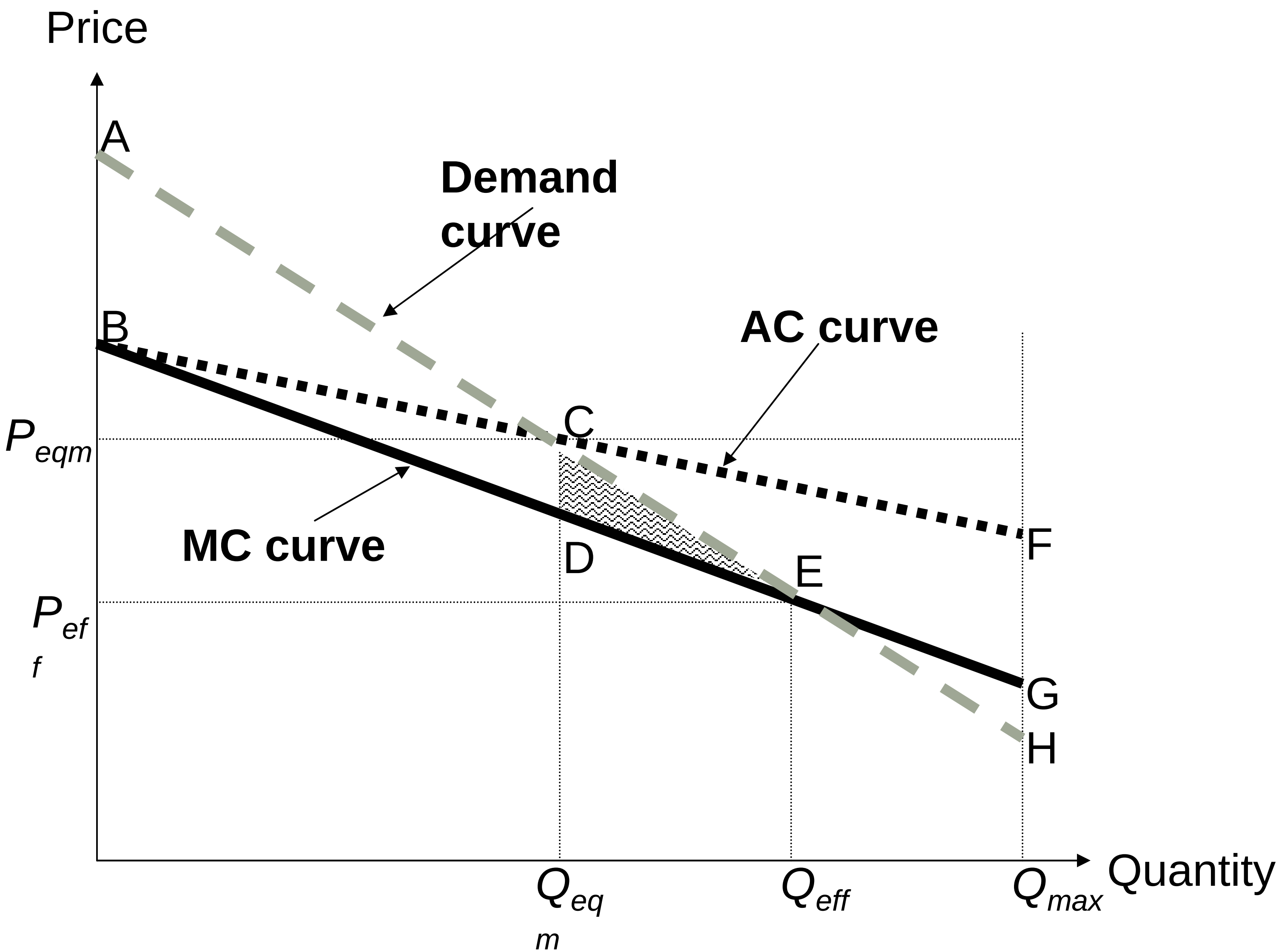
Public Policy in textbook case

- Competitive equilibrium produces too little insurance coverage
- Classic public policy interventions:
  - Mandates
    - Can achieve efficient outcome
    - Unambiguous welfare gain but magnitude an empirical question
  - Subsidies
    - Optimal level of subsidy must consider cost of public funds
    - Again an empirical question

