Dynamic Selection: Empirics

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ESWC, Montreal, Aug 2015

Introduction

- Large empirical literature on static contracting, mainly on informational asymmetries:
    - Testing for asymmetric information (Cardon and Hendel (2001), Chiappori and Salanie (2001), Cohen and Seligman (2010))
    - Computing welfare (Einav et al. (2013), Handel et al (2015))
    - Contracting rules (Handel et al. (2015))
- Dynamic contracting received less attention
    - extra hurdles

Introduction

- Many situations involve long lasting relations between parties
  - with information revealed over time
- Evolving information generates gains from dynamic insurance / long term contracts
  - even when information is symmetric

Introduction

Evolving information: reclassification risk

- For example, a changing type, can be insured
- Consider health insurance coverage at age 50
    - spot contracts insure the event risk, but not premium risk
    - premium risk could be insured before type is known, say at age 25
    - ...if long term (LT) contracts feasible
- Role of long term contracts depends on the nature of commitment
    - by firms, and by consumers

Introduction

Reclassification risk: the role of commitment

- If information ex-ante symmetric, full commitment (by both parties) yields efficiency
  - equating marginal utility from consumption over time and states
- For legal and practical reasons commitment is at most one-sided
  - consumers can walk out
- Optimal unilateral contracts (Harris and Holmstrom (1982) and Hendel and Lizzeri (2003)) involve front-loading (or some other form of commitment) to
  - reduce incentives to lapse
  - partially restoring consumers' commitment
  - alleviating reclassification (premium) risk
  - at the expenses of consumption smoothing

Introduction

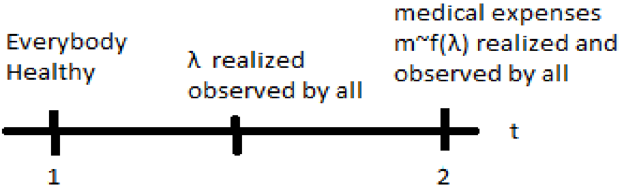
- Reclassification risk real concern in many situations
- Model of learning and imperfect commitment useful to explain dynamic selection and reclassification risk
- Important for understanding markets and designing policy
- Next, look at a simple model of symmetric learning and partial commitment
    - which simplifies Harris and Holmstrom (1982)
- After presenting model we'll move to the evidence

Introduction

- Evidence on:
  - relevance of working assumptions
  - testable implications:
    - selection
    - shape of optimal contracts
  - welfare implications of the theory
    - to judge impact
- We then move on to non-symmetric learning

Simple(st) Model

- risk averse consumers: preferences $u(c_t)$
- live two periods, with income y_t, $t = 1, 2$.
- health status λ revealed prior to period 2
- λ determines distributions of period 2 medical expense $m \sim f(\lambda)$
- information structure: symmetric learning
    - all parties observe λ



Simple(st) Model (cont)

- Assume competitive insurance industry
- For simplicity: no borrowing, and no discounting
- Interpretation:
  - we can think of $t = 1$ as age 25 (no information has been revealed yet)
  - and $t = 2$ as age 50
  - this is a simplification of a model with yearly updates and health expenses (coming later)
  - single period uncertain expenses to highlight forces in simplest way

Benchmark I

Short Term Contracts (No Commitment)

- Absent long term contracts
  - the spot insurance market opens once λ is known
- Competitive premiums: $p(\lambda) = E(m|\lambda)$
  - uncertainty in m fully insured in equilibrium
  - but uncertainty in λ (RR), left uninsured
- Main concern that motivated state regulation of health insurance and ACA
  - bad risks pay a lot or not renewed
  - lack of commitment prevents eliminating risk associated with λ

Benchmark II

Full Commitment to Long Term Contracts

- Parties commit to contracts offered at $t = 1$ (age 25)
- Competitive premiums break even ex-ante, $p_1 + p_2 = E_\lambda(E(m|\lambda))$
  - premiums are independent of λ : premium risk fully insured
  - p_1 and p_2 timed to smooth consumption
  - ... equating $u'(c)$ across periods and states
  - allocation is Pareto efficient

