

Insurance

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1) Risk Identification and Measurement

- **types of losses** -
 - property loss – BV, FMV, firm specific value (value of prop to current owner), replacement cost new (often > FMV)
 - business income exposures – indirect loss due to other (possibly insured) losses
 - extra expense exposure
 - liability loss – potential legal liability due to relationships with many
 - HR loss – K require comp for injuries + indirect losses from worker absence / distraction / leaving
 - external economic force losses – change in price of input / outputs

- **statistics background (basic)** -
 - **random variable** – variable whose outcome = uncertain
 - **probability distribution** – IDs all *possible* outcomes for a random variable (sum = 1)
 - **expected value (for a distribution)** = $\sum_i^n p_i X_i$ = “mean of the distribution”
 - **variance** = $\sum p_i (x_i - \mu)^2$
 - measures probable variation in outcomes around the E(V)
 - measures predictability of outcomes
 - **standard deviation** –
 - **maximum probable loss** - measures loss not to be exceeded w/ X% confidence
 - used to – describe loss distribution
 - **value at risk** –
 - used to – describe value of portfolio / value of a firm subject to loss
 - **sample mean** = average value from a sample of outcomes from a distribution
 - **sample SD** – variation in outcomes of a particular sample
 - **skewness (of probability distribution)** – measures symmetry of a distribution
 - **correlation** –
 - none = independent
 - positive = TEND to move together BUT no causality required
 - NOTE – uncorrelated RV not necessarily independent (tho vice versa holds)
 - **normal distribution** –
 - **covariance (X,Y)** = $\sum p_i (x_i - \mu_x)(y_i - \mu_y)$

- same sign as correlation
- con – magnitude is meaningless
- solution – **coefficient of variation** = $\text{Cov}(X,Y) / \sigma(X)\sigma(Y)$
 - always between -1 and 1

- **statistics (combinations of RV) -**
 - $E(\text{Constant} * X) = \text{Constant} * E(X)$
 - $\sigma(\text{Constant} * X) = \text{Constant} * \sigma(X)$
 - $\text{var}(\text{Constant} * X) = \text{Constant}^2 * \text{var}(X)$
 - $E(X + Y) = \text{avg of RV} = E(X) + E(Y)$
 - $\text{var}(X + Y) = \text{var}(X) + \text{var}(Y) + 2 \text{cov}(X,Y)$
 - $\sigma(X + Y) = [\text{var}(X) + \text{var}(Y) + 2 \text{cov}(X,Y)]^{1/2}$
 - $\text{var of avg of RV} = \text{var}[E(X+Y)] = \text{var}(X/2) + \text{var}(Y/2) + 2 \text{cor coeff}(X,Y) * \sigma(X/2) * \sigma(Y/2)$
 - if $\text{var}(X) = \text{var}(Y) \rightarrow \text{var}[E(X+Y)] = \frac{1}{2} \text{var}(X)[1 + \text{cor coeff}(X,Y)]$
 - if $\text{cor coeff}(X,Y) = 0 \rightarrow \text{var}[E(X+Y)] = \frac{1}{2} \text{var}(X)$
 - if X uncorrelated & have same variance $\rightarrow \text{var}[E(X+Y)] = \text{var}(X) / N$ (umber of participants in pool)

- **Risk Management Process -**
 - **i) identify loss exposures – unidentified exposures = implicit retention decision**
 - analyze sources and uses of funds
 - consider loss in asset value (source of funds)

 - **ii) calculation issues**
 - **frequency of loss** – number of losses in given time (historical / industry data)
 - **severity of loss** – magnitude of loss per occurrence

 - RoT – when frequency is uncorrelated w/ severity $\rightarrow E(L) = \text{frequency} * \text{severity}$

2) Pooling and Risk Diversification

- **defn**
 - **pooling arrangement** – pooling resources to pay accident costs

 - **law of large numbers** – as N goes to infinity \rightarrow average outcome approaches the $E(V)$
 - **central limit theorem** – distribution of the average outcome approaches a normal distribution (μ) and SD ($\sigma / N^{1/2}$) as N gets very large

- **if events uncorrelated -**
 - changes probability distribution facing each person (b/c of shared costs / losses) = diversification
 - reduces probability of extreme outcomes
 - risk decreases while individual's expected costs remain the same
 - pooling reduces the SD of $E(L)$ for all participants (~ distribution becomes more bell shaped)
 - key pt – $E(\text{Loss})$ is much more predictable than each individual's loss

- **if events correlated** – avg losses = more difficult to predict
 - why – common occurrence causes many losses (also influences severity)
 - perfect positive correlation = no risk reduction (σ does not change as new participants join)
 - less than perfect positive correlation = some risk reduction

- **Insurers as risk managers –**
 - costs – distribution (marketing) + underwriting (identifying potential participant's $E(L)$) + loss adjustment expenses (monitoring for fraud)

