Asymmetric Information and Adverse selection

Health Economics

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1

Introduction

- Intermediate micro – build models of individual, firm and market behavior
- Most models assume actors fully informed about the market specifics
  - Know prices, incomes, market demand, etc.
- However, many markets do not have this degree of information
- Look at the role of 'imperfect information'

2

- This is more than just 'uncertainty' – we've already dealt with that issue
- Problem of asymmetric information
  - Parties on the opposite side of a transaction have different amounts of information
  - Ex:
    - Car buyers/house sellers
    - Prospective employees/employers
- Health care ripe w/ problems of asymmetric information
  - Patients know their risks, insurance companies may not
  - Doctors understand the proper treatments, patients may not

3

Problem of individual insurance

- Consider market for health insurance
- Who has greatest demand?
  - Not low income
  - Risk averse
  - People who anticipate greater spending
- Problem
  - Firms do not know risk – people do
  - Asymmetric information (AI)
- AI can lead to poor performance in market

4

This section

- Outline problem of asymmetric information and adverse selection
- Focus on
  - How selection can impact market outcomes
  - 'How much' adverse selection is in the market
  - Give some examples
  - How home systems might get around AI/AS

5

- Focus in this chapter will be on the consumer side of AI – how their information alters insurance markets
- Other examples from the supply side we will do later

6

Market for Lemons

- Nice simple mathematical example of how asymmetric information (AI) can force markets to unravel
- George Akeloff, 2001 Nobel Prize
- Good starting point for this analysis, although it does not deal with insurance

7

Problem Setup

- Market for used cars
- Sellers know exact quality of the cars they sell
- Buyers can only identify the quality by purchasing the good
- Buyer beware: cannot get your $ back if you buy a bad car

8

- Two types of cars: high and low quality
  - High quality cars are worth $22,000
  - low are worth $2000
- Suppose that people know that in the population of used cars that ½ are high quality
  - Already a strong (unrealistic) assumption
  - But even with this strong assumption, we get startling results

9

- Buyers do not know the quality of the product until they purchase
- Assume firms (buyers) are risk neutral
- How much are they willing to pay?
- Expected value = (1/2)$22K + (1/2)$2K = $12K
- People are willing to pay $12K for an automobile
- Would $12K be the equilibrium price?

10

- Who is willing to sell an automobile at $12K
  - High quality owner has $22K auto
  - Low quality owner has $2K
- Only low quality owners enter the market
- Suppose you are a buyer, you pay $12K for an auto and you get a lemon, what would you do?

11

- Sell it for on the market for $12K
- Eventually what will happen?
  - Low quality cars will drive out high quality
  - Equilibrium price will fall to $2000
  - Only low quality cars will be sold
- Here AI/AS means that only a market for low quality goods exists

12

Some solutions?

- Deals can offer money back guarantees
  - Does not solve the asymmetric info problem, but treats the downside risk of asy. Info
- Buyers can take to a garage for an inspection
  - Can solve some of the asymmetric information problem

13

Rothschild-Stiglitz

- Formal example of AI/AS in insurance market
- Incredibly important theoretical contribution because it defined what would happen in an equilibrium
- Stiglitz shared prize in 2001 w/ Akerloff and Michael Spence – all worked on AI/AS

14

- p = the probability of a bad event
- d = the loss associated with the event
- W=wealth in the absence of the event

- EU_{wi} = expected utility without insurance
- $EU_{wi} = (1-p)U(W) + pU(W-d)$

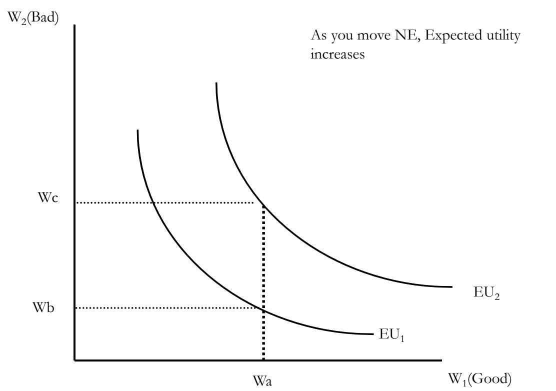
15

Graphically illustrate choices

- Two goods: Income in good and bad state
- Can transfer money from one state to the other, holding expected utility constant
- Therefore, can graph indifference curves for the bad and good states of the world