Long Term contracts: One Sided Commitment

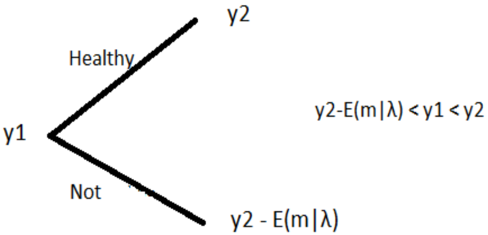
- Firms offer long term contracts: $\{p_1, p_2\}$
- At t=2 consumers can get coverage for $E(m|\lambda)$ on the spot market
  - lapsing the LT contract if spot price $E(m|\lambda) < p_2$
  - adverse selection: better risks lapse the LT contract
- Competitive equilibrium maximizes consumer welfare, breaking even ex-ante
  - s.t. the lapsation constraint, $\lambda-$consumers stay only if:

$$p_2 \leq E(m|\lambda) \tag{1}$$

Long Term contracts: One Sided Commitment (cont)

- In equilibrium: full event insurance
- Due to lack of consumer commitment
  - the lower p_2, the less uncertain second period premiums are
  - but low p_2 requires high p_1 (namely, front-loading)
- Since front-loading is costly in terms of consumption smoothing
  - optimal contracts trade-off: RR insurance and consumption smoothing
  - low y_1 makes front-loading costlier
- Notice the source of adverse selection is lack of commitment
  - not asymmetric information
  - perhaps a better name is adverse retention
  - consumer would be better off if could commit to stay in good states
  - ...to transfers resource from those events to less fortunate ones

- Why is RR left uninsured?



Moving on to Empirics

Assessing the relevance of the theory

- Relevance of working assumptions
  - symmetric learning
  - imperfect commitment
- Testable implications
  - is reclassification risk a concern in practice?
  - do better types leave?
  - are contracts front-loaded?
  - do front-loaded contracts have lower lapsation?
  - do lower lapsation contracts retain better risk pools?
- Welfare implications
  - magnitude of RR/dynamic selection problem?
  - quantifying gains from dynamics contracts

Relevance of the Theory

Symmetric Learning

- In which markets is there learning? and symmetric?
- Labor markets:
  - worker productivity is revealed over time
  - learning may not be symmetric: team performance, uninformed competitors
  - example with symmetric learning: academics
- Insurance:
  - health status evolves over time, and discoverable by insurers
  - regulation may preclude pricing the information
- Mortgages and credit markets
  - credit scores
  - idiosyncratic vs aggregate uncertainty

Relevance of the Theory

Unilateral Commitment

- In most markets consumers, and workers, are free to leave contractual arrangements
  - due to legal reasons termination fees hard to enforce
    - as the damage due to lapsation is difficult to prove (liquidated damage)
    - example: infamous cell phone early termination fees declared illegal by State Courts
  - practical reasons: uncertainty makes commitment costly (Fang and Kung 2012, Bayot 2015)
- Examples of one-sided commitment contracts: life insurance, health insurance (Germany), mortgages, academics' contracts

Testing Implications (of HH)

- Evidence from many markets speak on whether:
  - reclassification risk
  - better types lapse
  - contracts are front-loaded
  - front-loading or other commitments lower lapsation
  - lower lapsation contracts retain better pools
- Examples ....

Long term care insurance: Finkelstein, McGarry and Sufi (2005)

- Evidence showing long-term care insurance contracts are front-loaded
- Despite FL there is substantial lapsation
- Theory predicts adverse retention
- Evidence: regressing utilization on lapsation provide evidence of adverse retention
    - Good risks more likely to lapse

Testing the Theory

Life Insurance: Hendel and Lizzeri (2003)

- Data on Contract Dynamics
  - explicit contract data information from...
  - pricing software used by insurance agents
  - including future premiums
    - future premiums contingent on health status
    - health contingent premiums$\Longrightarrow$premium risk

Assumptions?

Does the model fit the life insurance industry?

- Competition:
  - 400 life insurers
  - term insurance is simple and homogenous good
- One sided commitment:
  - insurers commit to future policy terms
  - no penalty to consumers that lapse
- Symmetric learning
  - health type evolves over time (more later)
  - medical examination and questionnaires at underwriting

An instructive contract: S&U Annual Term

Age	S&U ART						
	Policy Year						
	1	2	3	10	11	19	20
40	370	475	640	1485	2555	5680	6375
41	385	490	660	1565	2815	6375	7040
42	400	530	690	1705	3105	7040	7790
49	630	890	1080	2725	6375	13675	14785
50	690	945	1155	2895	7040	14785	15765
51	735	1050	1295	3230	7790	15765	17230
58	1245	1750	2295	6420	14785	33165	35445
59	1340	1785	2480	6945	15765	35445	38715

Note: contracts offered in 7/1997 to preferred non-smoker, male

for $500,000 of coverage. ART=annual renewable term policy.