Empirical departure I: Loads

- Non-trivial loading factors in a variety of insurance markets
  - Admin costs of marketing, selling, and paying out on policies
  - Annuities, health insurance, long-term care insurance...
- Result: whether or not mandates can achieve a welfare gain now an empirical question
  - Tradeoff between two forces:
    - Allocative inefficiency from adverse selection
    - Allocative inefficiency from mandating insurance to those for whom it is not efficient to buy

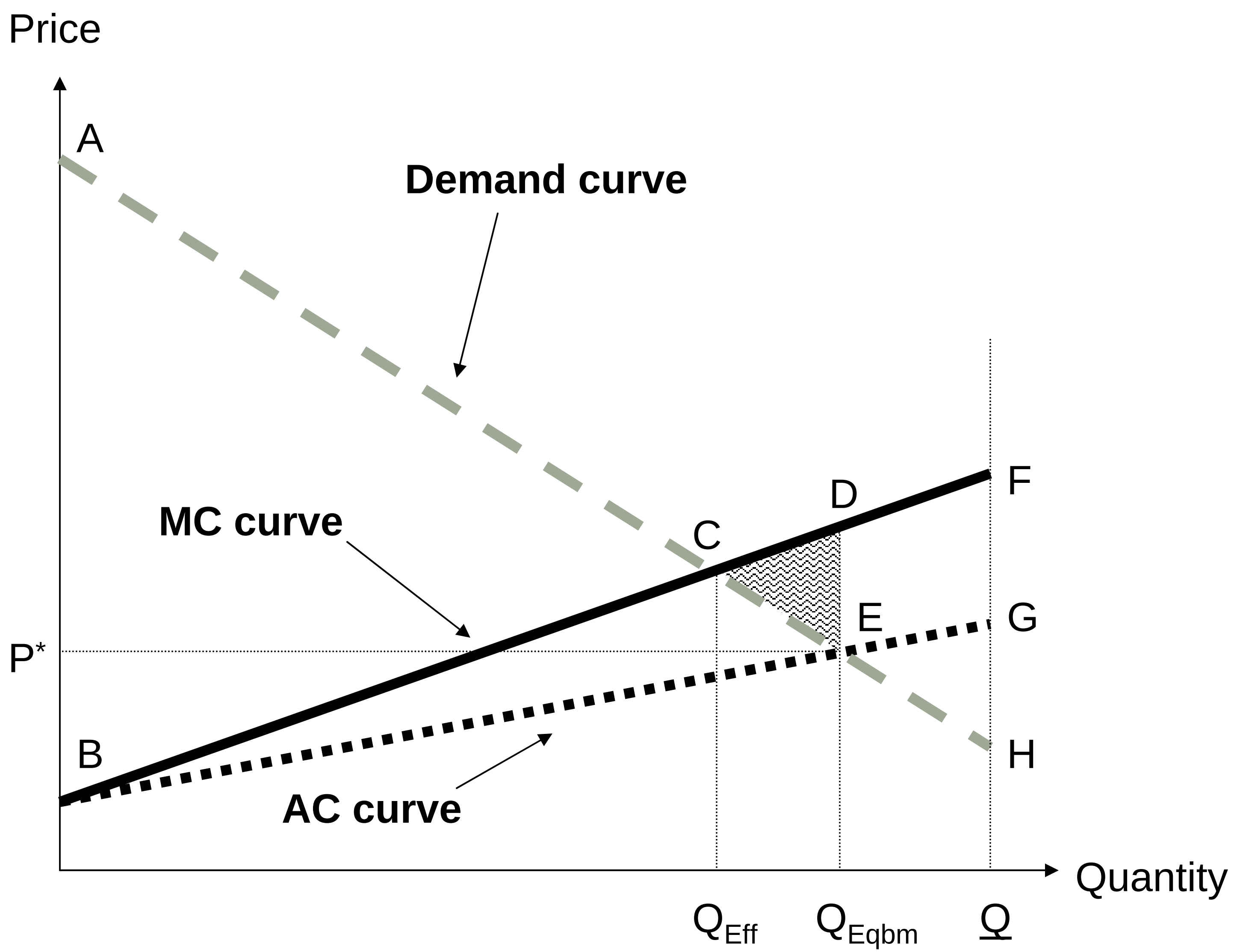
Implication of Loads



Empirical departure II: Preference Heterogeneity

- Traditional model assumes individuals vary only in their risk type (probability of accident).
  - Preferences (utility functions) same
- Recent empirical work has documented substantial preference heterogeneity over various types of insurance
  - Risk aversion (Finkelstein and McGarry 2006, Cohen and Einav 2007)
  - Cognitive ability (Fang, Keane and Silverman 2008)
- Preference heterogeneity can generate selection that is *advantageous*
  - Theoretical implications: over-insurance; *opposite* public policy implications (de Meza and Webb 2001)

Advantageous Selection



Testing for selection

- Test 1: positive correlation
  - Do those who have more insurance have higher expected costs?
  - Limitations: not robust to