- compensation – ex ante payments → avoids delay on part of participants + need funds available when loss occurs + avoids risk associated w/ ex-post assessments
- distribution –
 - direct writers – rely on exclusive agents / direct response
 - focus = careful U/W + large volume / agent + target specific customers (~ Life insurance)
 - broker – represents insurance buyer (technically) through relationships w/ multiple insurers
 - agent – represents insurer to sell to buyers
- stock markets for diversification –

3) Risk aversion

- defn -
 - full coverage – wealth is same regardless of whether loss occurs
 - bene of insurance = increase in wealth if loss occurs
 - cost of insurance = decrease in wealth if loss does not occur
 - risk aversion –
 - possible loss hurts more than same potential gain
 - require compensation for risk created by uncertainty (higher reward is not enough) = risk premium
 -
 - risk neutrality – care only about $E(\text{wealth})$
- Factors affecting demand for insurance -
 - risk averseness
 - premium loading – premium in excess of expected payments by the insurer
 - income and wealth –
 - more assets = more to insure
 - more money = better able to afford insurance
 - risk aversion declines as wealth increases
 - limited liability via bankruptcy = incentive to purchase less insurance
 - compulsory insurance – auto liability laws
 - information regarding loss distribution ~ whether loss is viewed as possible (but ignores info asymmetry)
 - other sources of indemnity ~ gov't pays for some types of losses (enviro, etc.)
 - non-monetary losses – can't always be covered by insurance / \$\$ (loss of child)
 - implicitly insured by courts when imposing product liability (but other customers simply pay)
 - ability to diversify risks – businesses are better at this; S/H can use stock markets
 - diversification requires independence b/w investments
- Business risk management – occurs through
 - **a)** corp insurance –
 - con - may be waste if S/H have already diversified risk at the S/H level (more relevant for closely held cos)
 - pros
 - efficient method for claims processing and loss control services
 - reduce expected cost of financing losses
 - reduce chance that firm will have to raise (costly) external capital
 - reduce likelihood of financial distress (and the associated costs)
 - reduce expected tax payments (when corp tax rates are progressive)
 - **b)** S/H diversification
- Expected utility –
 - utility – measure of person's well being associated with different amounts of wealth
 - key point –
 - risk aversion implies that utility does not increase linearly w/ wealth

- purchasing insurance = giving up wealth if loss does not occur to receive additional wealth if loss does occur
- **diminishing marginal utility** = concave utility function = risk aversion
- **Cost of uncertainty / risk** ~ how much individual willing to pay for full insurance

4) Asymmetric Information

5) Business Valuation

- value of publicly held firm = **sum of E(CF to infinity) / (1+r)^t**
- $r = E(\text{RoR})$ on investments w/ same risk = $r_f + \text{MRP} = r_f + \text{non-diversifiable risk premium}$
- **systematic risk** ~ **idiosyncratic risk** ~ **pure risk** ~ specific to one firm (or sector) and can be diversified
 - excluded from r b/c O/W makes discounted P too low → market will not compensate you for bearing this risk
 - $E(r_{t+1}) = [E(\text{div CF}_{t+1}) + E(P_{t+1}) - P_t] / P_t = [\text{CF}_{t+1} + \text{CG}_{t+1}] / P_t$
 - reduction (through insurance) – is waste b/c duplicative of what market can do thru diversification
- **non-systematic risk** ~ **non-idiosyncratic risk** ~ cannot be diversified
 - include economy wide (perfectly correlated) risks
 - non-diversifiable risk premium – is higher for firms whose risks more highly correlated w/ economy wide risks
 - reduction (through hedging K) –
- **firm's risk premium** ~ MRP ~ reduced by hedging / option (but does not increase value of firm b/c have to pay market P)
 - value of publicly held firm = $[E(\text{CF} - \text{cost of option K})] / (1+r - \Delta r)$ (→ lower CF and discount rate)
 - option K –
 - only exists b/c of transaction costs (O/w could perfectly replicate it through stocks & bonds)
- **Buy Insurance only if**
 - reduce risk of loss beyond insured loss (~ bankruptcy, T/C from issuing new funds, under-P stock)
 - reduce **Financial Distress** –
 - legal bankruptcy costs
 - K relationships – Suppliers (LT relationship ~ better K), EEs (switching costs if firm fails), Customers (LT relationship ensures consistency), Creditors (protects value of their claims)
 - key pt – K relationship is important b/c other party has non-diversified relationship w/ you
 - tax benes ~ lower cost of debt due to lower cost of Fin Distr (lower bankruptcy fees / lending costs to undiversified S/H) → more debt financing → deductibility of interest
 - limits potential liability – and you are risk averse (acts like bankruptcy to cap your loss)
 - anytime have non-diversifiable relationship with the thing being insured (body, life, etc.)
 - risk – moral hazard means people more likely to take risk once insure non-diversifiable risks to themselves
- **remember**
 - effect of idiosyncratic risks are reduced when pooled across (~ diversified between) firms
 - insurance should have no impact ~ it addresses firm specific risk (no impact on non-systematic risk)
 - firm buys insurance b/c ~
 - reduces risk of loss beyond insured loss (~ bankruptcy, T/C from issuing new funds, under-P stock)
 - reduces effect of S/H mis-interpreting signal from lower earnings (confusion whether one-time / recurring)
 - **RoT – buying insurance makes sense only if – T/C for raising capital > insurance loading**