S&U ART=annual contract that allows for reclassification, by showing good health.

Variety of Contracts

- Theory predicts a variety of contracts offered catering to different income profiles

Table 4				
Slope and Cost Dispersion across Contracts				
	Mean	Std Div	Min	Max
Q(1st)/Q(11th)	0.43	0.31	0.11	1.00
PV	16,055	5,245	6,871	28,754
Q(1st)/Q(11th)=ratio of first to the 11th premium. PV=present value of 20 years of coverage at r=0.08.				

- Notice wide range of present value of coverage

- More FL means lower lapsation, better pool, thus lower PV of cost of coverage

Findings

	log(PV)	
	(1)	(2)
Q(1st) / Q(11th)	-1.06	—
	(-16.79)	—
Other contract	–	–
characteristics	Y	Y
R^2	74.4	16.6
N	125	125

Dependent Variable log(PV) is the log of the present value (r=8%) of the cost to the consumer of 20 years of coverage starting at age 40.

Key Findings

- Available contracts embed learning and reclassification risk
- All contracts in the US and Canada were front-loaded
- Lapsation higher for less front-loaded contracts
- More front-loading associated with lower PV of premiums, which reflects a healthier pool
- Commitment reduces adverse selection
- Premium slope explains the majority of premium variation

Health Insurance: Browne and Hoffmann (2013)

- Browne and Hoffman (2013) study the German private health insurance market
- Government regulation allows premiums to depend on conditions at the timing of buying coverage
  - but premiums have to be flat thereafter (constant)
- Since health expenses increase with age: contracts are front-loaded
  - contracts create lock-in
- Report evidence consistent with the model
  - front-loading lowers lapsation
  - ...and better risks lapse

Relevance of the Theory: alternative forms of commitment

Impact of commitment: Crocker and Moran (2003)

- Looking at other forms of commitment: can attest to the role of imperfect commitment in contracting
- Alternative lock-in mechanism: bundling insurance with employment
- Using NMES and information on job attachment:
  - show link between worker immobility and health insurance generosity (yearly and lifetime limits)
- Employer related health insurance may work better than prepayment
  - latter problematic in health insurance Cutler and Zeckhauser (2000)
- Findings interpreted as evidence that key problem of health insurance markets is commitment rather than asymmetric information

Relevance of the Theory: further afield

The Limits of Equality: An Economic Analysis of the Israeli Kibbutz Abramitzky (2011)

- Kibbutz is a cooperative, aiming to achieve equality
  - equality viewed from ex-ante perspective means insurance
  - Kibbutz formation started early 1900s, reached 120K members
- Participation is voluntary, namely, limited commitment
- Until recently full equality among members
- However, recent negative shocks (lower subsidies, world agro prices, and bad investments) shifted away from full equality to different degrees of equality
- Data gathered on 250 Kibbutz plus census data

Findings

The Limits of Equality (cont)

- Back to the theory: Lock-in mechanism given by wealth of the kibbutz
  - Higher wealth reduces exit, and increases equality
- Ex-ante members want equality (or insurance), later learn their type (including human capital)
- Commitment achieves partial reclassification risk insurance
- Findings: entry and exit associated with negative selection
  - former Kibbutz members in unskilled occupations earn more than similar individuals in the city (good draws leave)
  - former Kibbutz members in skilled occupations earn less than similar individuals (all lawyers leave)
  - entering members: have lower wages before getting in

Labor Market: Chiappori, Salanie and Valentine (1999)

Unobserved Performance

- Chiappori, Salanie and Valentin (1999) study wage dynamics to uncover symmetric learning
- While Abramitzky observes workers type and Finkelstein et al observe Long Term Care utilization, in many situations, especially in the labor market, productivity is not observable
- Paper designs a test based on observables: promotions
- Late beginner property: implied by symmetric learning and downward rigidities (as in HH)
  - early starters' rank eventually conceal interim bad performance, expected to do poorer than late beginners (other things equal)

Moving on to Welfare

Handel, Hendel and Whinston (2015b)