- $EU_{wi} = (1-p)U(W) + pU(W-d)$
  $= (1-P)U(W_1) + PU(W_2)$

16



17

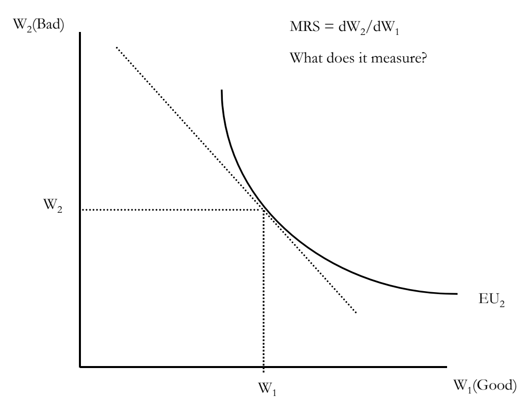
What does slope if the IC equal?

- $EU_w = (1\text{-}p)U(W_1) + pU(W_2)$
- $dEU_w = (1\text{-}p)U'(W_1)dW_1 + pU'(W_2)dW_2 = 0$
- $dW_2/dW_1 = -(1\text{-}p)U'(W_1)/[pU'(W_2)]$
  - Slope of indifference curve

18

- $MRS = dW_2/dW_1$
- How much income in the bad state to you have to give up to get $1 in the good state and keep utility constant

19



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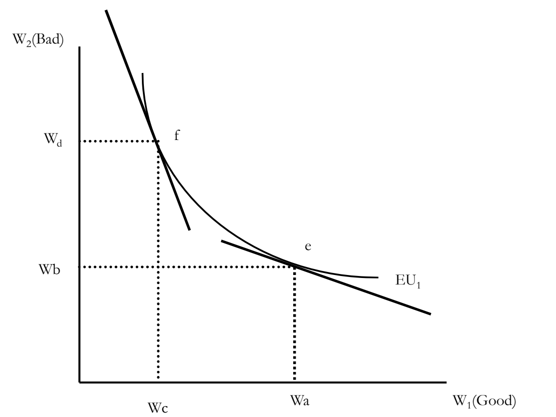


21

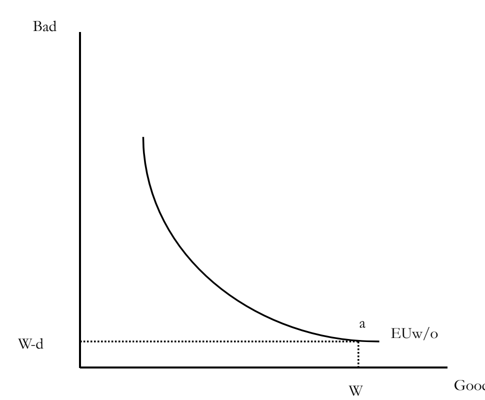
- At point F
  - lots of W_2 and low MU of income in bad state
  - Little amount of W_1, MU of income of W_1 is high
  - Need to give up a lot of income in the bad state to get one more $ in the good state and keep utility constant
- At point E,
  - lots of W_1 and little W_2
  - MU of W_1 is low, MU_2 is high, don't need give up much income in the bad state to get $1 in the good state and keep utility constant

22

Initial endowment

- Original situation (without insurance)
  - Have W in income in the good state
  - W-d in income in the bad state
- Can never do worse than this point
- All movement will be from here
- Base case from our section on expected utility

23



24

Add Insurance

- EU_w = expected utility with insurance
- pay α_1 in premiums for insurance
- α_2 net return from the insurance (payment after loss minus premium)