    - Preference heterogeneity
    - Moral hazard

TABLE 2
SELECTION EFFECTS AND ANNUITY PRODUCT CHARACTERISTICS

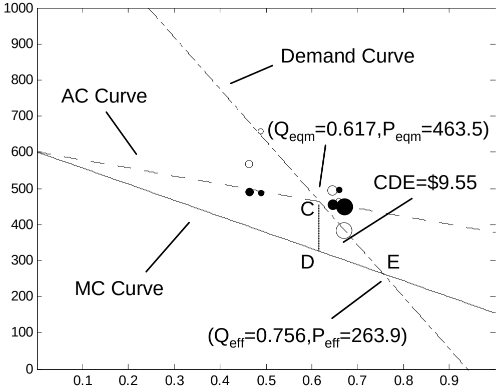
	Estimates from Hazard Model of Mortality after Purchasing an Annuity		Estimates from Linear Probability Model of Probability of Dying within Five Years	
Explanatory Variable	Compulsory Market (1)	Voluntary Market (2)	Compulsory Market (3)	Voluntary Market (4)
Index-linked	−.839***	−.894**	−.053***	−.185***
	(.217)	(.358)	(.019)	(.050)
Escalating	−1.085***	−1.497***	−.072***	−.152***
	(.113)	(.253)	(.010)	(.030)
Guaranteed	.019	.216***	.007*	.046***
	(.029)	(.060)	(.004)	(.016)
Capital-protected	…	.056	…	.064***
		(.051)		(.016)
Payment (£100s)	−.003***	.001**	−.0003***	.0003***
	(.0006)	(.0004)	(.0001)	(.0001)
Male Annuitant	.640***	.252***	.044***	.044***
	(.039)	(.051)	(.005)	(.014)
Observations	38,362	3,692	24,481	3,575
Number of deaths in sample	6,311	1,944	2,693	822

Source: Finkelstein and Poterba 2004

Testing for selection

- Test 1: positive correlation
  - Do those who have more insurance have higher expected costs?
  - Limitations: not robust to
    - Preference heterogeneity
    - Moral hazard
- Test 2: cost curve
  - Is marginal cost curve downward sloping?
  - Benefits: addresses two limitations of positive correlation test
  - Limitation: requires exogenous variation in prices