- While papers just reviewed do not have the necessary ingredients to evaluate the gains from long term contracting
- ... available health insurance data permits assessing welfare gain from long term contracts
- Key ingredients are:
  - expected costs given health states
  - transitions across health states
  - risk preferences
- Policy relevance: reclassification risk is key concern behind health insurance regulation
  - the ACA (Obamacare) bans pricing health conditions
  - the cost of the ban is adverse selection
  - LT contracts, as an alternative to the ban, may permit contending with RR without causing adverse selection

HHW (2015b): Data

- Individual-level panel: large employer (25K covered lives) from 2004-9
- Plan choices, plan characteristics and consumer demographics
- Detailed claims data for every person covered in PPO
- Realizations: all medical claims (ICD-9 codes, and payments)

- Adjusted Clinical Group (ACG) program, Johns Hopkins professional software provides risk score conditional on previous claims (ICD-9 codes) and demographics

- Used to compute
  - health types for each individual
  - use types changes (over time) to compute transitions

  - Risk Preferences from a Choice Model
  - [Choice model requires distribution costs, from a Cost Model]

Evolution of types

Is there learning? Symmetric?

	Health States:						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Age							
25-30	0.49	0.19	0.14	0.07	0.04	0.03	0.04
30-35	0.41	0.18	0.13	0.08	0.06	0.06	0.07
35-40	0.27	0.30	0.13	0.06	0.09	0.07	0.09
40-45	0.19	0.28	0.16	0.09	0.12	0.08	0.10
45-50	0.01	0.15	0.32	0.15	0.13	0.12	0.12
50-55	0.00	0.10	0.25	0.19	0.15	0.16	0.15
55-60	0.00	0.01	0.01	0.25	0.24	0.28	0.22
60-65	0.00	0.00	0.00	0.18	0.24	0.26	0.31
Cost ($K)	1,1	2,3	3,8	4,0	5,9	11,0	19,0

Persistence of information

Health State Transitions: 50-55 year olds

		λ_{t+1}						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	$\lambda_t = 1$	0.67	0.15	0.10	0.02	0.02	0.01	0.03
	$\lambda_t = 2$	0.25	0.37	0.20	0.09	0.04	0.02	0.04
λ_t	$\lambda_t = 3$	0.09	0.21	0.21	0.20	0.12	0.10	0.08
	$\lambda_t = 4$	0.10	0.19	0.26	0.12	0.10	0.19	0.05
	$\lambda_t = 5$	0.09	0.19	0.14	0.15	0.10	0.19	0.15
	$\lambda_t = 6$	0.00	0.09	0.13	0.09	0.19	0.23	0.28
	$\lambda_t = 7$	0.03	0.10	0.10	0.10	0.21	0.16	0.29

- There is persistence, but not fully persistent
- Gains from LT depends on persistence: too much or too little limit gains

Model

Multi-period version of previous model

- T periods, $U = \mathbb{E}\left[\sum_t \delta^t u(c_t)\right]$
- Income in period t is y_t
- Health state λ_t (ACG), determines expected health costs, $\mathbb{E}[m_t|\lambda_t]$
- Health expenses m_t and λ_{t+1} joint density $f_t(m_t, \lambda_{t+1}|\lambda_t)$
- m_t and λ_t are commonly observed by consumers and firms
- Competitive industry, firms are risk neutral with discount factor δ
- Capital market imperfections: no borrowing

Equilibria

Dynamic Contracts with One-sided Commitment

- Insurance companies commit to future actions
- Consumers can lapse at any time, no termination fees

Equilibrium Contracts
Predictions

Proposition

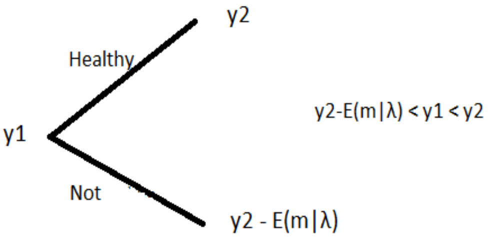
The optimal contract fully insures against within-period medical risk; consumers recieve in each period t following health state history $(\lambda_1, ..., \lambda_t)$ *the certain consumption* $\max_{\tau \leq t} c^*_\tau(\lambda_\tau)$. $c^*_t(\lambda_t)$ *is the consumption levels offered in the first period of a contract starting in period t with health state* λ_t,. *The levels* $c^*_t(\lambda_t)$ *lead the firms to break even in expectation.*

- Optimal contract offers a minimum guaranteed consumption level
- Guarantee is bumped up to match outside offers after good news
- New guaranteed consumption level is the first-period consumption of an optimal contract that would start at that date and state λ_t
- Consumption guarantee parallels downward rigid wages in HH (1982)

Equilibrium Contracts

Predictions

- Optimal contracts equate $u'(c)$ only across states with no outside offers (bad states)
- Why is RR left uninsured?



