CANADA'S ECOFISCAL COMMISSION

Practical solutions for growing prosperity



COMMISSION DE L'ÉCOFISCALITÉ DU CANADA Une fiscalité responsable pour une prospérité durable

Environmental Risk and Uncertainty:

Implications for policy

Dale Beugin & Jason Dion Canada's Ecofiscal Commission December 2018



Background

CANADA'S **ECOFISCAL** COMMISSION Practical solutions for growing prosperity



RESPONSIBLE RISK

How putting a price on environmental risk makes disasters less likely July 2018





Focus:

- Risks to the environment from economic activity
- Policy solutions, esp. "financial assurance"
- Analytical framework for environmental risk

Environmental risk: Oil by rail

Risk of environmental cost (EC)

(e.g., derailment leading to an oil spill)

No environmental cost (EC = \emptyset) P(EC = \emptyset) = 99%

Moderate environmental cost (EC = \$50M) P(EC = \$50M) = 0.99%

Severe environmental cost (EC = \$1B) P(EC = \$1B) = 0.01%



Oil by rail: Environmental risk

Reality:

- Continuous probability distribution
- Combination of *several* probability distributions:
 - Derailment
 - Spill size
 - Environmental sensitivity



Oil by rail: Environmental risk





<u>Source</u>: Environmental Research Consulting. (2018). Hudson River Oil Spill Risk Assessment: Oil Spill Probability Analysis.

Oil by rail: A second risk

Risk of public liability (PL)

(e.g., taxpayers paying for clean-up)

Why? Liability gaps

- Firms' liability for environmental damage might be defined, capped, or scoped in a way that makes it possible they won't be held fully accountable
- Or even where a firm is fully liable it may not be held accountable if it is bankrupt

...The risk of public liability is therefore a legal risk, a financial risk, or both

Oil by rail: A second, conditional risk

Risk of public liability (PL)

(e.g., taxpayers paying for clean-up)

No environmental cost

 $P(EC = \emptyset) = 99\%$

		Public absorbs no cost P(PL = \$0 EC = \$300M, A) = 80%
	Moderate environmental cos: P(EC = \$50M) = 0.99%	Public absorbs half the cost P(PL = \$25M EC = \$50M, A) = 20%
		Public absorbs majority of cost P(PL = ~50M EC = \$50M, A) = 0%
	Severe environmental cost P(FC = \$1B) = 0.01%	Public absorbs no cost P(PL = \$0 EC = \$1B, A) = 10%
		Public absorbs half the cost P(PL = \$500M EC = \$1B, A) = 70%
		Public absorbs majority of cost P(PL = ~\$1B EC = \$1B, A) = 20%



Risk externalities

A "risk externality" exists when two risks are present:

✓ Risk of environmental harm occurring

 Risk that – should harm occur – at least some of its costs will be borne by the public



...So what?

The problem with risk externalities: moral hazard



Public absorbs no cost

Moderate environmental cost P(EC = \$50M) = 0.99%

P(PL = \$0 | EC = \$300M) = 80%Public absorbs half the cost

P(PL = \$25M | EC = \$50M) = 20%Public absorbs majority of cost P(PL = ~\$50M | EC = \$50M) = 0%

Public absorbs no cost P(PL = \$0 | EC = \$1B) = 10%

Severe environmental cost P(EC = \$1B) = 0.01%

Public absorbs half the cost P(PL = \$500M | EC = \$1B) = 70%

Public absorbs majority of cost P(PL = ~\$1B | EC = \$1B) = 20%





Addressing risks with policy

No environmental cost

 $P(EC = \emptyset | A) = 99\%$



Linking to outcomes			<u>Probability</u>	Cost of environmental harm Private Social	
No environmental cost P(EC = $\emptyset \mid A$) = 99%				cost	cost
	Public absorbs no cost P(PL = \$0 EC = \$50M, A) = 80%		99%	Ø	Ø
		Public absorbs half the cost P(PL = \$25M EC = \$50M, A) = 20% Public absorbs majority of cost P(PL = \$50M EC = \$50M, A) = 0%	0.792%	\$50IVI	\$U
	Moderate environmental cost P(EC = \$50M A) = 0.99%		0.198%	\$25171	\$25IVI
	Severe environmental cost P(EC = \$1B A) = 0.01%	Public absorbs no cost $P(P) = c_0 F_C = c_1 P_A = 10\%$	0%	\$0	\$50M
Status quo (A): Commercial liability insurance		P(PL = \$0 EC = \$1B, A) = 10% Public absorbs half the cost	0.001%	\$1B	\$0
requirement of \$25M		P(PL = \$500M EC = \$1B, A) = 70% Public absorbs majority of cost	0.007%	\$500M	\$500M
Policy choice		P(PL = ~\$1B EC = \$1B, A) = 20%	0.002%	\$0	\$1B
New policy (B):	P(EC = Ø B) = 99.5%	Public absorbs no cost	99.5%	Ø	Ø
Liability insurance requirement <i>plus</i>		P(PL = $0 EC = 50M, B = 100\%$ Public absorbs half the cost P(PL = $25M EC = 50M, B = 0\%$ Public absorbs majority of cost P(PL = $250M EC = 50M, B = 0\%$ Public absorbs no cost P(PL = $0 EC = 1B, B = 20\%$ Public absorbs half the cost P(PL = $50M EC = 1B, B = 80\%$ Public absorbs majority of cost P(PL = $21B EC = 1B, B = 0\%$	0.495%	\$50M	\$0
an industry fund	Moderate environmental cost		0%	\$25M	\$25M
	P(EC = \$50M B) = 0.495%		0%	\$0	\$50M
			0.001%	\$1B	\$0
	Severe environmental cost P(EC = \$1B A) = 0.005%		0.004%	\$500M	\$500M
			0%	\$0	\$1B