- $EU_w = (1-p)U(W- \alpha_1) + pU(W-d+\alpha_2)$

25

Insurance Industry

- With probability 1-p, the firm will receive α_1 and with probability p they will pay α_2
- $\pi = (1-p)\,\alpha_1 - p\,\alpha_2$

- With free entry $\pi=0$
- Therefore, $(1-p)/p = \alpha_2/\alpha_1$
- $(1-p)/p$ is the odds ratio
- α_2/α_1 = MRS of $ for coverage and $ for premium – what market says you have to trade money from the bad state to get one more dollar in the good

26

Thinking ahead -- some intuition

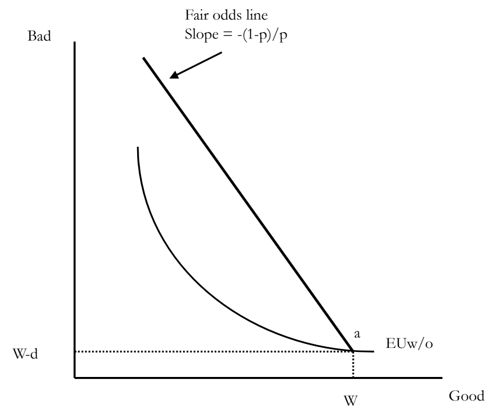
- We have two exchanges
  - What you are willing to exchange money from the good to the bad state
  - What the market says you have to exchange money from the good to the bad state
- An equilibrium will occur when these two are equal

27

Fair odds line

- People are endowed with initial conditions
- They can move from the endowment point by purchasing insurance – moving income from the good to the bad state
- The amount the market says they have to trade is the fair odds line -- a line out of the endowment with the slope equal to the fair odds
- When purchasing insurance, the choice must lie along that line

28



29

- We know that with fair insurance, people will fully insure
- Income in both states will be the same
- $W- \alpha_1 = W-d+\alpha_2$
- Which means $W_1=W_2$ and $d= \alpha_1+ \alpha_2$
- Let W_1 be income in the good state
- Let W_2 be income in the bad state

30

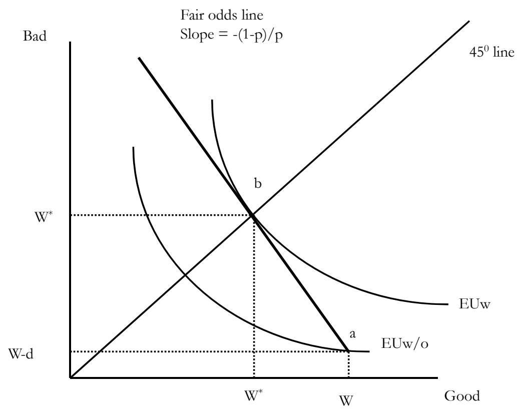
- $dEU_w = (1-p)U'(W_1)dW_1 + pU'(W_2)dW_2=0$
- $dW_2/dW_1 = -(1-p)U'(W_1)/[pU'(W_2)]$
- With fair ins., $W_1=W_2$ and $U'(W_1) = U'(W_2)$
- So $dW_2/dW_1 = -(1-p)/p$ at util. max. point

31

What do we know

- With fair insurance
  - Contract must lie along fair odds line (profits=0)
  - MRS = fair odds line (tangent to fair odds line)
  - Income in the two states will be equal
- Graphically illustrate

32



33

Consider two types of people

- High and low risk ($P_h > P_l$)
- Only difference is the risk they face of the bad event (W and d the same for both types)
- Firms cannot identify risk in advance
- People know who they are
- Question: Given that there are 2 types of people in the market, will insurance be sold?