Elements from Data

- Using:
  - expenses in each health state
  - age dependent transitions over time
  - risk preferences
    - estimated risk preferences from HHW (2015a) choice model: CARA with population mean $\gamma_j = 0.0004$
- We compute optimal contracts for different income profiles
  - recursively finding consumption guarantees
- To quantify gains from long term contracting

Results: Optimal Contract for Flat Net Income

Front-loading and Reclassification Risk

- "Flat net income" means constant $y_t - \mathbb{E}[m_t]$
  - of interest since gains from LT contracting unrelated to saving and borrowing
- First period premiums, age 25, and actuarial costs:

State	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Premium	2,750	4,155	6,008	6,130	8,885	11,890	18,554
Costs	1,131	2,291	3,780	3,975	5,850	10,655	18,554
Front-loading	1,619	1,864	2,228	2,155	3,035	1,235	–

Results: Optimal Contract for Flat Net Income

Front-loading and Reclassification Risk

- Second period premiums are contingent on more complex history:

Second Period Premiums								
		Period 2 state:						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	1	2,943	3,300	3,300	3,300	3,300	3,300	3,300
Period 1	**2**	2,943	4,302	4,705	4,705	4,705	4,705	4,705
State:	**3**	2,943	4,302	6,090	6,206	6,558	6,558	6,558
	4	2,943	4,302	6,090	6,206	6,680	6,680	6,680
	5	2,943	4,302	6,090	6,206	8,955	9,434	9,434
	6	2,943	4,302	6,090	6,206	8,955	11,919	12,440
	7	2,943	4,302	6,090	6,206	8,955	11,919	18,554

Results: Optimal Contract for Flat Net Income

Front-loading and Reclassification Risk

- By year 10 there are over 40 million histories: max and mean front-loading across histories by period for an individual who starts healthy ($\lambda_{25} = 1$):

Period:	1	2	3	4	5	6	7	8	9	10
Mean FL	1,702	1,682	1,758	1,834	1,919	2,280	2,461	2,536	2,568	2,469
Max FL	3,035	3,105	3,174	3,324	3,236	3,324	3,623	3,781	3,859	3,438

Results: Welfare

- With predicted contracts, we compute expected utility
- and constant certainty equivalent CE_X
- For each contracting scenario X:
  - TS is two-sided commitment
  - D dynamic contracts (one-sided commitment)
  - S spot (annual) contracts
  - ACA (60% coverage policies with deductible and OOP max)
  - $TSNS$ two-sided commitment with no savings ($\equiv$ ACA with 100% coverage)

Results: Welfare

- Comparisons for:

1. flat net income
2. non-managers
3. (re-scaled) managers

Results: Optimal Contracts

Welfare

Certainty Equivalent					
Income	TS	D	S	ACA	TSNS
Flat net	53.67	52.77	46.27	51.30	53.53
Non-mang	53.67	44.10	40.73	46.25	47.39
Ds Manag	53.67	34.10	31.74	36.84	37.93
r=0.0004 est median					

- CE_D as expected is in between spot and two-sided contracts
- TSNS always at least as good as D
- ACA better for steep profiles, worse for flat ones (adverse selection more costly, FL less costly)

Premium insurance

Cochrane (1995) and Pauly et al (1985)

- Alternative solution to RR is premium insurance
- While appealing, it requires borrowing, and non-practical
- Requires collecting or paying at the end of each period sum equivalent to information innovation (news)
  - bad news get paid, after good news has to pay
- Best news, is

$$\sum_{\tau > t} \delta^{\tau - t} \{ \mathbb{E}[m_\tau(\lambda_\tau) | \lambda_{t+1} = 1] - \mathbb{E}[m_\tau(\lambda_\tau) | \lambda_t = 7] \}$$

