

The Economics of Tobacco Harm Reduction: Economic Evidence and Policies

Donald Kenkel
Cornell University

Tobacco Harm Reduction Workshop
Ankara, Turkey

Organized by: Economic Research Agenda
September 14-15, 2023

Acknowledgement

- Funding: Produced with the help of a grant to Cornell University from the Foundation for a Smoke-Free World, Inc. (FSFW), a U.S. nonprofit 501(c) (3) private foundation. This study is, under the terms of the grant agreement with FSFW, editorially independent of FSFW. The FSFW had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication. The contents, selection, and presentation of facts, as well as any opinions expressed herein are the sole responsibility of the authors and under no circumstances shall be regarded as reflecting the positions of FSFW. FSFW accepts charitable gifts from PMI Global Services Inc. (PMI), which manufactures cigarettes and other tobacco products. Under FSFW's Bylaws and Pledge Agreement with PMI, FSFW is independent from PMI and the tobacco industry.

The Economics of Tobacco Harm Reduction

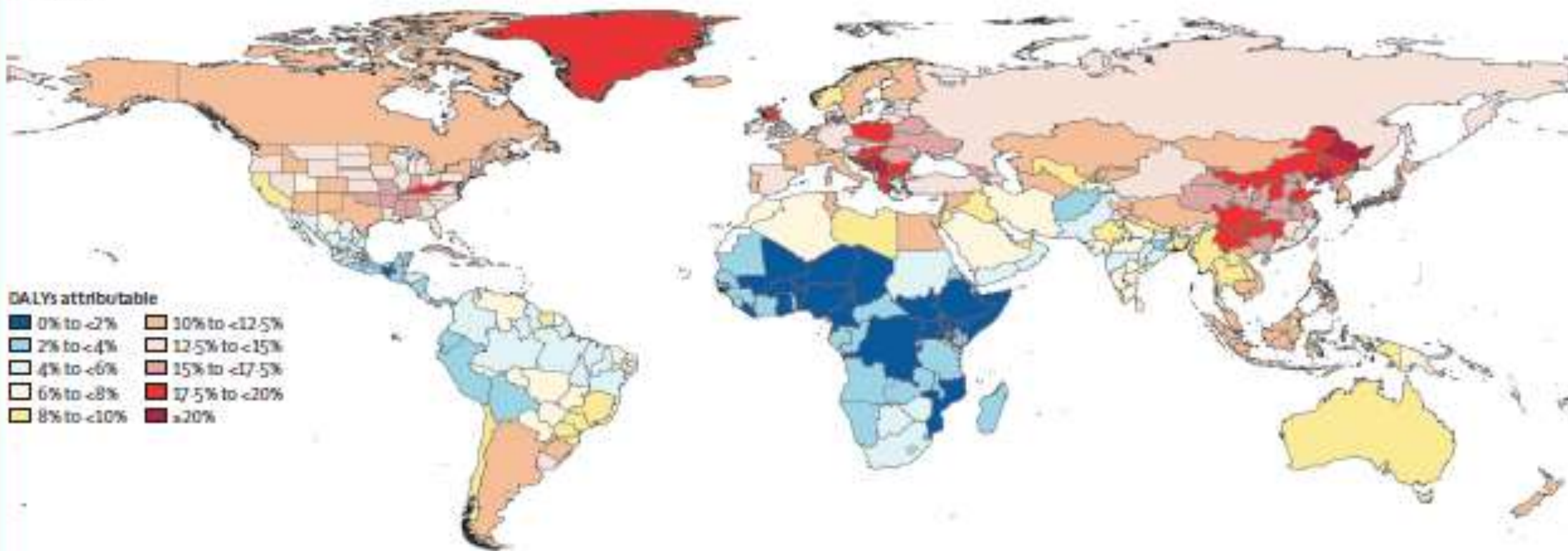
- Goal: contribute to the evidence base for tobacco regulation
- Health science research establishes potential for tobacco harm reduction
 - After lunch, Dr. Konstantinos Farsalinos will share his expertise on the epidemiological and clinical evidence.
- Economic research contributes to our understanding of how regulatory policies can affect the supply & consumer demand for e-cigarettes, cigarettes, and quitting tobacco and nicotine use:
 - **Excise taxes are a policy tool to increase monetary price.**
 - **Consumer information policies determines perceived “health price.”**
 - **Regulatory policies can also change how consumers value products.**
 - **Cost-benefit analysis provides systematic framework to evaluate tobacco regulations.**

