Public Economics for Public Policy
Part III: Taxation, Externalities, and Climate Change

Bluebery Planterose

Sciences Po *MPA 2022-2023*

Today's Lecture

Intro

Tax incidence and Efficiency Costs of Taxation

Labor Income Taxation

Externalities

Understanding Attitudes toward Climate Policies

Tax incidence and Efficiency Costs of Taxation

Tax Incidence

Tax incidence is the study of the effects of tax policies on prices and the economic welfare of individuals

What happens to market prices when a tax is introduced or changed?

Example: what happens when impose $1 per pack tax on cigarettes?

Effect on price $\Rightarrow$ distributional effects on smokers, profits of producers, shareholders, farmers, etc.

This is positive analysis: typically the first step in policy evaluation; it is an input to later thinking about what policy maximizes social welfare.

Tax incidence is not an accounting exercise but an analytical characterization of changes in economic equilibria when taxes are changed.

Key point: Taxes can be shifted: taxes affect directly prices, which affect quantities because of behavioral responses, which affect indirectly the price of other goods.

If prices are constant economic incidence would be the same as legislative incidence.

Example: Liberals favor capital income taxation because capital income is concentrated at the high end of the income distribution. Taxing capital means taxing disproportionately the rich.

Conservatives respond: if people save less because of capital taxes, capital stock may go down driving also the wages down and hurting workers. The capital tax might be shifted partly on workers

Partial Equilibrium Model:

Simple model goes a long way to showing main results.

Government levies an excise tax on good x

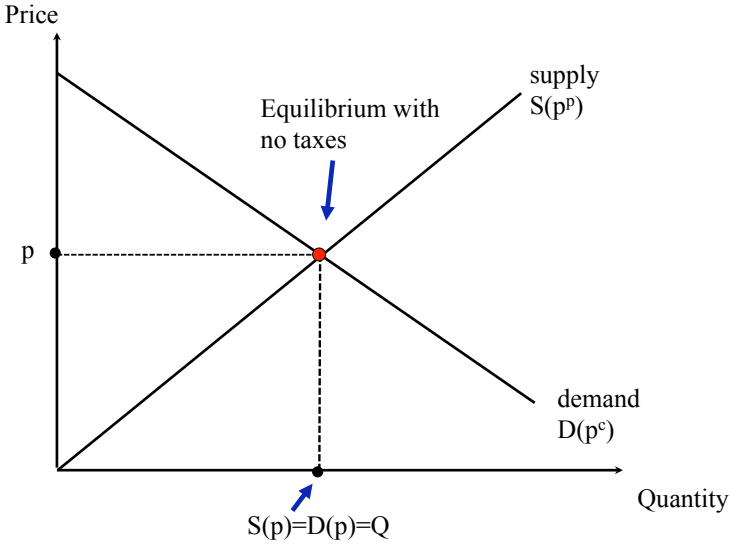
Excise means it is levied on a quantity (gallon, pack, ton, ...). Typically fixed in nominal terms (e.g, $1 per pack)

[ad-valorem tax is a fraction of prices (e.g. 5% sales tax)]

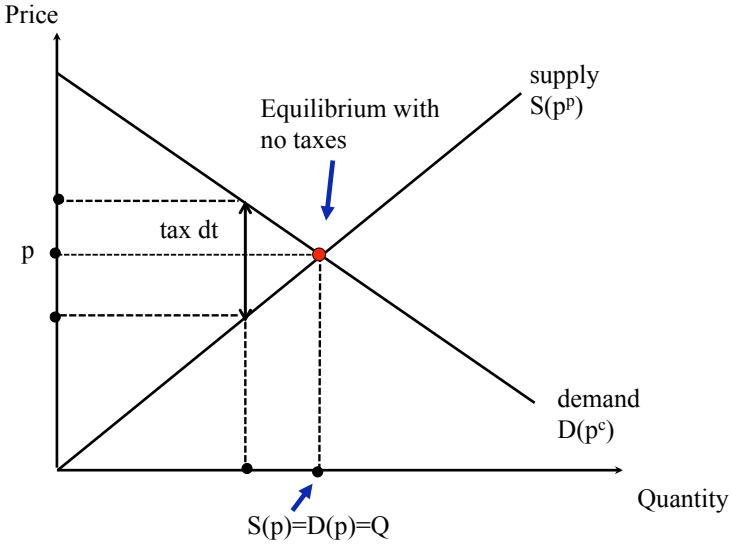
Let p denote the pretax price of x (producer price)