34

Define equilibrium

- Two conditions
  - No contract can make less than 0 in $E(\pi)$
  - No contract can make $E(\pi)>0$
- Two possible equilibriums
  - Pooling equilibrium
    - Sell same policy to 2 groups
  - Separating equilibrium
    - Sell policies to different groups

35

Comparing high and low risk

- Intermediate step is necessary
- Hold income and loss from risk constant
- Change probabilities
- Compare indifference curves for high and low risk
- Only difference will be probabilities
- Definitive change in slope

36

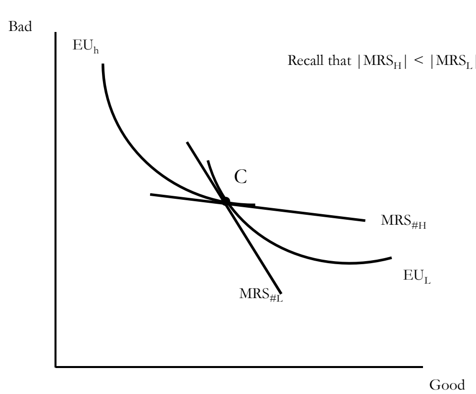
Comparing high and low Risk

- $EU_h = (1-p_h)U(W- \alpha_1) + p_hU(W-d+\alpha_2)$
- $EU_l = (1-p_l)U(W- \alpha_1) + p_lU(W-d+\alpha_2)$
- $MRS_h = (1-p_h)U'(W- \alpha_1)/[p_hU'(W-d+\alpha_1)]$
- $MRS_l = (1-p_l)U'(W- \alpha_1)/[p_lU'(W-d+\alpha_1)]$

37

- Compare $|MRS_h|$ vs $|MRS_l|$
- Since income will be the same for both people, $U'(W- \alpha_1)$ and $U'(W-d+\alpha_1)$ cancel
- $|MRS_h|$ vs $|MRS_l|$
- $|(1-p_h)/p_h|$ vs. $|(1-p_l)/p_l|$
- Since $p_h > p_l$ then can show that
  $|MRS_h| < |MRS_l|$

38

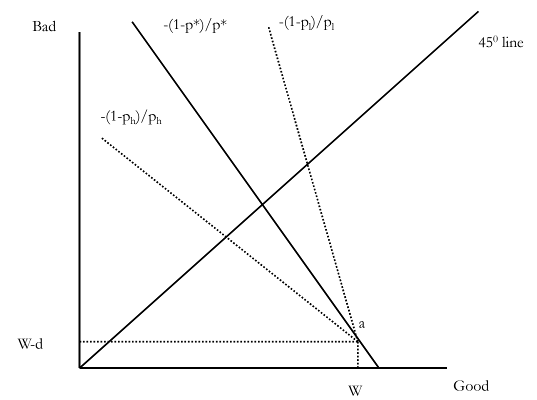


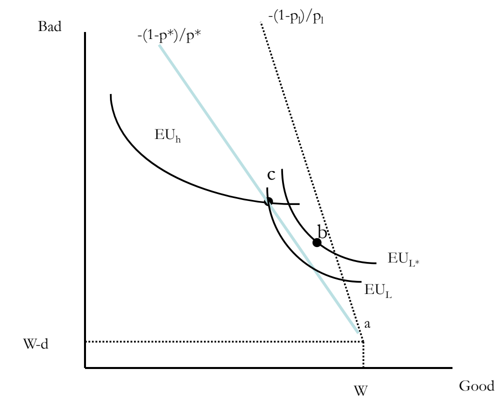
39

Will pooling equilibrium exist?

