



# PRICING LIVES

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# PRICING LIVES

- Why and how do we value lives?
- Valuing lives for policy
- Guidelines for Australia
- Corporate risk analysis
- Ethical and policy controversies
- Societal contexts for pricing lives

# PRICING LIVES: WHY DO WE VALUE LIVES?

- Policy analysis
- Corporate risk analysis
- Regulatory sanctions
- Court awards
- Focus on policy analysis context, then examine general applicability.

# RISKS OF ONE IN ONE MILLION

## Activity

Spending 1 hour in a coal mine

Spending 3 hours in a coal mine

Traveling 10 minutes by bicycle

Traveling 150 miles by car

Flying 1,000 miles by jet

## Cause of Death

Black lung disease

Accident

Accident

Accident

Accident

# CANCER RISKS OF ONE IN ONE MILLION

<b>Activity</b>	<b>Cause of Cancer Risk</b>
Living 2 months in at 5,280 feet	Cosmic radiation
Living 2 months in average stone or brick building	Natural radioactivity
One chest X-ray taken in a good hospital	Radiation
Drinking Miami drinking water for 1 year	Chloroform
Living 5 years at site boundary nuclear power plant in the open	Radiation

# THE NECESSITY OF TRADEOFFS

- Economic limits
  - i. 128,000 accidental deaths per year
  - ii.  $\text{GDP}/\text{Accidental death} = \$115 \text{ million}/\text{death}$
  - iii. Also 33 million disabling injuries

# PRICING LIVES: HOW DO WE VALUE LIVES?

- Risk-money tradeoffs for small risks of death

# THOUGHT EXPERIMENT

- How much are you willing to pay to eliminate one time only risk of death of 1/10,000?

## Amount in Dollars

Infinite

Above 1,000

500–1,000

200–500

50–200

0–50



# THOUGHT EXPERIMENT

- How much are you willing to pay to eliminate one time only risk of death of 1/10,000?

<b>Amount in Dollars</b>	<b>Value of Statistical Life (\$)</b>
Infinite	Infinite
Above 1,000	Above 10,000,000
500–1,000	5,000,000–10,000,000
200–500	2,000,000–5,000,000
50–200	500,000–2,000,000
0–50	0–500,000

# CALCULATING THE VALUE OF A STATISTICAL LIFE (VSL)

- Suppose 1/10,000 risk to 10,000 people so 1 expected death.
- Assume each would pay \$1,000 to eliminate the risk.
- $VSL = 10,000 \text{ people} \times \$1,000/\text{person} = \$10,000,000.$

# WHAT VALUE OF A STATISTICAL LIFE (VSL) MEANS

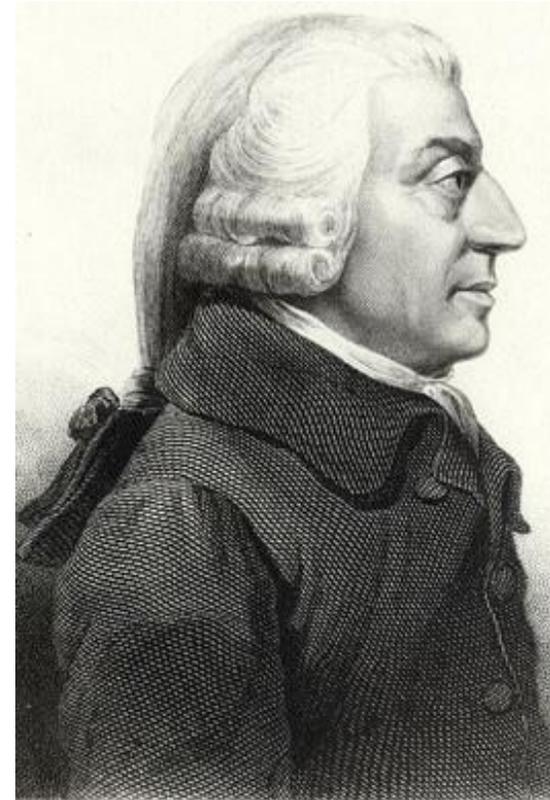
- VSL only gives rate of tradeoff for small risks.
- VSL understates amount of compensation needed to incur risk of certain death.
- VSL overstates amount willing to pay to avoid certain death.
- VSL is used to value small risk reductions by government programs.

# SOURCES OF TRADEOFF EVIDENCE

- Surveys
  - i. Not real decisions
- Market data – implicit values of life
  - i. Job market wage-risk tradeoffs
  - ii. Product market price-risk tradeoffs
  - iii. Housing market price-risk tradeoffs

# DOMINANT APPROACH: WAGE-RISK TRADEOFFS

- Adam Smith's theory of compensating wage differentials
- Controlling for other aspects of the job, how much pay for extra risk?