Three (competing) goals

- You might ask: why not go even harder with policy? (e.g., requiring liability insurance of \$1B or *closing* all liability gap
- Because policy-makers have three goals
 - Deterrence
 - Compensation
 - Economic activity
- These goals can be in competition
 - Deterrence and compensation can be at odds
 - And both can affect economic activity



Policy-makers have to strike a balance

Goals in the framework

EV for total costs (A): \$1.7M

EV for total costs (B): \$1.82M

There is no objective way to weight goals; must be based on local context & priorities

Jurisdictions will vary in the balance that makes sense for them



Other policy options

Regulations

- Require more frequent monitoring or inspection
- Require adoption of certain technologies
- Bar high-risk activities or tech.'s (e.g., rail cars)
- Liability rules
 - Clarify or broaden firms' legal liability for env. damages
- Financial assurance
- O Require firms to commit funds against their env. risks

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Regulation	s Liabil rule	ity s	Financial assurance	Probability	<u>Cos</u> environme	<u>t of</u> ental harm
	No environmental cost				Private cost	Social cost
	$P(EC = \emptyset A) = 99\%$			99%	Ø	Ø
	Moderate environmental cost P(FC = \$50M A) = 0.99%		Public absorbs no cost P(PL = \$0 EC = \$50M, A) = 80%	0.792%	\$50M	\$0
		\leftarrow	Public absorbs half the cost P(PL = \$25M EC = \$50M, A) = 20%	0.4000/	ς ζουνα	¢2ΓM
		Public absorbs majority of cost $P(P) = \sim 550M FC = 550M A) = 0\%$	0.198%	\$25IVI	ŞZ2IVI	
				0%	\$0	\$50M
Status quo (A):	Severe environmental cost P(EC = \$1B A) = 0.01%	Public absorbs no cost P(PL = \$0 EC = \$1B, A) = 10%	0.001%	\$1B	\$0	
insurance requirement of \$25M		Public absorbs half the cost P(PL = \$500M EC = \$1B, A) = 70%	0.007%	\$500M	\$500M	
		Public absorbs majority of cost P(PL = ~\$1B EC = \$1B, A) = 20%	0.0020/	¢Ω	¢1D	
choice				0.002%	ŞΟ	Ϋ́́
	$P(EC = \emptyset B) = 99.5\%$		Dublis show he was sent	99.5%	Ø	Ø
New policy (B): Liability insurance			Public absorbs no cost P(PL = \$0 EC = \$50M, B) = 100%	0.495%	\$50M	\$0
an industry fund			Public absorbs half the cost P(PL = \$25M EC = \$50M, B) = 0%	0.9/	\$25M	\$25M
	Moderate environmental cost P(FC = \$50M B) = 0.495%		Public absorbs majority of cost	0%	Ş231VI	Υ <u></u>
	Severe environmental cost P(EC = \$1B A) = 0.005%		P(PL = 350 V EC = 350 V , B) = 0%	0%	\$0	\$50M
			Public absorbs no cost P(PL = \$0 EC = \$1B, B) = 20%	0.001%	\$1B	\$0
		Z	Public absorbs half the cost P(PL = \$500M EC = \$1B, B) = 80%	0.004%	\$500M	\$500M
		P(PL = ~\$1B EC = \$1B, B) = 0%	0%	\$O	\$1B	

Putting the tools into action

- Policy-makers can calibrate the policy tools to strike their desired balance across policy goals
- Balance they achieve will depend on:
 - The types of tools put into action
 - The specific instruments used
 - How they are implemented
 - Their stringency

A focus on financial assurance

- A powerful tool:
 - 1. Reinforces liability rules, to narrow or plug liability gaps like bankruptcy (and thereby, addresses moral hazard)
 - 2. Flexible : can emphasize different goals, depending on priorities (e.g., "soft" vs. "hard" assurance)
 - 3. Market-based : puts a price on imposing risk to the environment (e.g., paying a regular premium for a surety bond)
 - Low-risk operations get a competitive advantage
 - Screening function
 - a llasful information for investors

Zooming out

• Multiple policy options, multiple decision

...By pricing risk using FA, we could better reconcile them

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The final piece

- Probability of environmental harm
- Potential magnitude
- Risk of harm leading to public costs



How can we deal with uncertainty?

- Risk that cannot be reliably estimated
- Could be legal, financial, environmental, or technological
- Often, uncertainty is the rule, not the exception
- Solutions:
 - Pursue desired balance across policy goals (as before) (some will focus on economic activity, others on risk reduction)
 - Greater reliance on scenario analysis
 - Assess risk qualitatively (e.g., L/M/H)
 - Solicit input from the public and from experts
- Uncertainty is not cause to ignore risk (the opposite, in fact)
- Doligy makers ignore for tailed upcortain ricks at their