- people are more homogenous than companies
- Friedman – no need for student loans → students can just IPO themselves
 - people IPOing their bodies ~ Martha Stewart + incentive K for athletes

6) Types of Insurance K

- **Retention (Self Insurance)** – buying no insurance
- **Traditional K** – fixed premium over short loss period
 - **coverage** -
 - **occurrence based** – claims payout ~ based on losses covered during policy period (regardless when claim filed)
 - more expensive due to uncertainty of eventual total risk
 - greater risk b/c longer exposure after point at which no more premium c/b charged
 - e.g., enviro, product, etc.
 - **claims based** – claims payout for claims made during period for losses occurring after a retroactive date
 - **double coverage** ~ bad b/c both insurers beg off
 - **ways to limit risk passed on** -
 - **claims based policy w/ recent retroactive date and short K life** – if loss is after retroactive date → insurer can increase future premiums
 - **retention (no insurance)** – Incremental (Amt paid / Actual loss) = linear = 1 (45 degree angle)
 - **deductibles** –
 - types – per occurrence (less coverage) + aggregate (more coverage)
 - **policy ceilings** – applies in aggregate
 - solution – layer policies w/ **attachment points** at cap for lower insurance levels
 - **why limit covg** – moral hazard + adverse selection
- **Loss sensitive K** – premium ultimately based on losses paid during insurance period (w/ K often multi-period)
 - **initial small premium** ~ pays for underwriting
 - **retro premium** – settles up acct
- **Finite risk K** -
 - **how it works** –
 - funds deposited into rolling account to meet insurance obligations
 - generally lasts 3-5 years
 - insured party gets back any residual (combats moral hazard)
 - **cash flows analysis** ~
 - Beginning Balance = PY Ending Balance + Premium (Set) – Insurer's fee
 - Ending Balance = Beginning Balance – Claims Paid + Int on Beginning Balance
 - **pros** – allows firms to smooth earnings (b/c annual premium is always the same)
- **Captive insurers** – insurer that is wholly owned by the policyholder
 - **pure captive** ~ insures parent corp / subs
 - **non-pure captive** ~ insures unrelated entities
 - **differs from self insurance b/c** – requires some non-trivial reserve (by regulation) + qualifies for added tax breaks
 - **offshore captives**
 - **why use?** – smaller required reserves + looser investment restrictions (c/b in parent) + relaxed reporting requirements + tax deferral (some regions allow deferral of income reporting for 1 yr + 1 day)

- **offshore** – maybe in the US (~ VT, MT)
- **pros** –
 - **adverse selection** – traditional insurer over-estimates risk and pools you w/ higher risk firms
 - **moral hazard** – mitigate / control moral hazard of other firms in your insurance pool (w/ insurance, they now act less safely) → less incentive to cheat affiliated businesses
 - **overloading** – mis-pricing by your insurance company
- **con** – still requires minimum capital per regulation
- **Remember** –
 - moral hazard becomes a risk again for Finite Risk K if cumulative rolling balance falls negative
 - almost always beneficial to buy some form of insurance due to the tax deductions (better to self insure than no insure)
 - insurance ~ part of corp strategy so not required t/b disclosed in F/S

7) Torts

- **background** –
 - sources of law ~ Common Law + Statutory Law
 - branches of law ~
 - Criminal – actions that threaten existence of the state
 - Civil (K + Tort) – acts that threaten property or person
- **types of tort liability** -
 - **no liability** – a specific type of tortfeasor cannot be liable (charities, gov'ts, etc.)
 - **negligence** –
 - **elements** -
 - **i) legal duty to not harm** ~ mfr, driver, doctor, etc.
 - **ii) broke legal duty** – tested w/
 - reasonably prudent man test
 - professional standards test (medical, S/H v. D&O, etc.)
 - cost justified precautions – compare MSB to MSC
 - value of life ~ Dept of Labor (\$5M); Dept of Commerce (\$2M)
 - **iii) proximate cause** – tested w/ foreseeability
 - **iv) injury occurred** -
 - **defenses** –
 - **a) contributive** – some states → any contrib. negl. is enough; others require > 51%
 - **b) comparative negligence** -
 - **c) assumption of risk** – but many states do not respect waiver of right to sue
 - **d) judgment proof** – any liability in excess of assets that law allows defendant to keep
 - **e) limited liability** – limits incentive to invest in safety → moral hazard ~ justification for compulsory insurance
 - **strict liability** –
 - **elements** – proximate cause + actual injury occurred
 - **defenses** – some allowed ... ?
 - much lower awards than negligence b/c of state caps
 - **absolute liability** –
 - **element** = actually caused an injury
 - **defenses** – none allowed
 - **but** - law typically specifies exactly which acts fall here (~ blasting)