# EXAMPLES OF TRADEOFFS

- Elephant Handlers in Philadelphia Zoo - \$1,000 extra per year.
- Firefighters in Kuwait - \$500,000 per year.
- 1,300 deaths per year due to switch to smaller, more fuel-efficient cars.



# HEDONIC WAGE EQUATIONS

- In log *wage* equation form, estimate

$$\ln(\textit{wage}) = \alpha + X'\beta_0 + \beta_1 \textit{Risk} + \epsilon.$$

- VSL calculation is  $\partial w / \partial \textit{Risk}$ , or

$$VSL = \hat{\beta}_1 \times \overline{\textit{wage}} \times 2000 \times 100,000.$$

# THE AVERAGE VALUE OF STATISTICAL LIFE

- Median U.S. value in \$9–11 million range (\$2015).
- Require \$1,000 to face risk of 1/10,000.
- International evidence is problematic.
  - Data weaknesses.
  - Methodological differences.
  - Anchoring biases.

# PRICING LIVES: VALUING LIVES FOR POLICY

- How do we conceptualize the appropriate value?
- How do we map the concept into a monetary figure?

# HISTORY OF THINKING ABOUT PRICING LIVES

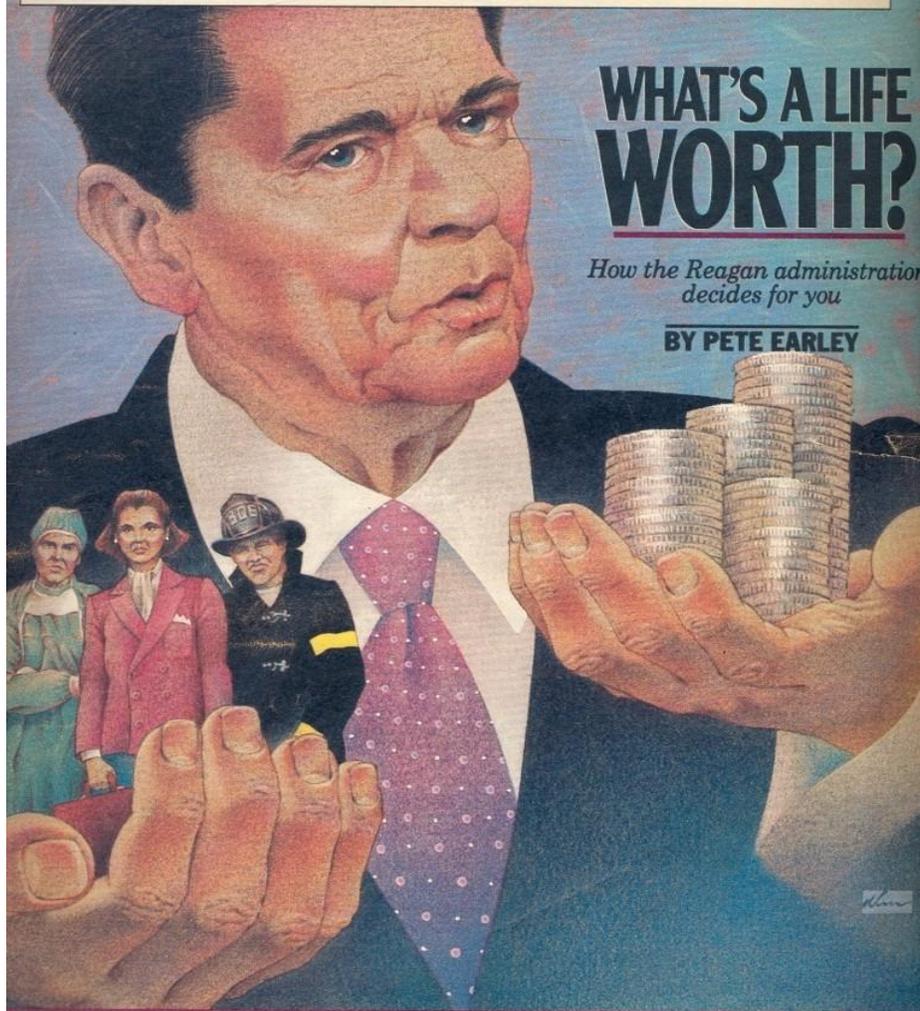
- Early studies – present value of lost earnings.
  - i. Easy to calculate
  - ii. Used in court cases
- Benefits principle for all policies – society’s willingness to pay for the benefit.
- Benefit is risk reduction – risk/money tradeoff.
- Good economics, but viewed as “immoral.”