Tobacco Harms

- Tobacco use remains a leading cause of death and disease across the globe.
- 1.3 bill. tobacco users
- 8.7 mill. deaths annually
- 230 mill. DALYs

Percent of Global Burden of Disease Attributable to Tobacco

C Tobacco



Caribbean and central America

Persian Gulf

Balkan Peninsula

Southeast Asia

West Africa

Eastern
Mediterranean

Modern tobacco harm reduction products offer potential to prevent most of the harms of smoking

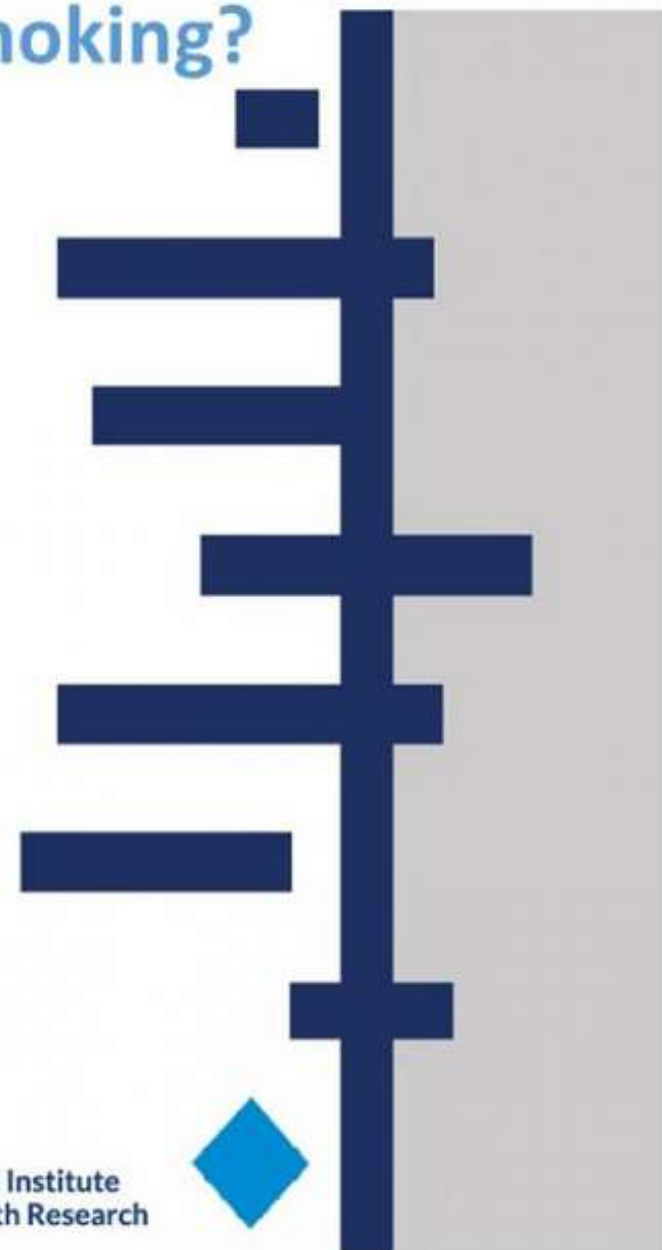
- Consensus report of the U.S. National Academies of Science, Engineering, and Medicine concludes that: *There is **conclusive** evidence that completely substituting e-cigarettes for combustible tobacco cigarettes reduces users' exposure to numerous toxicants and carcinogens present in combustible tobacco cigarettes*" (NASEM 2018, emphasis in original to indicate highest evidence standard).
- U.S. FDA actions recognize potential gains from non-combusted products
 - Brand of smokeless tobacco authorized as reduced-risk product
 - Brand of heated tobacco product authorized as reduced-exposure product
 - Brands of tobacco-flavored e-cigs authorized as appropriate for the protection of public health due to potential health benefits to smokers who switch

Can electronic cigarettes help people quit smoking?

Key messages

- There is high-certainty evidence that electronic cigarettes with nicotine increase quit rates compared with nicotine replacement therapy.
- There is moderate-certainty evidence that e-cigarettes with nicotine increase quit rates compared with e-cigarettes without nicotine.
- We did not detect any clear evidence of harm from nicotine e-cigarettes when used to quit smoking; however, longest follow-up was two years and the overall number of studies was small.

