Social Insurance: Connecting Theory to Data

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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
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

Price

Demand curve

AC curve

MC curve

$P_{eqm}$

$P_{ef}$

$Q_{eq}$

$Q_{eff}$

$Q_{max}$

$Q_{eqm}$

$Q_{max}$
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

Demand curve

MC curve

AC curve

Price

Quantity
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>
<thead>
<tr>
<th>EXPLANATORY VARIABLE</th>
<th>Compulsory Market (1)</th>
<th>Voluntary Market (2)</th>
<th>Compulsory Market (3)</th>
<th>Voluntary Market (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index-linked</td>
<td>-.839*** (.217)</td>
<td>-.894** (.358)</td>
<td>-.053*** (.019)</td>
<td>-.185*** (.050)</td>
</tr>
<tr>
<td>Escalating</td>
<td>-1.085*** (.113)</td>
<td>-1.497*** (.253)</td>
<td>-.072*** (.010)</td>
<td>-.152*** (.030)</td>
</tr>
<tr>
<td>Guaranteed</td>
<td>.019 (.029)</td>
<td>.216*** (.060)</td>
<td>.007* (.004)</td>
<td>.046*** (.016)</td>
</tr>
<tr>
<td>Capital-protected</td>
<td>... (.056)</td>
<td>... (.051)</td>
<td>... (.004)</td>
<td>... (.016)</td>
</tr>
<tr>
<td>Payment (£100s)</td>
<td>-.003*** (.0006)</td>
<td>.001** (.0004)</td>
<td>-.0003*** (.0001)</td>
<td>.0003*** (.0001)</td>
</tr>
<tr>
<td>Male Annuitant</td>
<td>.640*** (.039)</td>
<td>.252*** (.051)</td>
<td>.044*** (.005)</td>
<td>.044*** (.014)</td>
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<tr>
<td>Observations</td>
<td>38,362</td>
<td>3,692</td>
<td>24,481</td>
<td>3,575</td>
</tr>
<tr>
<td>Number of deaths in</td>
<td>6,311</td>
<td>1,944</td>
<td>2,693</td>
<td>822</td>
</tr>
</tbody>
</table>

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

(Q_{eqm}=0.617, P_{eqm}=463.5)

(Q_{eff}=0.756, P_{eff}=263.9)

CDE=$9.55
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
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 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
  \[ eu(A + w_h - t(b)) + (1 - e)u(A + w_l + b) - \psi(e) \]
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:

$$\max_{b,t} V(b, t)$$

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
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

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

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
  2. Shimer and Werning (2007): reservation wages
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
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 \( \gamma \)

<table>
<thead>
<tr>
<th>( \gamma )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{b^*}{w} )</td>
<td>0</td>
<td>0.05</td>
<td>0.31</td>
<td>0.45</td>
<td>0.53</td>
<td>0.7</td>
</tr>
</tbody>
</table>

- 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:

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

- 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
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.
Private insurance → “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
Private insurance → “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)


- Sufficient statistic approach: Spinnewijn (2011) on UI with over-optimistic agents
Other Dimensions of Policy: Path of Benefits

- Tradeoff: upward sloping path → 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 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