- **tort damages** –
 - **compensatory** – compensate injured party
 - **monetary** ~ lost wages, medical, etc.
 - **non-monetary** ~ pain & suffering
 - **punitive** – punish tortfeasor above compensatory dmgs (goal ~ deter bad behavior)
 - typically capped – b/c usually calced as multiple of compensatory dmgs (so if comp dmgs capped, then punitive dmgs capped)
 - **consider** –
 - is it efficient to allow pain and suffering?
 - Prof says – giving consumers the choice is “first-best outcome”
 - optimal amount of compensation in suit = amt people w/b willing to pay for separate insurance
 - some states allow you to buy reduced P auto insurance and waive your right to sue for pain & suffering
 - risk – free riders w/ no insurance retain their right to sue for pain & suffering
 - Dr’s striking → supply shifts left + demand stays same + P stays same in ST b/c HMO regulation = **supply shortage**
- **optimal level of safety expenditure** -
 - **social optimum investment** – always → $MSC = MSB$
 - **marginal social benefit (MSB)** = bene to consumer from lowering E(Loss) [ignore tort recovery]
 - gives sense of efficiency
 - includes some of all private benefits
 - **marginal private benefit (MPB)** – bene to firm from lowering E(Payment for loss)
 - **RoT**
 - w/ efficient tort – firm’s $MPB = MPC = MSB$ (if torts fully compensate injured parties for 100% of actual loss)
 - w/o torts – firm’s $MPB = MPC < MSB$ → **deadweight loss** results b/c firm invests to little
 - w/ punitive torts – firm’s $MPB = MPC > MSB$ → **deadweight loss** results b/c firm invests to much
 - Coase (no torts, ideal info, no T/C) – $MSB = MSC$ (range)
 - Coase (no torts, ideal info) – $MSB < MSC$ (range) **deadweight loss** results b/c firm invests to little
 - effect ~ transaction costs limit amount of MSB transferable to firm
 - Coase (no torts, with info problems) $MSB < MSC$ (range) **deadweight loss** results b/c firm invests to little
 - effect ~ customer perceives too little value from investments in safety
 - **consider** –
 - net cost to consumer after actual loss + expected tort transfer
- **Why have a tort system?**
 - **Coase theorem** – says private competitive solution is efficient IFF → no transaction costs (~ negotiation costs) + all parties have perfect / full info
 - no need for tort system IF – all safety info of product is included in P
 - torts needed where Coase fails
- **states of world**
 - no gov’t – Coase applies
 - gov’t w/ torts – Coase fails
 - compulsory insurance – torts fail, e.g., due to limited liability
 - safety restrictions –
 - force people to invest in safety that O/W would not (e.g., due to limited liability undermining even torts)
 - torts just provide some economic incentives
- **remember** -
 - negligence usually gives higher awards than strict liability b/c no caps (b/c harder to prove)
 - many states do not respect right to sue

8) Employee Benefits

- **What are EE benefits** – non-wage compensation linked to employment generally w/ insurance component
- **Types** –
 - traditional plan – ER provides bene + EE contributes + ER pays balance
 - cafeteria plan – ER gives EE money + EE picks benes / pays balance
 - life insurance – see next section
- **Why provided** –
 - regulation – SS + Workers Comp + States beginning to micromanage health plans
 - cost efficiency - EoS from pooling (lower admin costs to ER / EEs) + lower search costs for EEs + lower search / admin costs to insurer
 - labor productivity – attracts “right” EEs + improve health / reduce absenteeism + align ER / EE interests + deter T/O + induce timely retirement
 - tax benes – valuable to EE b/c tax advantaged (means ER can pay less for same affect); no relevance to ER (b/c deductible)
 - life insurance –
 - **to ER** - protect against reputation costs + liability protection
 - **to EE** – premiums are pre-tax to \$50k face value / yr + no U/W w/ group coverage + EoS means less cost + gov't life insurance benes are low
 - RoT – consider which is greater -
 - $EU [prob_{live} * U (wealth - premium) + (1-p) * U (dead \& \text{family provided for})]$
 - $EU [prob_{live} * U (wealth) + (1-p) * U (dead \& \text{family NOT provided for})]$
- **Who pays** – ER pays in ST (b/c can't adjust quickly); EE pays in long run (more benes mean ER can afford less wages)
- **Problems** – ER costs escalate + plan changes irritate EEs + equity issues among EEs + cherry picking among groups + deferred promises can get expensive
- **Remember**
 - benefits change through the employment lifecycle (recruit, retain, retire)
 - tax deductibility means ER indifferent b/w wage / bene (but may prefer bene to keep EEs healthy)