The Washington Post Magazine

WHAT'S A LIFE WORTH?

How the Reagan administration decides for you

BY PETE EARLEY



June 9, 1985

# VALUING LIVES FOR POLICY

- 1982 hazard communication debate.
- Life is too sacred to value so OSHA calculated “cost of death” as present value of lost earnings.
- OMB: Benefits did not exceed costs so rejected regulatory proposal.
- OSHA appealed to VP Bush.
- I analyzed merits of proposal using proper value of statistical life (VSL) estimates – 10 times the present value of lost earnings.

# EVIDENCE TO SETTLE THE DEBATE

- My estimates used in 1982 were just over \$3 million.
- Benefits now exceeded costs, and regulation was issued.
- Some attacked as too big – people anchored on present value of lost earnings.
- Historical context is that VSL was more supportive of risk regulation than failing to quantify by making reduced risks “priceless.”

# EXAMPLES OF U.S. VALUE OF A STATISTICAL LIFE (VSL)

- Dept. of Transportation: \$9.4 million.
- Environmental Protection Agency: \$9.7 million.
- Dept. of Health and Human Services: \$9.6 million.

# PRICING LIVES: GUIDELINES FOR AUSTRALIA

- What are international VSL practices?
- What should VSL practices be in Australia and other countries?

# VSL GUIDELINES AND POLICY EXAMPLES

<b>Country</b>	<b>VSL (\$ millions)</b>
Australia	2.7
Canada	5.6
Malaysia	1.0
United Kingdom	
- Transport	2.4
- Floods	2.1
United States	
- Transportation	9.4
OECD	
- Range	1.8–5.5
- Base	3.6

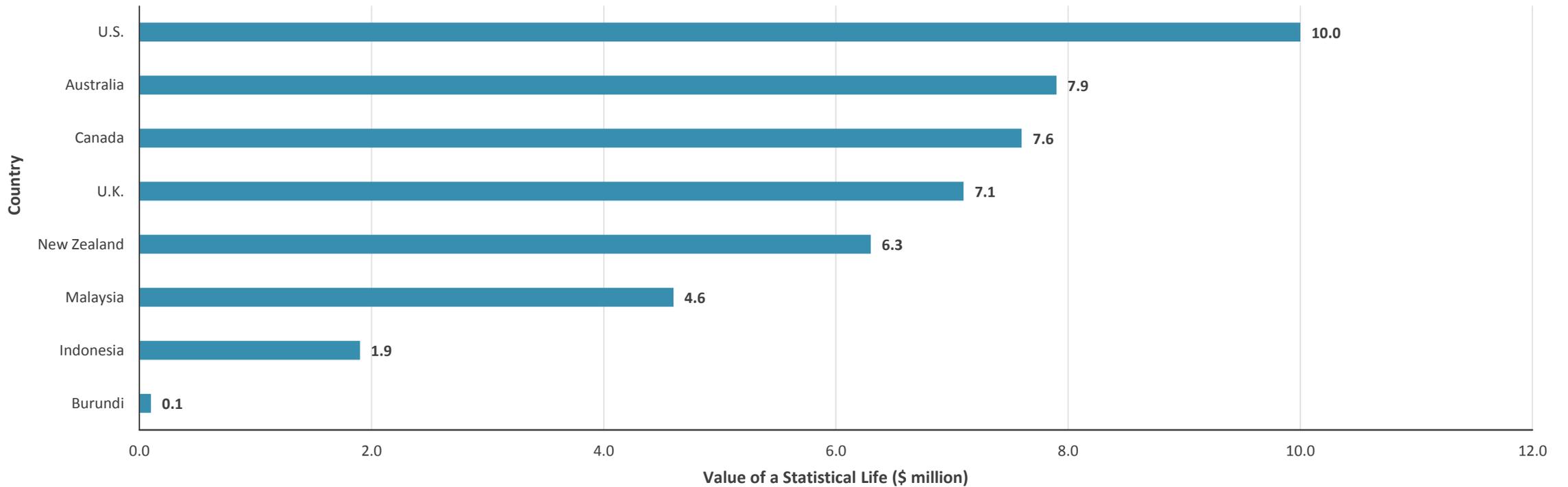
# WHY INTERNATIONAL VSL LEVELS ARE WRONG

- Substantial reliance on stated preference studies, leading to low VSL, e.g., OECD base value of \$3.6 million.
- International labor market studies are biased by anchoring on U.S. values.
  - Estimates are implausibly large given income differences across countries.
  - Australia VSL such as \$7.1 million, \$22.0 million.
  - India VSL such as \$4.9 million, \$13.7 million.
  - Rampant publication selection bias.