  - For example at age 26 luckiest have to pay:
  - $\sum_{\tau > 25} \delta^{\tau - t} \{ \mathbb{E}[m_\tau(\lambda_\tau) | \lambda_{26}] - \mathbb{E}[m_\tau(\lambda_\tau) | \lambda_{25}] \} = \$16,947$
  - Not practical: easy to report bad health

Asymmetric Learning

Theory and main issues

- Greenwald (1986): current employers have better information than potential employers, creates frictions
  - outsiders pay less expecting movers' lower quality
- Waldman (1984) and Ricart-i-Costa (1988): information revealed by promotions (rank)
  - leads to delayed promotion
- Evidence: Katz and Gibbons (1991)
  - comparing wages and unemployment duration after: individual layoff and plant closings
  - shorter unemployment and higher wages after plant closing

Asymmetric Learning

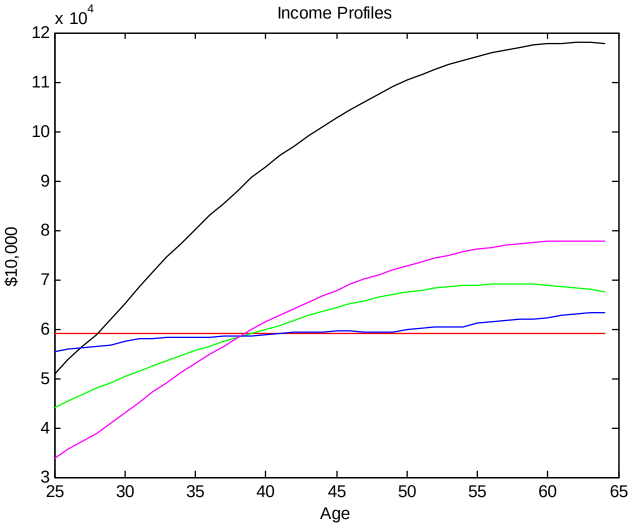
Theory and main issues: insurance

- Kunreuther and Pauly (1985), D'Arcy and Doherty (1990): current insurance learn customer type (at least accident experience), competitors don't.
  - customers locked-in, good draws cannot show their type, become profitable
  - lowballing: competition drives initial premiums down, due to later profits (firms invest in customers)
- Testable implications:
  - lowballing $\Longrightarrow$opposite of front-loading
  - good types locked-in, advantageous selection$\Longrightarrow$opposite than under symmetric learning

- De Garidel-Thoron (2005)
  - symmetric priors, asymmetric learning
  - one sided commitment
  - lock-in of good types, enhances commitment (as in Crocker-Moran 2003)
- Policy question: welfare consequence of disclosing accident information?
  - information sharing welfare reducing
- Evidence: Cohen (2012)
  - auto insurance without information sharing
  - good types less likely to lapse
  - over time good types more profitable: get a discount lower than the loss differential
  - consistent with informational advantage

Conclusion

- Reclassification risk concern present
- Model of learning and imperfect commitment relevant for understanding dynamic selection and reclassification risk
- Important for understanding markets and designing policy
    - imperfect commitment source of adverse selection in insurance markets
    - welfare consequences can be important


Income Profiles
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Age

Results: Front-loading and income

Managers							
State	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Premium	1,678	3,165	5,256	5,449	8,245	11,593	18,554
Costs	1,131	2,291	3,780	3,975	5,850	10,655	18,554
Front-loading	547	874	1,476	1,474	2,395	938	-

Flat net income							
State	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Premium	2,750	4,155	6,008	6,130	8,885	11,890	18,554
Costs	1,131	2,291	3,780	3,975	5,850	10,655	18,554
Front-loading	1,619	1,864	2,228	2,155	3,035	1,235	–

Results: Optimal Contract for Downscaled Manager

Second Period Premiums

		Period 2 state:						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	1	1,699	3,204	3,524	3,524	3,524	3,524	3,524
Period 1	**2**	1,699	3,204	5,011	5,011	5,011	5,011	5,011
State:	**3**	1,699	3,204	5,289	5,478	7,102	7,102	7,102
	4	1,699	3,204	5,289	5,478	7,295	7,295	7,295
	5	1,699	3,204	5,289	5,478	8,279	10,090	10,090
	6	1,699	3,204	5,289	5,478	8,279	11,615	13,439
	7	1,699	3,204	5,289	5,478	8,279	11,615	18,554