9) Life Insurance

- **death bene** – amt beneficiary receives (not taxable + excluded from estate)
- **cash value** – amt of savings accumulation
- **death protection** = death bene – cash value (~ pure death protection)
- **face amount** ~ stated amount of coverage
 - for term, WL, some UL ~ death bene
 - for other UL ~ death bene – cash value
- **endowment policy** – pays face amount of policy if either (i) insured dies or (ii) insured survives the term
 - key features - requires large premium + main uncertainty is when bene paid + similar to a savings account
 - decline in popularity b/c no longer tax favored unless very LT (like whole life)
- **disintermediation** – policyholder w/d of cash value as policy loans to invest elsewhere
- **actuarially fair premium** ~ PV of expected claim cost based on mortality tables (consider conditional prob)

	Cash Value life Insurance			
	Term Insurance	Whole Life	“Investment Sensitive K”	
			Universal Life	Variable Life
Term	<ul style="list-style-type: none"> some term fixed by K 	<ul style="list-style-type: none"> policyholder’s entire life 		
Benefit	<ul style="list-style-type: none"> <u>pure death protection</u> (only) <ul style="list-style-type: none"> not taxed 	<ul style="list-style-type: none"> <u>death protection</u> <ul style="list-style-type: none"> equals face amt (regardless of when insured dies) paid to insured IF survives to 100 AND pays all premiums DP V = Death bene – CV DP V = Face – CV DP V decreases as CV rises <u>savings accumulation</u> <ul style="list-style-type: none"> Cash value schedule ~ fixed at time policy purchased grows over time until reaches Face Value at age 100 Returns <> reported nor unbundled 	<ul style="list-style-type: none"> <u>death protection</u> - two options <ul style="list-style-type: none"> i) death bene = level face amt (regardless of when insured dies) <ul style="list-style-type: none"> DP decreases as CV rises ii) death bene = face amt + CV <ul style="list-style-type: none"> DP = Death bene - CV <u>savings accumulation</u> <ul style="list-style-type: none"> CV varies directly w/ prem paid, charges, int CR guarantee some minimum rate of int (usually) 	<ul style="list-style-type: none"> <u>death protection</u> <ul style="list-style-type: none"> Death bene varies w/ CV (but w/ some guaranteed minimum) Death bene ~ level bene + added bene if get RoR on investment <u>savings accumulation</u> <ul style="list-style-type: none"> CV depends on return on portfolio picked by insured CV can decline effectively invest in Mutual fund w/ insurance name
Surrender (~ early policy lapse)	None (b/c no savings accumulation)	<ul style="list-style-type: none"> <u>surrender value</u> = preset cash value (no explicit charge) paid up insurance ~ CV buys a paid up whole life policy extended term insurance ~ CV buys a paid up term policy w/ same FV as original policy 	<ul style="list-style-type: none"> <u>surrender V</u> = variable CV surrender charge applies (decreases during term) 	<p>Varies over time depending on investment returns</p> <p>surrender charge applies (decreases during term)</p>
Premiums	<ul style="list-style-type: none"> premiums increase over time w/ mortality risk premium to face value \$50K ~ tax free non-contributory + exp rated 	<ul style="list-style-type: none"> continuous prem ~ level over life single prem ~ one upfront premium limited pay ~ level over set period 	<ul style="list-style-type: none"> total flexibility if insured pays more / less → CV just adjusted accordingly c/b avoided if high int. 	
Other	<ul style="list-style-type: none"> almost all guarant. renewable many convertible to cash value w/o showing proof of insurability cheaper premiums early in life than for Cash Value insur. few PT / temps + waiting period (~ 1 mo for suicide) EE <> control benes + exclusions (suicide/ terrorism) 	<ul style="list-style-type: none"> an endowment policy to 100 guaranteed insurability opt ~ allows purchase add. insurance <u>key point</u> – insured is pre-paying death protection early participating policies ~ pays annual div (tax free b/c return of premiums) policy loan – insured can borrow against CV (reduces death bene) – also-automatic if miss premium payment expense loading – generally front loaded (lower CV accumulation early) 	<ul style="list-style-type: none"> an endowment policy death bene and savings accum. ~ essentially unbundled insured bears risk re: int and mortality rate Δs <u>risk</u> – if level death protection and CV > face amt → no death bene (no tax bene) <u>solution</u> – death bene automatically increased policy loan – allowed (unpaid int ~ deducted from CV) 	<ul style="list-style-type: none"> policy loan – allowed variable universal life ~ combo of ability to choose portfolio + flexible prem pay