# MY PROPOSED APPROACH FOR INTERNATIONAL VSL

- Use baseline U.S. estimate from labor market studies using most accurate fatality rate data, e.g., \$10 million.
- Extrapolate to other countries based on income elasticity of the VSL and differences in income (GNI per capita, World Bank).
- International income elasticity is about 1.0.
  - Higher than U.S. elasticity of 0.5–0.6.
  - Somewhat larger than OECD estimate.
- Application of approach leads to reduction of U.S. VSL for other countries, but still higher.

# INTERNATIONAL VSL



# POLICY GAPS

- United Kingdom
  - \$2.1–\$2.4 million for policy versus \$7.1 million desirable.
- Australia
  - \$2.7 million for policy versus \$7.9 million desirable.
- Malaysia
  - \$1.0 million for policy versus \$4.6 million desirable.
- Consistent pattern of undervaluation of life throughout the world.

# PRICING LIVES: CORPORATE RISK ANALYSES

- How do companies price lives?
- Why do companies err?
- How can we value lives adequately?

# GM IGNITION SWITCH RECALL OVERVIEW

- 2014 NHTSA fined GM \$35 million for not reporting defect.
- Did recall analysis in 2007 but no evidence of full benefit-cost analysis.
- How should GM have handled the defect?
- Why did GM ignore the problem?
- How can regulatory policy and liability rules be restructured to foster more responsible corporate behavior?
- Does the VSL have a constructive role to play?

# GM IGNITION SWITCH FAILURE

- Switch accidentally turns off.
- Initially, GM identified 64 fatalities due to crash, also injuries and property damage.



# GM IGNITION SWITCH RECALL ASSESSMENT

- 2007 recall cost estimate of \$100 million, some subsequent estimates higher.
- Reported safety defect in February 2014 to NHTSA.
- How to do a benefit-cost analysis.
- Mortality cost calculation:
  - \$9.4 million VSL × 64 deaths = \$602 million, or \$448 million using \$7 million VSL.
- Repair easily passes a benefit-cost test.

# GM SAFETY CULTURE

- Valukas Report, 2014.
- Forbidden words: bad, critical, dangerous, defect, failure, problem, safety, serious, unstable.
- Inflammatory words also prohibited: apocalyptic, catastrophic, deathtrap, decapitating, evil, ghastly, inferno, terrifying, you're toast.
- Company drivers of GM vehicles advised not to make comments such as:
  - "This is a safety and security issue..."
  - "Dangerous...almost caused an accident."
  - "This is a very dangerous thing to happen."
  - "This is a lawsuit waiting to happen."

# GM PRACTICES



## THE GM SALUTE

If confronted with a problem, indicate it's not your responsibility by crossing your arms

- GM nod: nod agreement with implicit commitment to inaction.
- GM salute: point to others at the meeting deflecting responsibility from yourself.
- Is lack of safety culture a historical accident?
- Only characteristic of GM?
- History of attempts at benefit-costs analysis is bleak.

# FORD RISK ANALYSES

- *Grimshaw v. Ford Motor Co.*, Ford Pinto gas tank fire.
  - Ford's benefit-cost calculations using \$200,000 court awards to value burn deaths, concluding costs of \$137.5 million exceeded \$49.6 million benefits.
  - Called "the most remarkable document ever produced in an American lawsuit."
  - Juror comparison of \$11 per vehicle cost with burn death generates hindsight bias effects.
  - \$125 million punitive damages, what I have termed "blockbuster awards."

# FORD RISK ANALYSES

- *Miles v. Ford Motor Co.*
  - Tension eliminator for shoulder harness on a seatbelt.
  - Ford “would first run a ‘cost benefit’ analysis to see what the cost would be to fix or repair the defect. Next, Ford would assign arbitrary values to each death or serious injury and would predict the number of occurrences which would involve either death or serious injury. Finally, Ford would determine the cost to litigate such deaths and serious injuries...if the cost to repair the defect exceeded the other costs, Ford would not correct the defect.”

# CHRYSLER RISK ANALYSIS

- *Jimenez v. Chrysler Corp.*, \$250 million punitive damages for risk analysis:
  - “Chrysler officials at the highest level cold-bloodedly calculated that acknowledging the problem and fixing it would be more expensive, in terms of bad publicity and lost sales, than concealing the defect and litigating the wrongful death suits that inevitably would result.”
  - \$250 million punitive damages award.