- Price paid in the pooling equilibrium will a function of the distribution of H and L risks
- Let λ be the fraction of high risk people
- Average risk in the population is
- $p^* = \lambda p_h + (1- \lambda)p_l$
- Actuarially fair policy will be based on average risk
- $\pi = (1-p^*) \alpha_1 - p^*\alpha_2 = 0$

40

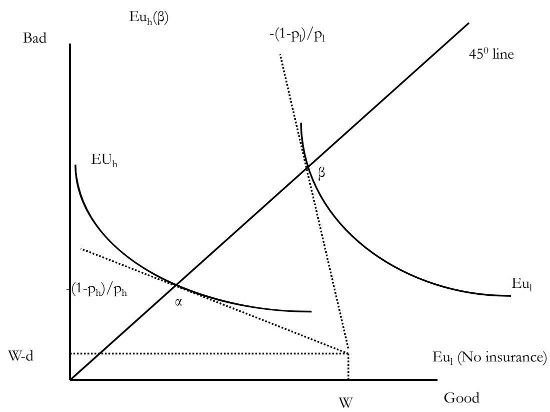




Will pooling equilibrium exist?

- Given PC assumption, all pooled contracts must lie along fair odds line for p^*
- Consider option (c)
- As we demonstrated prior, holding W_1 and W_2 constant, $|MRS_h| < |MRS_L|$
- Consider plan b. This plan would be preferred by low risk people (to the north east). So if offered, low risk would accept.

- High risk would not consider b
- Since b lies below the fair odds line for L, it would make profits
- The exit of the low risk from plan c would make it unprofitable so this will not be offered
- The existence of b contradicts the definition of an equilibrium, so a pooling equilibrium does not exist



45

Separating equilibrium

- Contract (α and β) for high and low risk
  - α provides full insurance in PC situation for H
  - while β does the same for L
- Can this situation last?
- Ask question
  - Would a low risk person want α contract?
  - Would high risk person want β contract?

46

Some solutions

- Gather data about potential clients and price insurance accordingly
  - Correlates of health care use are factors such as age, race, sex, location, BMI, smoking status, etc.
  - 'statistical' discrimination, may be undone by legislation
  - Expensive way to provide insurance – collecting data about health is costly

47

- Pre-existing conditions
  - Insurers would not cover conditions for a period of time that were known to exist prior to coverage
  - E.g., if have diabetes, would not cover expenses related to diabetes
  - Reduces turnover in insurance.
  - May create job lock (will do later)
  - Has been reduced to some degree by Federal legislation for those continuously with ins.

48

- Group insurance
  - Gather people (by area, employer, union)
  - price policy by pool risk
  - Require purchase (otherwise, the low risks opts out)
  - Next section of class is about the largest group insurance program – employer sponsored insurance

49

Insurance Design

- Construct policies that appeal to high and low risk customers
- Their choice of insurance reveals who they are
- Example: suppose there are two policies
  - High price but low deduc. and copays
  - Low price, high deduc. but catastrophic coverage
  - H/L risk people from R/S. Who picks what?

50

Is adverse selection a problem?

- What is evidence of adverse selection?
- Some studies compare health care use for those with and without insurance
  - Demand elasticities are low
  - Large differences must be due to adverse selection
  - Problem: adverse selection looks a lot like moral hazard. How do you know the difference?

51

Example: Harvard University

- Offered insurance through Group Insurance Commission (GIC)
- Initially offered two types of plans
  - Costly plan with generous benefits (Blue Cross/Shield)
  - HMO plan, cheaper, lots of cost sharing
- The generous plan costs a few hundred dollars more per person than the HMO
- Enrollment in the plans were stable over time

52

- Mid 1990s, Harvard faced a budget deficit (10K employees with health insurance)
- In 1994, Harvard adopted 2 cost saving strategies
  - Would now no longer pay the premium difference between generous plan and the HMO – employees mst make up the difference
  - Aggressively negotiated down benefits and premiums. Premiums for the HMO fell substantially
  - Out of pocket expenses for generous plan increased

53

- Who do you anticipate left the generous plan?
- What happened to the characteristics of the people left in the generous plan?
- What do you think happened to premiums in the generous plan?