Hartmann-Boyce J, Lindson N, Butler AR, McRobbie H, Bullen C, Begh R, Theodoulou A, Notley C, Rigotti NA, Turner T, Fanshawe TR, Hajek P. Electronic cigarettes for smoking cessation. *Cochrane Database of Systematic Reviews* 2022, Issue 11; DOI 10.1002/14651858.CD010216.pub7



What does “most” of the harms mean?

- Microsoft Word auto-suggests “most” as replacement for “the majority of”
- UK consensus: vaping e-cigs is 5% as harmful as smoking (McNeil et al 2018)
- Survey of “public health experts”: median response was that the impact on vaping on life expectancy is 25% the impact of smoking (Allcott and Rafkin 2022).
- Recent FDA regulatory impact analyses of tobacco regulations assumed that the impact of vaping on life expectancy is 15% the impact of smoking.
- Any of these estimates => encouraging smokers to switch to vaping could substantially improve public health

Simple economic model of consumer demand for tobacco products

- Health production function: $H = H(\text{Cigs}, \text{Vapes}, \dots)$
- Utility: $U = U(H, C, V, \dots)$
 - Joint production: cigarettes and vapes are a direct source of pleasure but harm health
- First-order condition for utility-maximizing choices of Cigs =>
 - marginal benefits = marginal costs
 - $U_C/\lambda = p_C + |H_C U_H/\lambda|$
 - = money price + health price
- See Grossman (1972, 2000) and extensions
- Becker and Murphy (1988) extend to addiction

Supply side of tobacco product markets

- Supply side varies across countries
 - Profit-maximizing manufacturers in the private sector
 - State-owned enterprises
- Legal products subject to excise taxes, general sales/ value-added taxes
- Various regulations imposed on cigarettes
 - Warning labels
 - Complete or partial bans on advertising
- Newer regulations imposed on e-cigarettes and other harm-reduction products
 - Limit or bans on available flavors, nicotine labels
- Illegal markets often play a non-trivial role, to avoid taxes, prohibitions, or other regulations

Excise taxes are a policy tool to increase money price of cigarettes and vapes

- Excise taxes passed through to the prices consumers pay for cigs and vapes.
 - Pass-through rate depends on supply-side too; often close to 1-for-1
- Public health authorities recognize cig taxes as a powerful tool:
 - *A tax increase that increases tobacco prices by 10% decreases tobacco consumption by about 4% in high-income countries and about 5% in low- and middle-income countries. (World Health Organization 2023)*
 - Recent review provided by DeCicca, Kenkel, and Lovenheim (2022, Journal of Economic Literature)
- Emerging economic research literature estimates that demand for vapes responds to prices, not a strong consensus yet on magnitude of response

Smoking Participation Elasticities

Figure from
DeCicca et al. 2022
Journal of Econ Lit.