# GM RISK ANALYSES

- *Moseley v. General Motors*, fuel-fed fire impact case.
  - Risk analysis by Edward Ivey.
  - Used \$200,000 per fatality.
  - “They knew” was “a constant refrain among the jurors interviewed.”
  - Blockbuster punitive damages award of \$101 million.
  - Included \$1 million exclamation point!

# GM RISK ANALYSES

- *Anderson v. General Motors*, Chevrolet Malibu fire case.
  - \$4.8 billion punitive damages award, \$107.8 million compensatory damages.
  - “Jurors told reporters that they felt the company had valued life too lightly.”
  - Zero-risk mentality: “There is no evidence that the car they put out there was as safe as they could have put out there.”
  - “We’re just like numbers, I feel, to them. Statistics. That’s something that is wrong.”

# GM RISK ANALYSES

- *Hardy v. General Motors*
  - Chevrolet Blazer door latch risk analysis.
  - \$100 million punitive damages award, \$50 million compensatory damages.
  - Risk analysis showed awareness of the risk.

# CAN WE DO BETTER?

- Past efforts based on wrongful death awards – human capital measure.
- What if used VSL?
- Economic rationale, larger fatality benefits measure.
- Consistent with government practices but government policies are prospective, and tort liability is retrospective.
- Need legal protections for risk analyses.

# PRICING LIVES: ETHICAL AND POLICY CONTROVERSIES

- Identified lives
- Income
- Age
- Immigrants
- The devaluation of life

# ISSUE 1. IDENTIFIED LIVES

- Examples of lives to be saved
  - i. Girl in a well
  - ii. Trapped coal miner
  - iii. Beached whales
- Identified lives not statistical lives



## ISSUE 2. SHOULD INCOME LEVELS MATTER?

- Yes for lost earnings approach.
- Willingness to pay increases with income.
- Provide policies poor don't value?
- Airline safety – should we regulate it more stringently than highway safety?
  - Planes versus guardrails

# SHOULD INCOME LEVELS MATTER? CARNIVAL CRUISE LINES

- Carnival Cruise Lines – Costa Concordia
  - Lifeboats for 1st class?
- *Ex post*, death is certainty not lottery.



# INCOME LEVELS AND GOVERNMENT PRACTICE

- Department of Transportation adopted Viscusi-Aldy (2003) income elasticity estimate of 0.55 and raised it to 1.0 based on Kniesner, Viscusi, and Ziliak (2010) estimates.
- Adjustments for income made across time, not at any point in time.
- Adjustments across income groups are much more controversial.
- Rationale for income adjustment is stronger if beneficiaries of safety regulation pay for higher costs of safety.
- OECD and World Bank reduce the VSL for poorer countries.

# INCOME AT POINT OF TIME OR OVER TIME

- Department of Transportation's adjustment for income is very sound economic approach.
- Income changes over time for future generations receive greater support.
- Efficient, but redistributes income from poorer current generation to richer future generation.

## ISSUE 3. ARE OLDER PEOPLE'S LIVES WORTH LESS?

- Shorter remaining life, often worse health.
- No theoretical basis or link to preferences of affected population.
- Correct approach – how does willingness to pay for risk reduction vary with age?

# THE “SENIOR DISCOUNT” CONTROVERSY

**Seniors on sale**  
**37% off**



- Environmental Protection Agency used a senior discount of 37% in analysis of Clear Skies Initiative.
- Political firestorm

# ARE AGE DIFFERENCES FAIR?

- Is same value per statistical life equitable?