Results: graphical illustration



Welfare Costs of Selection

- Two approaches to empirically estimating welfare costs of selection:
  - Model consumer valuation of existing contracts as in previous graphs – "goods based" approach (Einav, Finkelstein, and Cullen 2010)
  - Model realized utility over insurance plans as a function of primitives – "characteristic based approach" (e.g. Carlin and Town 2010)
- Tradeoff:
  - Plan valuation approach: weaker assumptions but more limited counterfactual analysis
    - Cannot make welfare statements for contracts not observed
  - Realized utility approach requires stronger assumptions but allows analysis of counterfactual contracts not observed in data

Welfare Costs of Selection

- General conclusion of estimates to date: welfare costs of selection small
    - On the order of a few percent of premiums
- But interpretation unclear
    - Lampost problem: existing empirical work focused mostly on welfare costs of pricing distortions for existing contracts
    - Larger welfare costs where markets have completely unraveled?

Optimization Failures as a Motivation for SI

- Given adverse selection, expect individuals to "self-insure" against temp. shocks by building up savings
- With such buffer stocks, still no need for large social safety nets to insure against temporary shocks such as unemployment
- In practice, individuals appear to be very liquidity constrained when hit by shocks: median job loser has <$200 in assets
- Suggests that *individual* failures to optimize must be an important motive for SI
- Difficult to generate non-negligible optimal benefit levels in standard dynamic lifecycle models (Lucas 1989)

Part 2: Optimal Public Insurance

1. Formula for Optimal Benefit Level in Static Model
2. Empirical Implementations
3. Relaxing Key Assumptions
4. Other Dimensions of Policy

Static Model [Baily 1976, Chetty 2006]

- Static model with two states: high (employed) and low (unemployed)
- Let w_h denote the individual's income in the high state and $w_l < w_h$ income in the low state
- Let A denote wealth, c_h consumption in the high state, and c_l consumption in the low state
- Agent controls probability of being in the bad state by exerting effort e at a cost $\psi(e)$
- Choose units of e so that the probability of being in the high state is given by $p(e) = e$

Static Model: Setup

- UI system that pays constant benefit b to unemployed agents
- Benefits financed by lump sum tax $t(b)$ in the high state
- Govt's balanced-budget constraint:

$$e \cdot t(b) = (1 - e) \cdot b$$

- Let $u(c)$ denote utility over consumption (strictly concave)
- Agent's expected utility is

$$eu(A + w_h - t(b)) + (1 - e)u(A + w_l + b) - \psi(e)$$

Static Model: Second Best Problem

- Agents maximize expected utility, taking b and $t(b)$ as given

$$\max_{e} eu(A + w_h - t) + (1 - e)u(A + w_l + b) - \psi(e)$$

- Let indirect expected utility be denoted by $V(b, t)$

- Government's problem is to maximize agent's expected utility, taking into account agent's behavioral responses:

$$\max_{b,t} V(b, t)$$
$$\text{s.t. } e(b)t = (1 - e(b))b$$

Two Approaches to Characterizing Optimal Policy

1. **Structural**: specify complete models of economic behavior and estimate the primitives
   - Identify b^* as a fn. of discount rates, borrowing constraints, etc.
   - Challenge: difficult to identify all primitive parameters
2. **Sufficient Statistic:** derive formulas for b^* as a fn. of high-level elasticities
   - Estimate elasticities using quasi-experimental research designs
   - Requires weaker assumptions but only permits local welfare analysis

Static Model: Second Best Optimum

- Optimal benefit level b satisfies:

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} = \frac{\varepsilon_{1-e,b}}{e}$$

- LHS: benefit of transferring \$1 from high to low state
- RHS: cost of transferring \$1 due to behavioral responses
- Large literature on estimating behavioral responses to social insurance programs ($\varepsilon_{1-e,b}$), reviewed in Krueger and Meyer handbook chapter