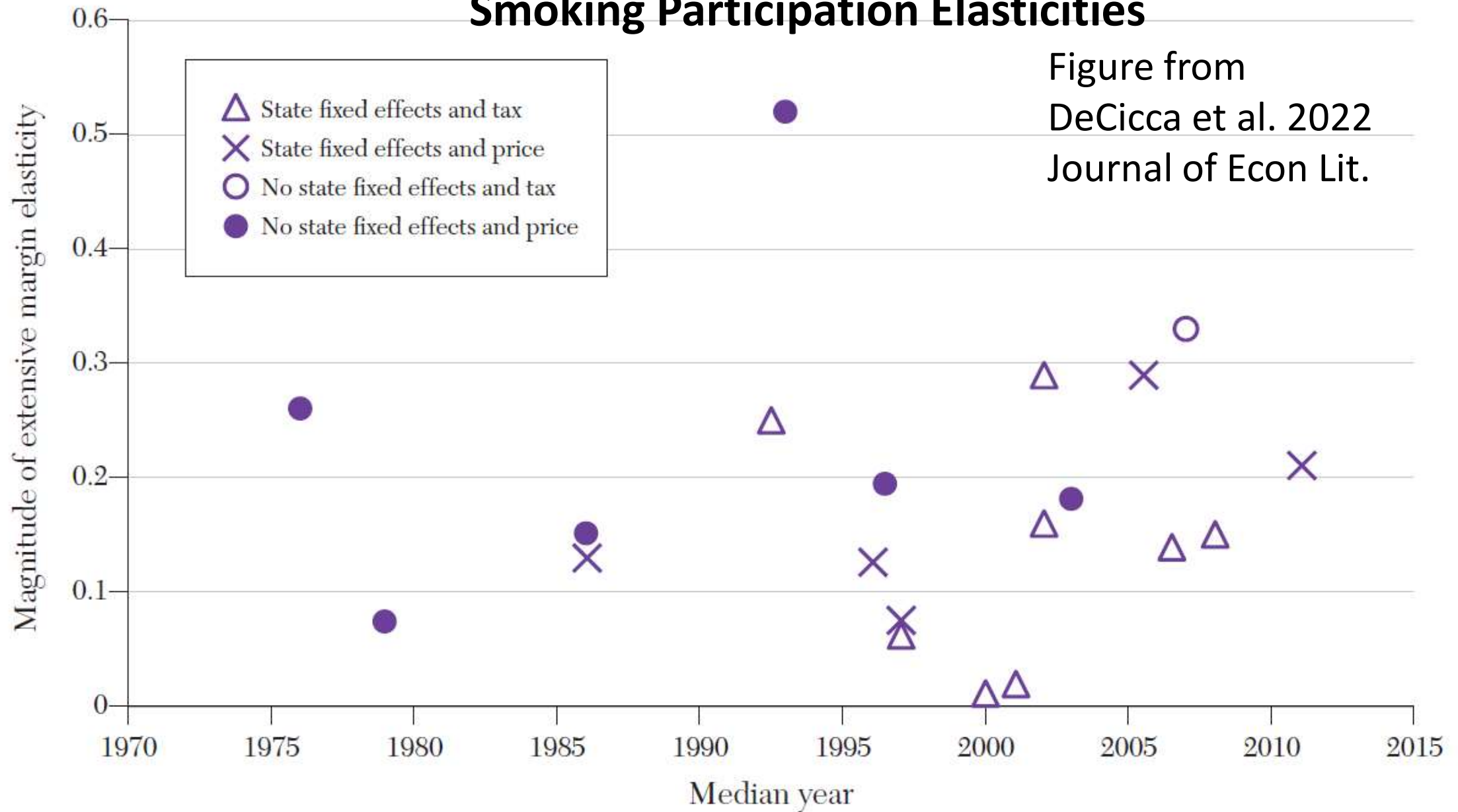


Figure 9. Magnitudes of Extensive Margin Tax/Price Elasticity Estimates by Median Year of Data

From the DeCicca et al. review of research on smoking price elasticities:

Overall, the findings from the empirical literature since 2000 suggest a consensus range slightly more inelastic than the consensus range of -0.2 to -0.35 from Chaloupka and Warner (2000). Although the majority of estimates fall within a range that is aligned with prior research, several recent studies suggest that this consensus overstates extensive margin elasticities. One of the smallest elasticities in figure 9 comes from Callison and Kaestner (2014). Their result is notable because they employ cutting-edge econometric techniques coupled with substantial within-state variation in cigarette taxes and find a much smaller elasticity than much of the rest of the literature.

Evidence so far is that cigarettes & vapes are economic substitutes

- Economic substitutes:
 - Tax cigs \Rightarrow vape demand \uparrow
 - Tax vapes \Rightarrow cig demand \uparrow
- Cornell Discrete Choice Experiments find consistent evidence of price effects across all 7 countries studied
- Cross-price effects (e-cig tax \Rightarrow smoking \uparrow) mean that harmonizing cigarette and e-cigarette tax hikes is less effective in reducing smoking & improving health
 - Example: for Indonesia, we estimate \$1 cig tax \Rightarrow 9 pct pt. \downarrow in smoking
 - If combined with \$1 e-cig tax \Rightarrow net impact = 3 pct pt. \downarrow in smoking
- James Prieger and co-authors provide excellent general discussion of optimal taxation of cigarettes and e-cigs.

	Cigarettes	E-Cigarettes/HTPs	Quit smoking and not use e-cigarettes
Estimated impact of \$1 increase in price of cigarettes:	US		
	-0.027***	0.014***	0.012***
	(0.001)	(0.001)	(0.001)
Decreases smoking	AUSTRALIA		
	-0.005***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)
Increases vaping	UK		
	-0.008***	0.006***	0.002***
	(0.001)	(0.001)	(0.000)
Increases quitting	JAPAN		
	-0.040***	0.032***	0.009***
	(0.002)	(0.002)	(0.001)
Increases quitting	INDONESIA		
	-0.090***	0.077***	0.012***
	(0.006)	(0.006)	(0.003)
Increases quitting	CHINA		
	-0.013***	0.015***	-0.002**
	(0.002)	(0.002)	(0.001)
Increases quitting	SWEDEN		
	-0.026***	0.017***	0.009***
	(0.001)	(0.001)	(0.001)