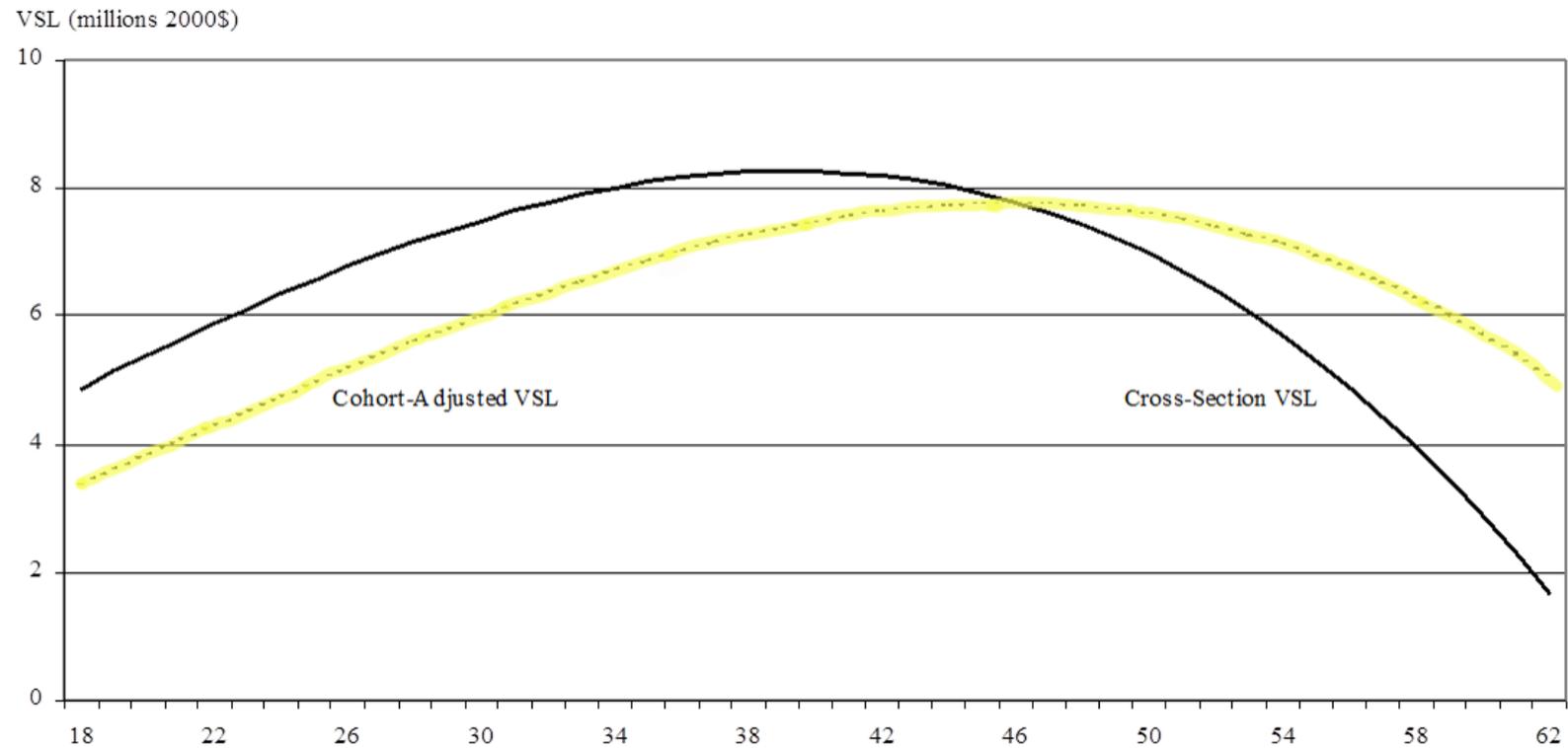
*versus*

- Is same value per statistical life year equitable?
  - Return to first principles – willingness to pay

# AGE AND THE LABOR MARKET

- Series of studies over two decades.
- Most recent use age-specific risk data.
- Result is inverted-U shape pattern.
- Flatter if control for consumption over the life cycle or cohort effects.
- VSL tracks lifetime income and consumption.