- **Life insurance –**
 - Tax Issues -
 - **benes** - death benes not taxable + no tax on increase in CV during policy
 - **other points –**
 - tax applies on appreciation of CV above premiums paid – this is key b/c even amt paid for CV accumulation is treated as tax basis (??? – p. 125)
 - no deductibility for premiums
 - penalties for early w/d
- **Annuity K –**
 - two periods – **accumulation period** (when policyholder pays premiums) + **payout period** (when insurer pays out)
 - types -
 - **straight life annuity** – only pays until annuitant dies
 - **annuity certain** – pays over a fixed period of time regardless of death
 - **life annuity, period certain** – pays for fixed number of yrs + then pays until some person dies
 - **jt and last survivor annuities** – pays until two people die
 - **deferred annuities** ~ pre-retirement accumulation + post-retirement distribution ~ tax deferred
 - **single premium** – purchased w/ single premium (guarantee int rate)
 - **flexible premium** – gives purchaser flexibility as to timing / amt of premium (no guarantee)
 - **fixed annuities** – return credited to K varies w/ current interest rates (but insurer guarantees some minimum)
 - **variable annuity** - return varies w/ return on stock / bond investment (NO guaranteed minimum)
 - use – protect annuitant from outliving financial resources
 - bene – lower expenses than CV life insurance (b/c mortality experience is lower??)
 - also - c/b surrendered (charges may apply)
- **Pricing –**
 - term life – PV of expected future claim costs given mortality table and interest (discount) rate
 - multi-year pricing – requires use of conditional probabilities for all years after yr 1
 - level premium – equates PV of E(cash inflows) to PV of E(cash outflows)
 - annuity – PV of E(cash outflows) – use conditional probabilities from mortality table over annuity term + discount
 - whole life – forecast CF until policyholder ~ 100
 - **single premium** →
 - **continuous level premium** → premium is a life annuity → PV of E(premium payments) must = single Prem.
 - i) calculate likelihood of being alive at each age (i.e., will pay premium) → [**prob * P**]
 - ii) calc PV of probabilities → [$(\text{prob} * P) / (1+r)^n$]
 - iii) sum individual PV amounts → [sum of discounted Prob * P] and set equal to single premium
 - **limited payment whole premium** – pay level payment for fixed number of yrs
- **Cost comparisons –**
 - term insurance →
 - **interest adjusted cost index** (IACI) ~ (accumulated future value of all premiums – Div) / $(1+.05)^n$ [~ n=20]
 - interest adjusted cost per \$1,000 FV, assuming held 20 yrs + 5% interest (p. 141)
 - whole life insurance →
 - **IACI** ~ (accumulated future value of all premiums – Div – CV) / $(1+.05)^n$
 - **implicit rate of return** – on premiums that go as contribution to savings accumulation
- **Remember –**
 - when valuing life ~ PV of expected income stream ~ 7 * income (RoT for 25 yr old)
 - ER prefers term insurance b/c only wants to cover while you work

10) Health Insurance

types –

	Fee For Service	Preferred Provider Org (PPO)	HMO	Point of Service	PSO
ER	selects plan features (deductibles / co-insurance applies) + either self insures or purchases insurance from insurers / BCBS org				
EE	select service provider + pay premium	chooses provider w/i PPO	less choice of providers	choose provider in network	
elements	reimbursement (indemnity) + reimb for medical exp + deductible & co-pay for Usual, Customary, & Reasonable (UCR) expenses + annual / lifetime ceilings + waiting period (~ 9 mos) + exclusions	<ul style="list-style-type: none"> DR contracts w/ insurer to offer services at reduced rates DRs ~ independent 	pay more for out of network referrals	<ul style="list-style-type: none"> in-network care fully reimbursed out of network service ~ subject to deductible + large co-pay 	<ul style="list-style-type: none"> owned by providers hold harmless clause ??
probs	<ul style="list-style-type: none"> ex ante moral hazard (little incentive to prevention) ex post moral hazard (excessive utilization once sick → MC > MB) 	<ul style="list-style-type: none"> doesn't work so well w/ small groups more expensive than HMO ltd to PPO providers 	<ul style="list-style-type: none"> backlash from public b/c no flexibility HMO Drs not as good b/c face no competition no incentive for quality of care 		<ul style="list-style-type: none"> solvency issue cost v. quality of care issues
solutions	boost deductibles / co-insurance + reduce UCR (so insured pays more; DR incentives Δ) + managed care		too little care boosts later probs + malpractice litigation + competition + internet / consumer info		
Bene	EE flexibility	low cost v FFS + greater choice than HMO + new DRs can build practice	boosts prevention + controls costs (25% lower than FFS) + keep people out of hospital		