54

TABLE I
CHANGES IN EMPLOYEE PAYMENTS RESULTING FROM PRICING REFORM, 1995

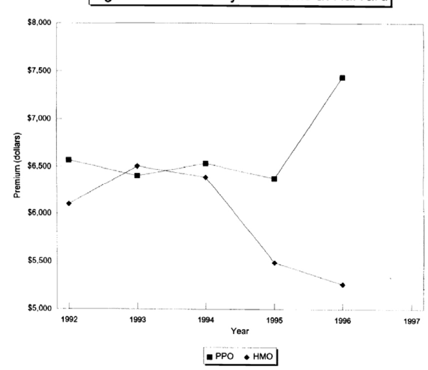
Plan		Total premium	Employee payment: Old policy	Employee payment: New policy	Employee payment: Change	Share of enrollment, 1994
Individual						
PPO	HealthFlex Blue	$2773	$ 555	$1152	$597	16%
IPA	BayState	2127	489	576	87	5
	Pilgrim	2123	382	564	182	2
	Tufts	2119	381	564	183	8
G/S	HCHP	1945	253	384	131	25
	HUGHP	1957	235	396	161	44
HMO average		$1980	$ 277	$ 421	$144	84%
Family						
PPO	HealthFlex Blue	$6238	$1248	$2208	$960	22%
IPA	BayState	5772	1154	1572	418	9
	Pilgrim	5734	1032	1488	456	3
	Tufts	5721	1030	1488	458	10
G/S	HCHP	5252	683	1056	373	28
	HUGHP	5264	632	1068	436	29
HMO average		$5395	$ 776	$1191	$415	78%

G/S is a group/staff model HMO. HCHP is Harvard Community Health Plan. HUGHP is Harvard University Group Health Program, the HMO run by the University. In 1994 there were 3627 individual policies and 3387 family policies among full-time employees.

Out-of-pocket premiums are for an individual with salary between $45,000 and $70,000.

55

Figure 3: Real Family Premiums at Harvard



Note: Premiums are in 1996 dollars

56

Sharp rise is OOP
For PPO

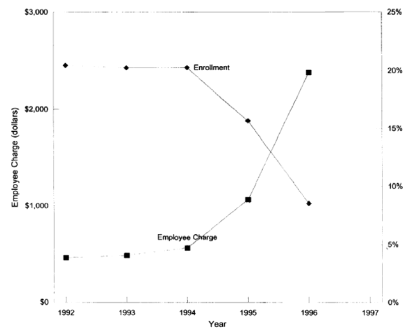
TABLE II
TRENDS IN REAL PREMIUMS AND ENROLLMENTS

Measure	1992	1993	1994	1995	1996
Individual					
Out-of-pocket cost of PPO	$ 290	$ 279	$ 361	—	—
1995 treatment group	290	279	361	$ 731	$1414
1996 treatment group	290	279	361	346	1414
Share of enrollees in PPO*	20%	20%	20%	—	—
1995 treatment group	—	—	18	14%	9%
1996 treatment group	—	—	13	12	5
Real premium					
PPO	$2854	$2794	$2828	$2773	$3228
HMOs	2066	2239	2240	1980	1910

Big increase in PPO premiums
And drop in enrollment

57

Figure 4: Real Employee Charge for the PPO and Enrollment in the PPO at Harvard



Note: Employee charge is in 1996 dollars and is for a family policy.

58

TABLE IV
CHARACTERISTICS OF PLAN ENROLLMENT CHANGES

First year enrollment	1994–1995 sample HMO		1994–1995 sample PPO		1995–1996 sample HMO		1995–1996 sample PPO	
Second year enrollment	HMO	PPO	HMO	PPO	HMO	PPO	HMO	PPO
Share of enrollees	99%	1%	15%	85%	100%	0%	39%	61%
Average age	41**	46**	46**	50**	41	***	46**	51**
Percent <40	50%	26%	31%	21%	50%	***	30%	15%
Percent 40–60	44	68	56	61	45	***	60	66
Percent >60	6	6	13	18	5	***	10	19
Index of spending	0.96	1.09	1.09	1.16	0.97	***	1.09	1.20
Average spending	—	—	—	—	—	—	$1893	$2648

Individual and family plans are grouped together. Average spending in the last row is adjusted for individual/family policies.
**Difference between age of people switching and remaining in plan is statistically significant at the 5 percent level.
***Too few people for reliable estimates.