# COHORT-ADJUSTED AND CROSS-SECTION VALUE OF STATISTICAL LIFE, 1993–2000



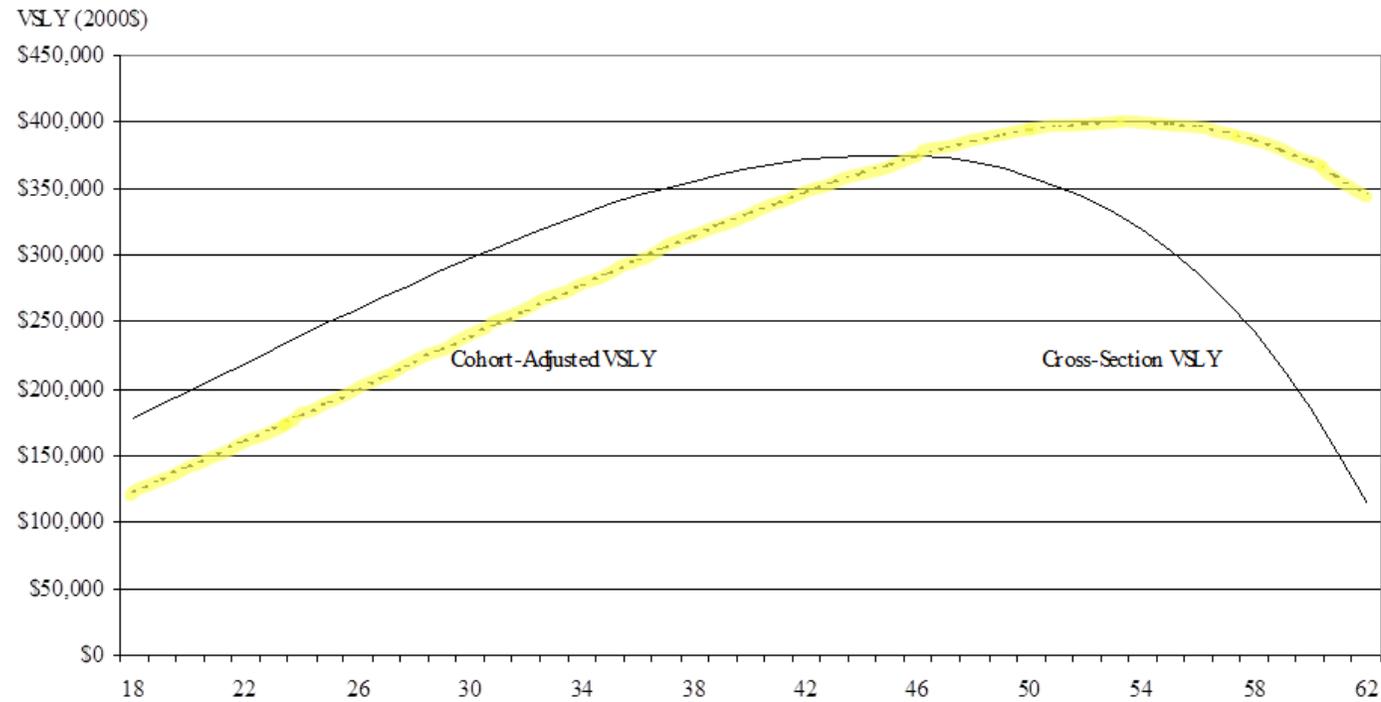
# WHAT DO WE KNOW ABOUT AGE-VSL?

- VSL does not peak at birth.
- VSL does not plummet as we age.
- VSL for workers around age 60 is *higher* than for workers age 20.
- Use of VSL by age may not be controversial if done correctly.

# VALUE OF A STATISTICAL LIFE YEAR (VSLY)

- Not a constant.
- Not steadily declining with age even though health may decline.
- VSLY rises steadily.
- Popular approach used by Food and Drug Administration.
- My U.S. values almost an order of magnitude greater than U.K. cutoff for worthwhile medical expenditures.

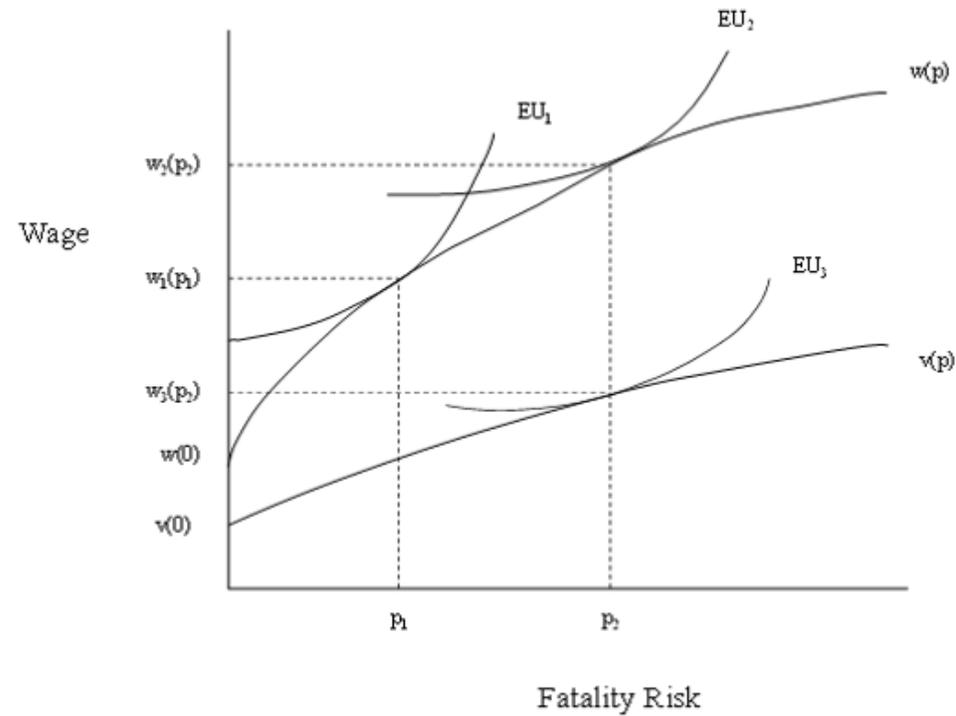
# VALUE OF A STATISTICAL LIFE YEAR, BASED ON COHORT-ADJUSTED AND CROSS-SECTION VALUE OF STATISTICAL LIFE, 1993–2000