- rising costs** – tech advances + more expensive preemies + more survive w/ disease + low prevention + changing defn of health (Botox / Viagra) + too much protection from costs due to insurance (moral hazard)
- P elasticities** - medical care consumption ~ income & P sensitive → = $c + [a \cdot P \text{ of medical care}] + [b \cdot \text{income}]$
 - P elasticity of demand ($\% \Delta Q / \% \Delta P$) → Patient days (-.7); hospital admissions (0.0 to -0.5) [~ a < 0]
 - Income elasticity of demand ($\% \Delta Q / \% \Delta I$) ~ + 1.0 [~ b ~ 1]
- P to EE** – depends on insurance and tax bracket
 - no insurance / after tax = P
 - insurance / after tax = $P(1-k)$ [~ k ~ medical fraction covered by insurance]
 - insurance / before tax = $P(1-k-t)$ ← **what consumer pays**
- sick leave / personal days** –

- no legal requirement to pay
- risk – malingering → solution ~ medical certification after 3 days
- most firms self insure b/c so predictable (everyone uses all of it)
- few firms allow cumulation (~ moral hazard)

- **ER considerations** –
 - **non-contributory plan** – ER premium not taxable to EEs if plan not discriminatory
 - **contributory plan** – EE premiums paid from taxable income (unless use flexible spending acct)

- **group medical plan issues** – rising premiums + renewability (group insurance typically not) + portability (pre-existing exclusions limit job Δs)

- **COBRA** – HI offered at EE expense if left b/c of qualifying event (resignation, retirement, dismissal)
 - premium ltd to 102% of ERs cost of group plan

- **Retiree issues** –
 - ERs historically offered to incentivize EEs to stay
 - FAS 107 required to book liab (despite no ability to pre-fund in tax beneficial way) → ERs stopped providing
 - ERs change terms → impise UCR / deductible / copays
 - solutions – ER reserves right to amend plan + bankruptcy

- **remember** -
 - **Monday affect** – more on the job injuries reported on Monday than any other day
 - most US non-elderly get medical expense insurance through work
 - uninformed consumers over consume healthcare

11) Workmens' Comp

- **Philosophy** –
 - **no fault coverage** – expedite claims + ignore cause + no tort liability / no pain & suffering
 - **features** – mandatory / immediate coverage (w/ no vesting) + medical determination (ensures injury from work)
 - **risk** – moral hazard
 - **solution** – waiting period + replenishment rate < 100% + ER selects DRs / fee schedules + managed care

 - **types of payments** –
 - **medical only** – no indemnity
 - **indemnity** -
 - **temporary total** – waiting period w/ retroactive pay + limited to 80% replenishment rate and a cap
 - **permanent partial** – recover per benefit schedule + often lump sum
 - **permanent total** – EE can't work permanently
 - **death** – burial & survivor benefits

- **Benefits & Financing** –
 - **premium** - mandatory ER premium set at state level based on work category
 - projected loss cost / \$100 payroll per class
 - class rate = projected loss cost + load
 - **residual market** – for cos that can't find insurance → all insurcos share cost based on voluntarily written policies

- **Challenges** –
 - **rising costs** – rising medical costs + new injuries recognized (repetitive stress) + growing bene claims (less stigma for mental claims) + more fraud