59

Insurance 'death spiral'

- Adverse selection in health plan raises rates
- Lower risk patients exit due to increased costs
- Which increases costs
- Lather, rinse, repeat

60

Small Group Reform

- People without EPHI or small firms must purchase insurance in the 'Small Group' Market
- Small groups tend to have
  - Higher prices
  - Higher administrative fees
  - Prices that are volatile

61

- Prices are a function of the demographics
- Concern: prices for some groups too high
- Lower prices for some by "community rating"
- Nearly all states have adopted some version of small group reform in 1990s

62

What happened?

- Increased the price for low risk customers
  - Healthy 30 year old pays $180/month in PA
  - $420/month in NJ with community ratings
- Low risks promptly left the market
- Which raised prices
- Policy did everything wrong

63

Lesson

- Idea was correct:
  - Use low risk to subsidize the high risk
- But you cannot allow the low risk to exit the market

64

Table 1
Timing and nature of state reforms: 1991–1996

State	Full reform	Partial reform	Bare bones plan laws	State	Full reform	Partial reform	Bare bones plan laws
AK	1994–1996			MT	1994–1996		1992–1996
AL				NC	1992–1996		1993–1996
AR		1992–1996	1993–1996	ND	1995–1996	1994–1992	1992–1996
AZ		1994–1996	1992–1996	NE	1995–1996	1992–1994	1992–1996
CA	1994–1996			NH	1996	1994–1995	
CO	1996	1995	1992–1996	NJ	1995–1996		1992–1996
CT	1992–1996		1992–1996	NM	1996	1992–1995	1992–1996
DC				NV			1992–1996
DE	1994–1996	1992–1993	1994–1996	NY	1994–1996		
FL	1994–1996	1992–1993	1994–1996	OH	1993–1996		
GA		1992–1996	1994–1996	OK	1995–1996	1993–1994	1991–1996
IA	1993–1996	1992	1992–1996	OR		1992–1996	1992–1996
ID	1994–1996		1996	PA			
IL		1995–1996	1992–1994	RI	1993–1996		1991–1996
IN		1993–1996		SC	1996	1992–1995	
KS	1993–1996	1992	1993–1996	SD	1996	1992–1995	
KY	1996		1991–1996	TN	1994–1996		1994–1996
LA	1995–1996	1992–1994		TX	1995–1996		
MA	1992–1996		1992–1996	UT		1996	
MD	1995–1996		1992–1996	VA	1994–1996		1991–1996
ME	1994–1996	1991–1993		VT	1993–1996		
MI				WA	1994–1996		1993–1996
MN	1994–1996		1994–1996	WI		1993–1996	1993–1996
MO	1995–1996	1994	1992–1996	WV		1992–1996	1992–1996
MS		1996	1993–1996	WY	1993–1996		1993–1996

Source: Simon (2000).

65

Effect of full reform on Employer-provided ins. rates, CPS

		Before	After	Δ
Reform	Small	39.36	37.39	-1.97
No ref.	Small	47.18	47.04	-0.14
			ΔΔ	-1.83
Reform	Large	75.79	73.71	-2.08
No ref.	Large	79.61	77.36	-2.25
			ΔΔ	0.17
			ΔΔΔ	-2.00

66

Premiums increased by almost $8

Table 4
OLS results, establishment level: the impact of full reform

	N	Mean	Small*Full*Post
Premiums	26,651	181.1	**7.8 (4.2)**
Employee contribution	28,052	32	**5.1 (2.4)**
Decision to offer	50,485	0.66	−0.01 (0.01)
Coverage rate	47,598	42.9	**−2.12 (1.29)**

Standard errors in parentheses. Bold font indicates significance at least at the p=0.10 level. See footnote 16 for a full explanation of control variables included.

67