Maximum Indemnity Benefits in 2003

State	Type of permanent impairment					Temporary Injury (10 weeks)
	Arm	Hand	Index finger	Leg	Foot	
California	$108,445	$64,056	$4,440	$118,795	$49,256	$6,020
Hawaii	180,960	141,520	26,800	167,040	118,900	5,800
Illinois	301,323	190,838	40,176	276,213	155,684	10,044
Indiana	86,500	62,500	10,400	74,500	50,500	5,880
Michigan	175,657	140,395	24,814	140,395	105,786	6,530
Missouri	78,908	59,521	15,305	70,405	52,719	6,493
New Jersey	154,440	92,365	8,500	147,420	78,200	6,380
New York	124,800	97,600	18,400	115,200	82,000	4,000

Source: Gruber 2007

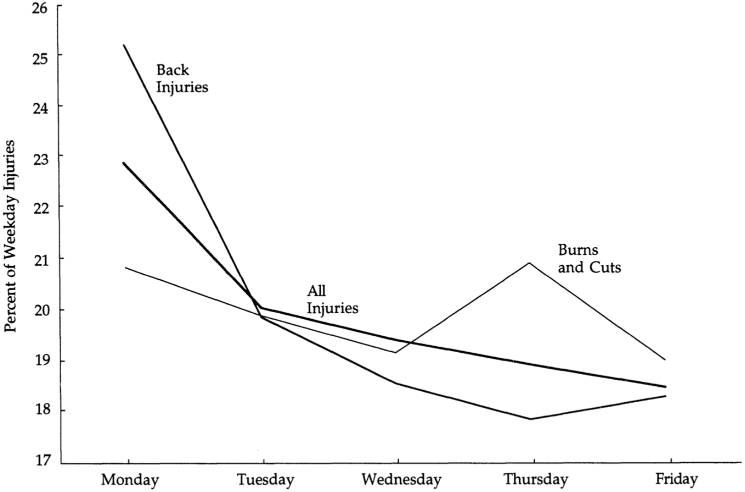


Figure 1. Distribution of Weekday Injuries.

Source: Card and McCall 1996

Empirical Implementation

- Calculating optimal benefit level requires identification of gap in marginal utilities $\frac{u'(c_l)-u'(c_h)}{u'(c_h)}$
- Three ways to identify $\frac{u'(c_l)-u'(c_h)}{u'(c_h)}$ empirically
  1. Gruber (1997): cons-based approach
  2. Shimer and Werning (2007): reservation wages
  3. Chetty (2008): moral hazard vs liquidity

Empirical Implementation 1: Consumption Smoothing

- Write marginal utility gap using a Taylor expansion

$$u'(c_l) - u'(c_h) \approx u''(c_h)(c_l - c_h)$$

- Defining coefficient of relative risk aversion $\gamma = \frac{-u''(c)c}{u'(c)}$, we obtain

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} \approx \gamma \frac{\Delta c}{c}$$

- Gap in marginal utilities is a function of curvature of utility (risk aversion) and consumption drop from high to low states

Empirical Implementation 1: Consumption Smoothing

- Gruber (1997) uses PSID data on food consumption and cross-state variation in UI benefit levels to estimate

$$\frac{\Delta c}{c} = \beta_1 + \beta_2 \frac{b}{w}$$

- Finds $\beta_1 = 0.24$, $\beta_2 = -0.28$
- Without UI, cons drop would be about 24%
- Mean drop with current benefit level ($b = 0.5$) is about 10%

Empirical Implementation 1: Consumption Smoothing

- Optimal benefit level $\frac{b}{w}^*$ varies considerably with γ

γ	1	2	3	4	5	10
$\frac{b}{w}^*$	0	0.05	0.31	0.45	0.53	0.7

- Problem: benefit level sensitive to level of risk aversion

- Estimates of risk aversion highly context-specific and unstable

Empirical Implementation 2: Moral Hazard vs. Liquidity

- First order condition for optimal search intensity:

$$\psi'(e^*) = u(c_h) - u(c_l)$$

- Comparative statics of this equation imply that gap in marginal utilities is proportional to ratio of liquidity effect to substitution effect:

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} = \frac{\partial e/\partial A}{\partial e/\partial w_h} = \frac{\partial e/\partial A}{\partial e/\partial b - \partial e/\partial A}$$

- Substitution effect measures moral hazard; liquidity effect measures degree of market incompleteness

- Advantage of this formula: does not require data on consumption or estimates of risk aversion

Figure 5a

Effect of Severance Pay on Nonemployment Durations

Source: Card, Chetty, and Weber 2007

Shimer and Werning 2007: Reservation-Wage Model

- Reservation wage model: probability of finding job (e) determined by decision to accept or reject a wage offer, not search effort

- Wage offers drawn from distribution $w \sim F(x)$

- Reservation wage prior to job search satisfies

$$u(\bar{w}_0 - t) = W(b)$$

- Government's problem is

$$\max W(b) = \max u(\bar{w}_0 - t) = \max \bar{w}_0 - t$$

- Yields a formula for optimal benefits in terms of reservation wages:

$$\frac{dW}{db} = \frac{d\bar{w}_0}{db} - \frac{1-e}{e} \cdot (1 + \frac{1}{e} \cdot \varepsilon_{1-e,b})$$

Figure 10a

Effect of Severance Pay on Subsequent Wages

Source: Card, Chetty, and Weber 2007

Key Assumptions in the Static Model

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} = \frac{\varepsilon_{1-e,b}}{e}$$

- This formula was derived under several strong and unrealistic assumptions
- Now consider the consequences of relaxing these assumptions
- Basic theme: formula is robust to many types of generalizations, except for changes that introduce additional externalities into the model

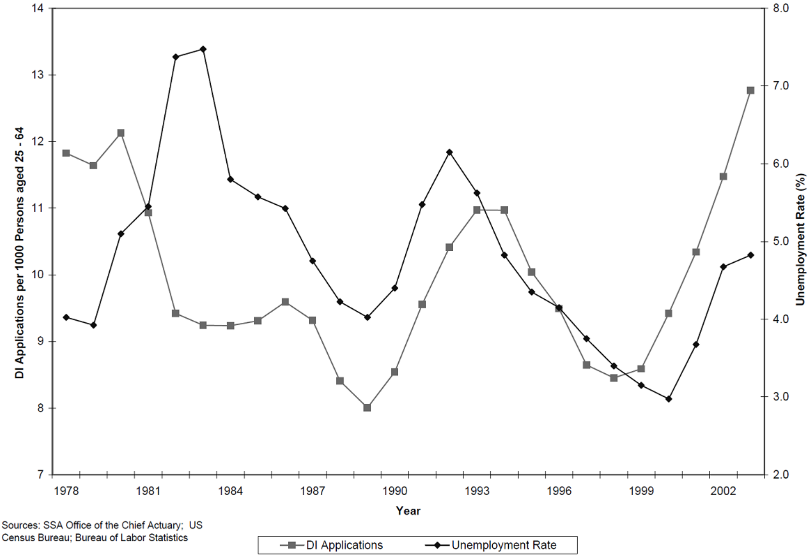
Extension 1: Dynamics

- Consider a dynamic model in which agents choose consumption and face an asset limit
- Formula above goes through with minor modifications
- General result: formula holds in a model in which agent chooses N behaviors and faces M constraints provided that agent maximizes utility subject to constraints (Chetty 2006)
  - Intuition: envelope conditions used to derive formula still apply
  - All behavioral responses have second-order effects on welfare except change in effort (e), which has a first-order effect on government revenue
- Main implication: empirical parameters above are "sufficient statistics" for welfare analysis in a broad class of positive models
- Key assumption: private welfare is maximized by agents subject to constraints

Extensions 2-4: Externalities

- Private insurance $\rightarrow$ "multiple dealing" externalities (Pauly 1974)
  - Expansion of government benefit has first-order fiscal externality on private insurer's budget
- Externalities on government budgets due to income taxes and other social insurance programs