- **Other Influences** – OSHA (but micromanaging + little evidence) + ADA

- **Prof's takeaways** –
 - EEs pay for lawsuits / claims through lower wages

12) Disability Insurance and Health Care Reform

- **Private Disability Insurance** –
 - Short Term DI (STD) -
 - **generally** - provides continued salary if temporarily unable to work + voluntary to ER (BUT 6 states mandate 26 weeks covg) + deductible to ER + taxable to EE (if non-contributory)
 - **mitigating moral hazard** – eligibility is MD certified + 30 day waiting period + ~ 60% replacement rate < 100% + 6 week max benes + coord benes w/ sick leave/ WC / other
 - Long Term DI (LTD) –
 - **generally** - provides continued salary if permanently unable to work + voluntary to ER + deductible to ER + taxable to EE
 - **mitigating moral hazard** – eligibility is MD certified + 6 mo waiting period + ~ 40% replacement rate < 100% + duration for fixed term / until firm's retirement age + coord benes w/ sick leave/ WC / other + subject to periodic rechecks
 - problems – rising claims (fraud / job nature changing / new types of disability / long tails for 9/11 DI not known) + can't cut off covg just b/c of cost issues
 - solution – cutback benes + cost sharing + case mgmt + back to work efforts
- **Government Disability Protection (SSDI)** -
 - generally - provides continued salary if unable to work at anything + requires medical confirmation of disability expected to last ≥ 12 mos (or result in death) + US citizen / national / alien + have paid DI taxes for 10 yrs (and last 5 out of 10 yrs) + 5 mo waiting period + coordinated w/ other benes
 - benefit formula –
 - i) compute Avg Indexed Monthly Earnings (AIME)
 - ii) compute Primary Insurance Amount = 90% of first tier + 32% of next tier + 15% of remaining w/ cap
 - iii) avg after tax replacement rate ~ 60% (100% w/ family benes)
 - financing SSDI – mandatory 1.2% payroll tax ($\frac{1}{2}$ ER; $\frac{1}{2}$ EE)
 - challenges – new applicants / cases (kids / drugs) + longer life expectancy + aging baby boom + states have lowered own covg & rely more on feds + more advocates finding claimants (mentally ill, AIDS, etc)
- **Health Care Reform** –
 - challenges – rising demand for quality care + tech advances + longer life expectancy + uninsured get care through expensive means + defensive medicine + over utilization + lack of insurance (15% of population) + charity care
 - possible policy objectives – universal covg + minimum bene for all + reduce over utilization
 - proposed reforms –
 - **nationalization** → less choice to individuals + rationing access to care + allows 24/7 covg to all
 - **mandatory private insurance purchase** → fewer uninsured + more utilization + higher costs + wages fall + restricted choices
 - **selective intervention** → deal w/ specific problem classes (uninsured children) ~ COBRA / legislation on pre-existing conditions
 - **Medical Savings Accounts** →

13) Retirement

- **Generally** –
 - risk – retirees exhaust resources before death → shortfall is highest for high earners → situation helped by having pension / house
 - solution – private + ER + gov't
 - why pensions provided – tax deferred + attraction / retention / retirement benes to ER
- **ER Provided Plans** –
 - Defined Bene Plans –
 - **formula** – many possible → $\sim B_t = 2\% * \text{final pay} * \text{yrs of service}$

- **early plans** – subsidized early retirement
- **cash balance plans** – smoothed retirement benes (IBM)
- **Defined Contribution Plans** -
 - **formula** ~ $C_t = 6\% \times \text{current pay}$
 - **growth** – EEs like ownership + EEs like matching & control + portability of DC + DB seen as more costly by ERs
 - **features** – either ER / EE may contribute pre-tax + fully funded by defn + NOT insured by PBGC + investment risk born by EE
- **Challenges** –
 - DB - funding shortfall estimated at 300 B (asset Vs falling / liab rising / recession hurts ability to contribute) + prudent investment of DB assets / framing of investment alts + expensive fiduciary insurance + participant litigation
 - PBGC arrears
 - DC concerns – plan participant myopia (little diversification)
- **ERISA** –
 - **funding** – annual contributions must cover annual accruals + amortize past under-funding + termination liability funding requirements + plan sponsors legally liable for investments
- **Social Security** –
 - **generally** – covers elderly consumption needs and some medical needs +
 - **why have** – problems w/ relying on private saving (Samaritan's dilemma) + poor always around + ER pensions might not provide COLA
 - **OASI** – provides basic retirement / health benes that ERs often augment
 - combines insurance (benes rise w/ earnings / not means tested) & welfare (real returns higher for low wage EEs)
 - **benes amt** – based on wages earned (Avg Indexed Monthly Earnings) + length of worklife w/ full benes paid at normal retirement age
 - i) compute Avg Indexed Monthly Earnings (AIME)
 - ii) compute Primary Insurance Amount (PIA) = 90% of first tier + 32% of next tier + 15% of rest to cap
 - **bene types** – retirement + survivor + disability
 - **problem** ~ financing – shortfall ~ 22T
 - → PAYGO ~ from payroll tax (ER / EE pay 6.2% to \$86,400) + HI tax (ER / EE pay 1.45% uncapped)
 - **alts** –
 - **maintain current situation** – bene reduction + tax increase
 - **Δ to welfare system** - benes means tested → moral hazard for greater risk and no savings
 - **move to funded system** – govt or EEs invest in stock market
 - **increase inflow / contributions** – increase rate + increase base + absorb state EEs + increase immigration + take general revenues
 - **lower outflow / bene g rate** – means testing + lower annual COLA adj. + switch from wage indexing (to P index / longevity index) + raise Normal Retirement Age +
 - **increase return on trust assets** - PRAs
 - **key hurdles** ~ political
 - **Key themes** – no complete privatization of SS + no bene cuts + improve safety net + wath building + better diversification + greater transparency
 - **Medicare** – pays medical expenses for aged 65+ and disabled if < 65
 - **benes** – Part A (hospital insurance) + Part B (supplementary medical)
 - **financing** –
 - **HI** ~ dedicated payroll tax (ER / EE pay 1.45% uncapped)
 - **SMI** ~ contributory + heavily subsidized w/ general revenue
 - **challenges** – shortfall + criticism (low benes / slow processing / HMO's give little flexibility)