## ISSUE 4. SEGMENTED LABOR MARKETS

- Workers may face different labor market offer curves.
- Settle into separate labor market equilibria (Viscusi and Hersch 2001).
- Test: If workers face greater risk levels but receive less total wage compensation for risk, then cannot be on same market offer curve.

# THE VISCUSI-HERSCH HEDONIC LABOR MARKET MODEL



# EXAMPLES OF SEPARATE LABOR MARKET OFFER CURVES

- Smokers and Nonsmokers  
(Viscusi and Hersch 2001)
- Black-white VSL differences  
(Viscusi 2003)
- Mexican immigrants versus other immigrants or native Americans (Hersch and Viscusi 2010)

# VSL AND IMMIGRANT STATUS

	Fatality Risk*	VSL
<b><u>Estimates Based on the CPS</u></b>		
Native U.S.	4.35	7.95
Mexican immigrants	5.97	Not significant
<b><u>Estimates Based on the NIS</u></b>		
All immigrants	4.50	9.35
Mexican immigrants	5.70	Not significant
Mexican immigrants who speak English	5.70	3.44

\*Fatality rate by industry-immigrant status-age. Risk is annual fatality rate per 100,000 workers.

# ISSUE 5. THE DEVALUATION OF LIFE

- Environmental Protection Agency Air Office lowered the VSL from \$8 million to \$7 million.
- Economic puzzle since income levels have risen over time so expect rising VSL.
- Based on differing results of 2 meta-analyses (Viscusi and Aldy vs. Mrozek and Taylor).

# 2008 DEVALUATION OF LIFE (CONT'D)

- Political firestorm – Bush conspiracy?
- But all Environmental Protection Agency VSL numbers still exceeded those used by other agencies. Change and direction of change matter.
- Proposed legislation in 2008 whereby Environmental Protection Agency must only raise VSL and differences in VSL are prohibited.

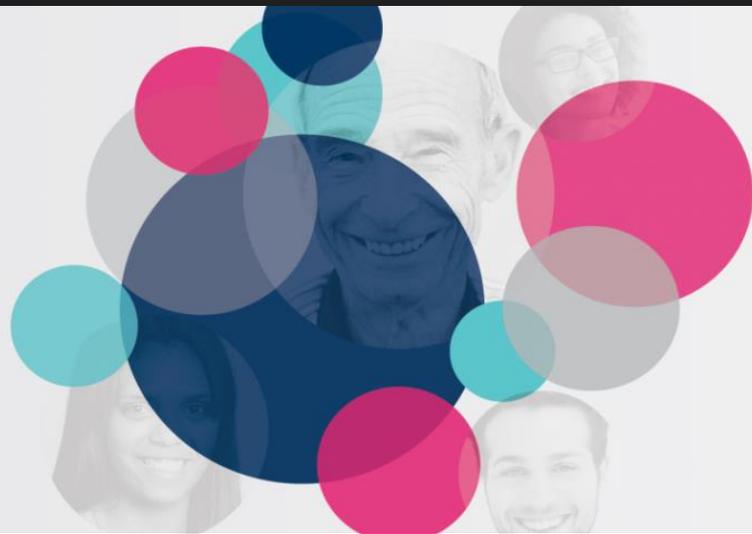
# PRICING LIVES: SOCIETAL CONTEXTS FOR PRICING LIVES

- Government policies
- Corporate risk decisions
- Regulatory sanctions
- Personal injury case liability and damages awards

# CONCLUSIONS

- Age, income, and other influences on value of statistical life remain controversial.
- Much of the controversy is due to misunderstanding of “economic” value.
- Benefits are grounded in society’s willingness to pay.
- Monetizing benefits makes them matter.
- Treating some benefits as “priceless” may make them “worthless.”
- VSL for Australia is \$7.9 million (U.S.), \$10.4 million (Australia).
- Broader, correct application of the VSL would save lives throughout the world.

W. Kip Viscusi, *Pricing Lives: Guideposts for a Safer Society*,  
Princeton University Press, 2018



**2017 Australian  
Conference of Economists**

Economics for Better Lives  
19-21 July 2017 Sofitel Sydney