	Cigarettes	E-Cigarettes/HTPs	Quit smoking and not use e-cigarettes
Estimated impact of \$1 increase in price of e-cigarettes:	US		
	0.014***	-0.016***	0.002
	(0.002)	(0.001)	(0.001)
Decreases vaping	AUSTRALIA		
	0.012***	-0.013***	0.001
	(0.003)	(0.002)	(0.002)
Increases smoking	UK		
	0.006*	-0.008**	0.002
	(0.003)	(0.003)	(0.002)
	JAPAN		
	0.025***	-0.037***	0.012***
	(0.002)	(0.002)	(0.002)
	INDONESIA		
	0.060**	-0.060***	-
	(0.019)	(0.018)	(0.011)
	CHINA		
	0.022***	-0.017**	-0.004
	(0.006)	(0.006)	(0.002)
	SWEDEN		
	0.016***	-0.020***	0.004**

Consumer information policies determine “health price” of cigs & vapes

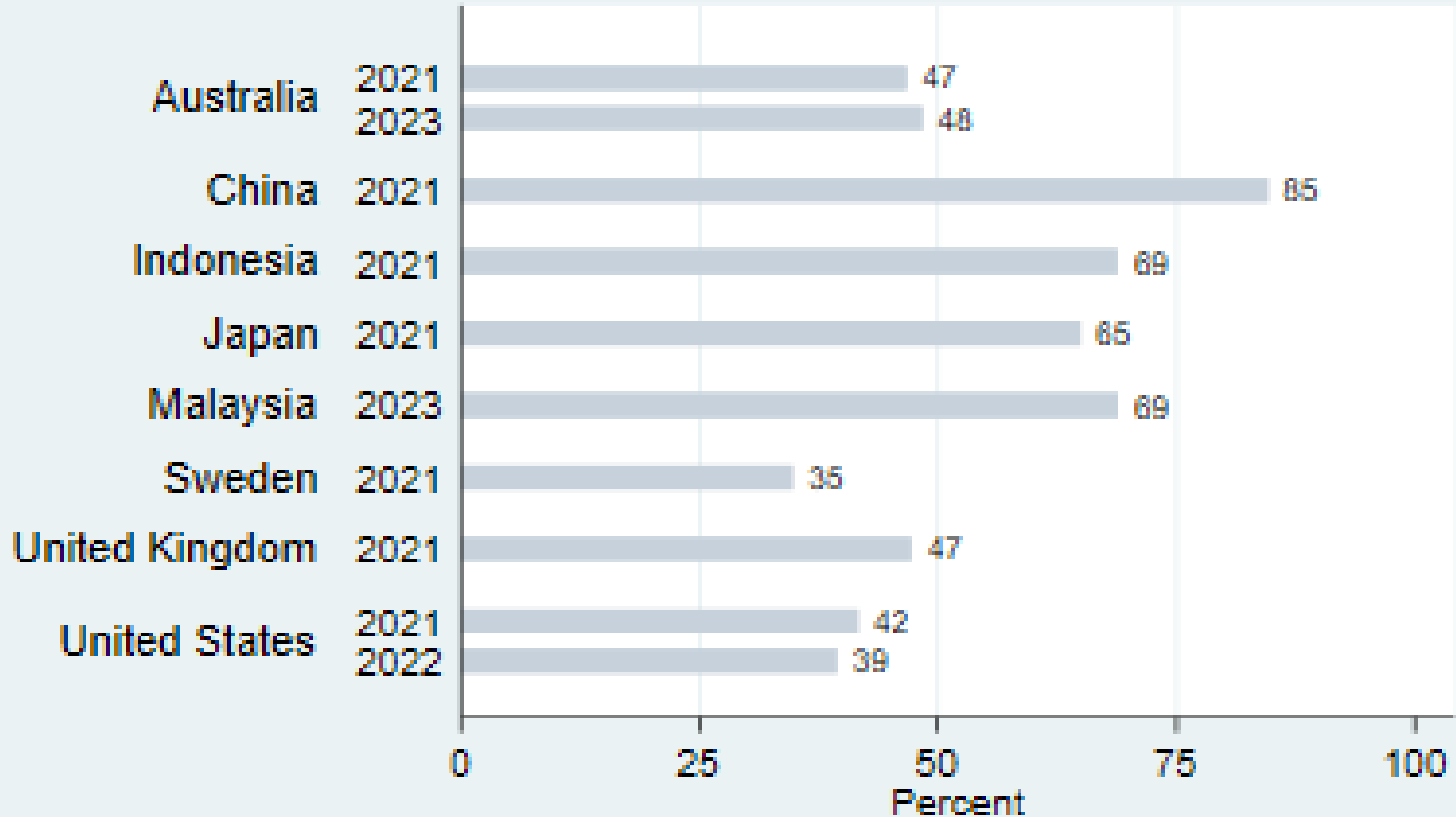
- Empirical estimates of health price = $|H_C U_H / \lambda|$ range from \$20 to over \$200 per pack
 - Gruber and Koszegi (2001), Cutler (2002), Sloan et al. (2004), Viscusi and Hersh (2008)
- At current money prices in U.S., at most money price is only 20% of the full price, perhaps only 2.5% or less.
- Improved consumer information over time about the health price can explain downward trend in smoking in US (Jin et al. 2016, Journal of Benefit-Cost Analysis) and many other countries
- Consumer misinformation about the health price of vaping may limit consumer demand for tobacco harm reduction products.