Figure 5: DI Applications and Unemployment Rate



Sources: SSA Office of the Chief Actuary; US Census Bureau; Bureau of Labor Statistics

Source: Duggan and Imberman 2005

Extensions 2-4: Externalities

- Private insurance $\rightarrow$ "multiple dealing" externalities (Pauly 1974)
  - Expansion of government benefit has first-order fiscal externality on private insurer's budget
- Externalities on government budgets due to income taxes and other social insurance programs
- Social multiplier effects and congestion externalities
  - Complementarities across individuals in utility of leisure [Lindbeck et al. 1999]
  - Search externalities with job rationing [Landais, Michaillat, Saez 2011]

Extension 5: Imperfect Optimization

- Conceptual challenges in welfare analysis in behavioral models (Bernheim chapter)
- Structural approach: DellaVigna and Paserman (2005) on UI, Fang and Silverman (2009) on welfare program participation
- Sufficient statistic approach: Spinnewijn (2011) on UI with over-optimistic agents

Other Dimensions of Policy: Path of Benefits

- Tradeoff: upward sloping path $\longrightarrow$ more moral hazard but more consumption-smoothing benefits (Shavell and Weiss 1979)
- Tools of new dynamic public finance literature have been used to analyze optimal path of benefits in more general models
  - Hopenhayn and Nicolini (1997) – show optimal path is declining when govt. can control consumption
  - Werning (2002) extends analysis to case with hidden savings
  - Shimer and Werning (2008) – with perfect liquidity and CARA utility, optimal benefit path is flat

Takeup

- Takeup rate is very low for most SI programs – a major puzzle in this literature (Currie 2004)
  - Why leave money on the table?
- Andersen and Meyer (1997) show that after-tax UI replacement rate affects level of takeup.
  - So at least some seem to be optimizing at the margin.
- Possible explanations: myopia, stigma, hassle, lack of info.

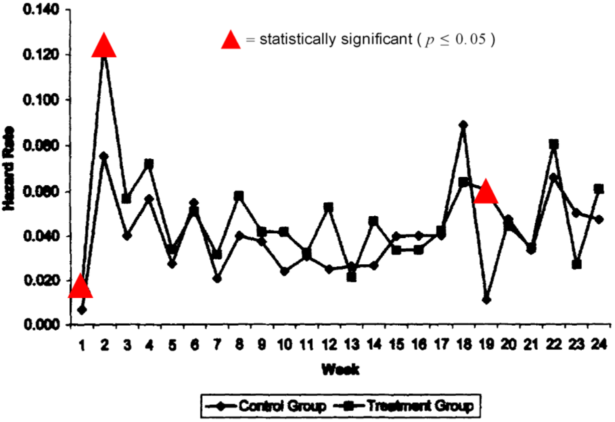


FIGURE 2. HAZARD FUNCTIONS OF THE TREATMENT AND CONTROL GROUPS, KENTUCKY WPRS EXPERIMENT, OCTOBER 1994 TO JUNE 1996

Source: Black, Smith, Berger, and Noel 2003

Mandated Savings

- Alternative to tax and transfer based insurance system: mandated savings
  - Feldstein and Altman (2007): pay UI taxes into a savings account
  - if unemployed, deplete this savings account according to current benefit schedule
  - If savings exhausted, government pays benefit as in current system (financed using an additional tax)
- Idea: people internalize loss of money from staying unemp longer
  - Reduces distortion from UI while providing benefits as in current system
  - Problem: to internalize incentives at retirement, agents must be forward looking, but then no need to mandate savings

Challenges for Future Work

1. Evidence on parameters for many programs
2. Models with imperfect optimization
3. Incorporation of general equilibrium responses
4. Integrating literature on motives for insurance with work on optimal insurance
5. Evaluating global policy reforms (e.g. universal healthcare) rather than local policy changes