Cornell cross-country surveys describe extent of consumer information about e-cigs

- Cornell team conducted online surveys that asked about tobacco harms
 - Each country's N \approx 600 smokers per round
- Broad similarities across countries show that many consumers lack information
- Many consumers incorrectly believe that nicotine causes cancer
 - Consumers who believe nicotine causes cancer will perceive non-existent risks from the nicotine in e-cigs and other harm reduction products
- Many consumers are mis-informed about the relative and absolute risks of e-cigs
 - Average perception in UK = vaping is 75% as risky as smoking
 - Perceived health price = \$15/ pack-equivalent or more
 - If they believed UK public health authorities, health price = \$1/pack-equiv

Agree (strongly/somewhat) with: Nicotine in cigarettes is the substance causing most of the cancer caused by smoking

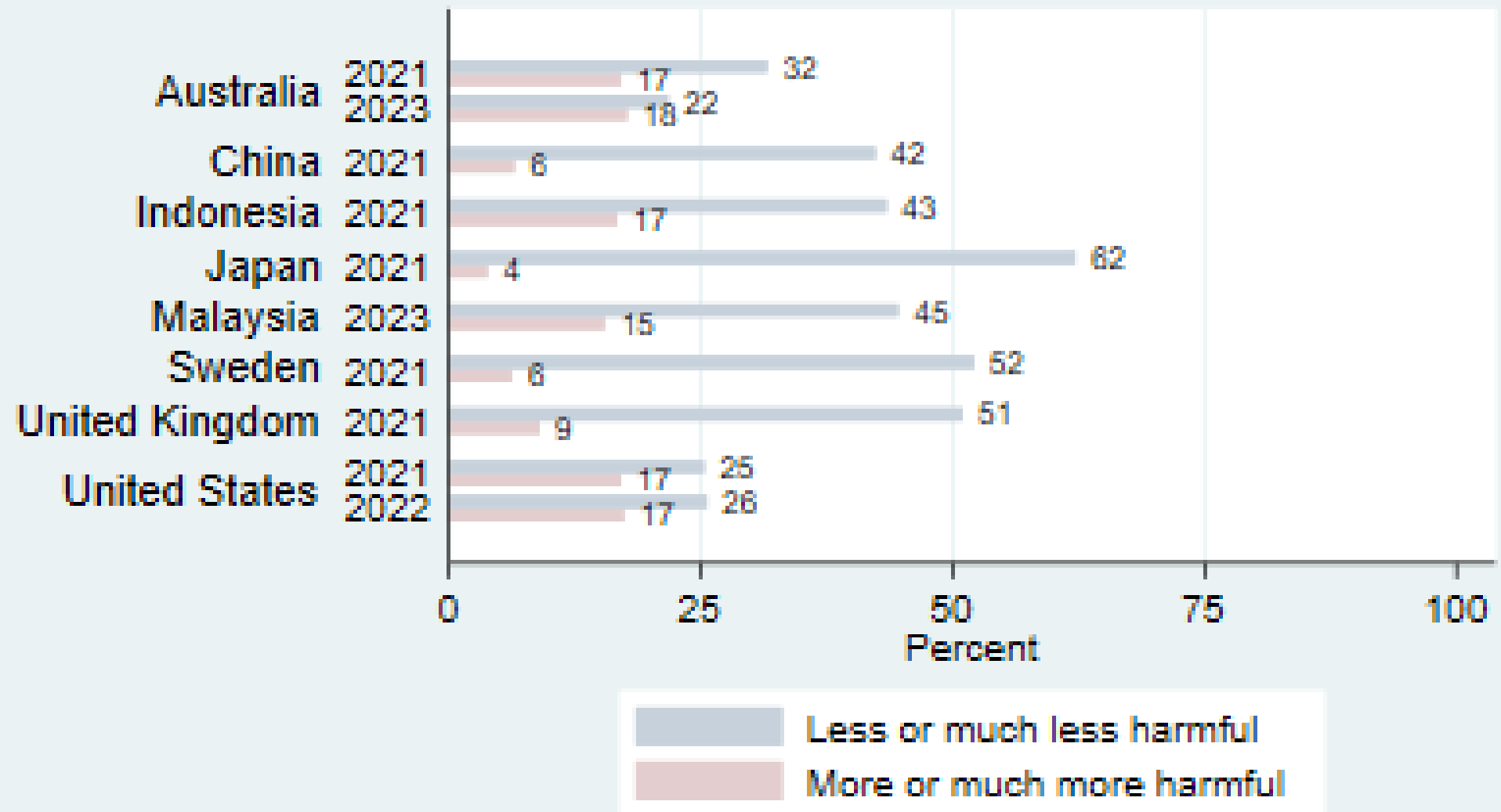
Current smokers



Source: Cornell online cross-country DCEs 11/2021-2/2023.

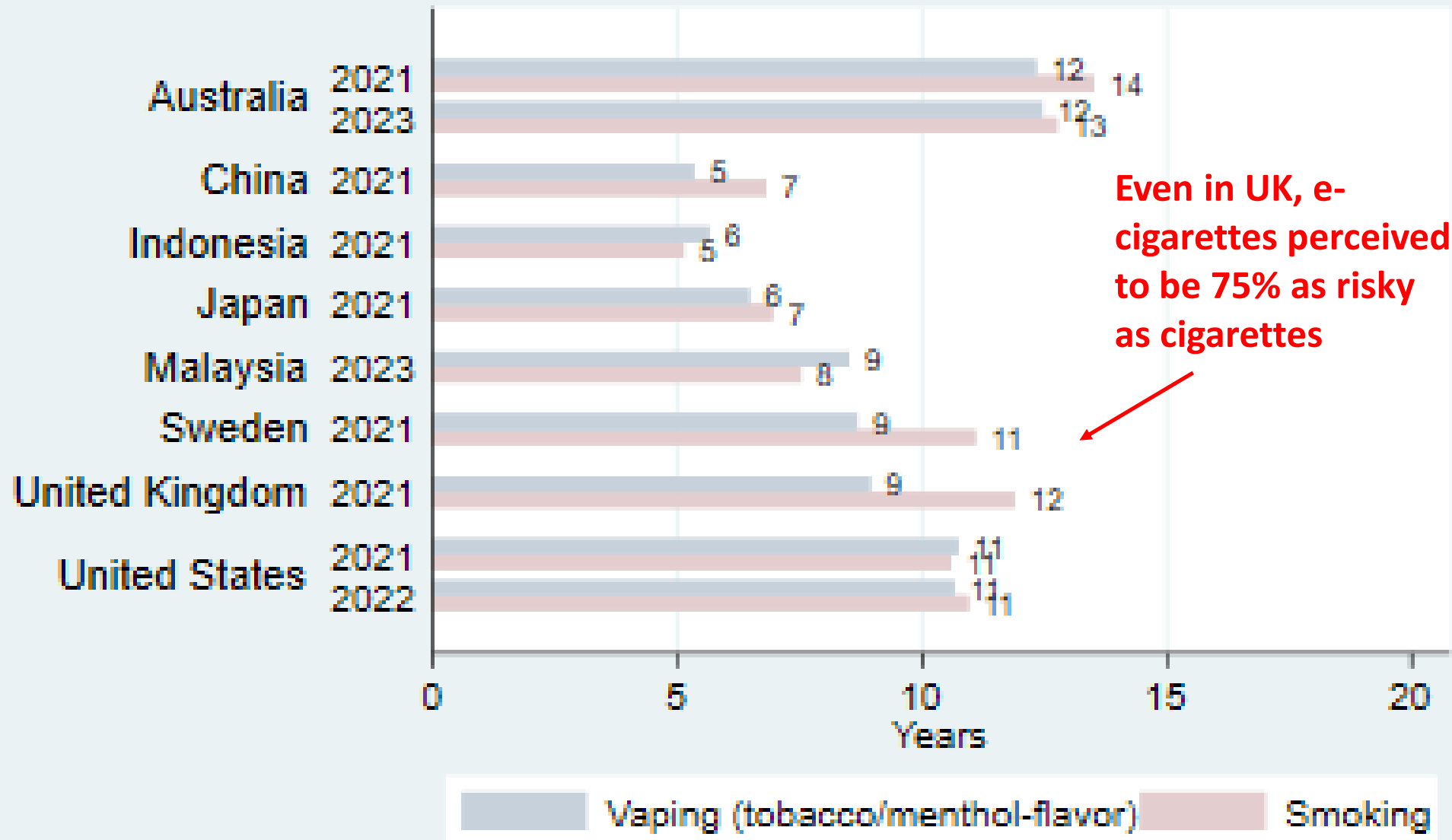
Compared to smoking cigarettes,
would you say that e-cigarettes are

Current smokers



Source: Cornell online cross-country DCEs 11/2021-2/2023.; Heated sticks for

Perceived life years lost due to Current smokers



Source: Cornell online cross-country DCEs 11/2021-2/2023.

Preliminary estimates of unintended consequence of e-cigarette health messages

- In Cornell discrete choice experiments, the e-cig option was shown with alternative health messages:
 - No health message
 - E-Cigarettes aren't completely risk-free, but they carry a small fraction of the risk of cigarettes.
 - This product contains nicotine. Nicotine is an addictive chemical. (Current warning required by US FDA and in some other countries.)
 - E-cigarettes may expose users to chemicals and toxins at levels that have the potential to cause health effects.
- In the US and some of other countries we studied, the FDA warning about nicotine had the largest impact on consumer choices to ↓ vaping and ↑ smoking
 - Common consumer misperception that nicotine causes cancer

Preliminary estimates of the impact of health warning messages on e-cigarettes

Variable	Immediate	Immediate	Immediate	6-Months	6-Months	6-Months
Variable	Cig Estimate	E-Cig Estimate	Quit Estimate	Cig Estimate	E-Cig Estimate	Quit Estimate
FDA Warning (Compared to No Warning)	.034**	-.019**	-.015*	-.017*	-.005	-.012
Sample Restricted to Subjects Who Agree with Incorrect Statement that Nicotine Causes Cancer						
FDA Warning	0.045***	-0.020	-0.025*	0.018	-.015	-0.033**
Sample Restricted to Subjects Who Disagree that Nicotine Causes Cancer						
FDA Warning	0.010	-0.008	-0.002	0.016	-0.022	0.007

Regulatory policies can also change how consumers value products

- First-order condition for utility-maximizing choices of vapes =>

$$\begin{aligned} \text{marginal benefits} &= \text{marginal costs} \\ U_V/\lambda &= p_V + |H_C U_H / \lambda| \\ &= \text{money price} + \text{health price} \end{aligned}$$

- Regulating e-cig attributes => \downarrow marginal benefits of vaping ($\downarrow U_V$)
 - Restrictions on flavors
 - Restrictions on nicotine levels
 - Restrictions on device (e.g. pod-based or disposables)
 - Emerging research, including preliminary results from Cornell projects, finds that restrictions on e-cig flavors => \downarrow vaping, \uparrow smoking

Cost-benefit analysis provides systematic framework to evaluate tobacco regulations

- E-cigarette regulation will have impacts on multiple outcomes
 - Rate of vaping among youth and adults
 - Rate of smoking among youth and adults
 - Rate of quitting
 - Rates of smoking-related illness and death
 - Medical expenditures on smoking-related illness and death
 - Tax revenues
- First:

Steps in Cost-Benefit Analysis

- CBA is a tool to evaluate whether regulations fix market failures and improve economic efficiency.
 - Economic efficiency requires that societal resources are in their most highly valued use.
- Step 1: Determine whether the regulation addresses a market failure => what outcomes “count” in the CBA
- Step 2: Develop credible estimates of the causal treatment effects of the regulation on these outcomes.
- Step 3: use common metric of \$ (or Euros, etc.) to value benefits & costs