Let $p^c = p + t$ denote the tax inclusive price of x (consumer price)

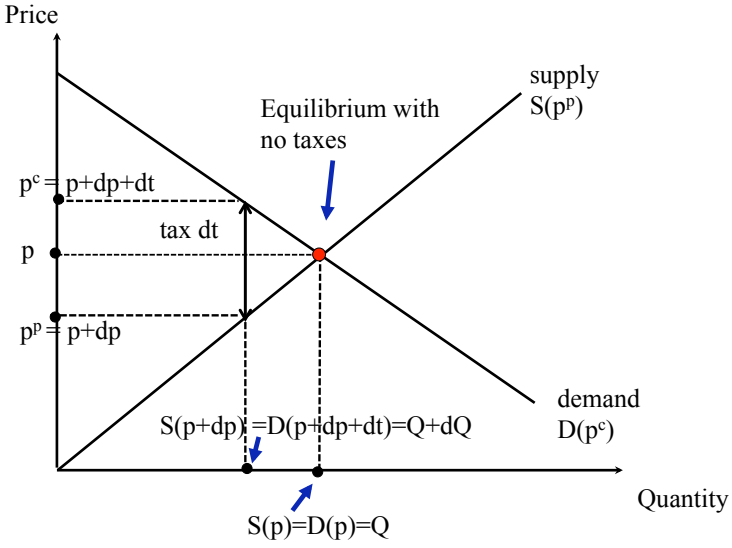
Partial Equilibrium Tax Incidence



Partial Equilibrium Tax Incidence



Partial Equilibrium Tax Incidence



Elasticity: percentage change in quantity when price changes by one percent

$\varepsilon^D = \frac{p^c}{D}\frac{dD}{dp^c} < 0$ denotes the price elasticity of demand

$\varepsilon^S = \frac{p^c}{S}\frac{dS}{dp^c} > 0$ denotes the price elasticity of supply

It is possible to express how the change dt generates change dp so that equilibrium holds, with elasticities:

$$\frac{dp}{dt} = \frac{\varepsilon^D}{\varepsilon^S - \varepsilon^D}$$

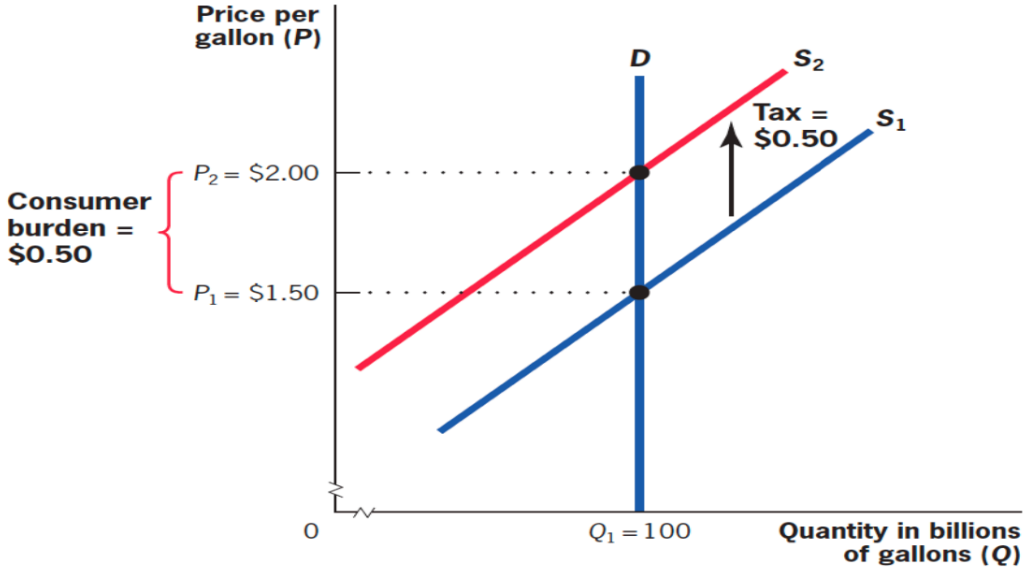
When do consumers bear the entire burden of the tax? ($dp/dt = 0$ and $dp^c c/dt = 1$)

1. $\varepsilon^D = 0$ [inelastic demand]. Example: short-run demand for gasoline inelastic (need to drive to work)
2. $\varepsilon^S = \infty$ [perfectly elastic supply]. Example: perfectly competitive industry

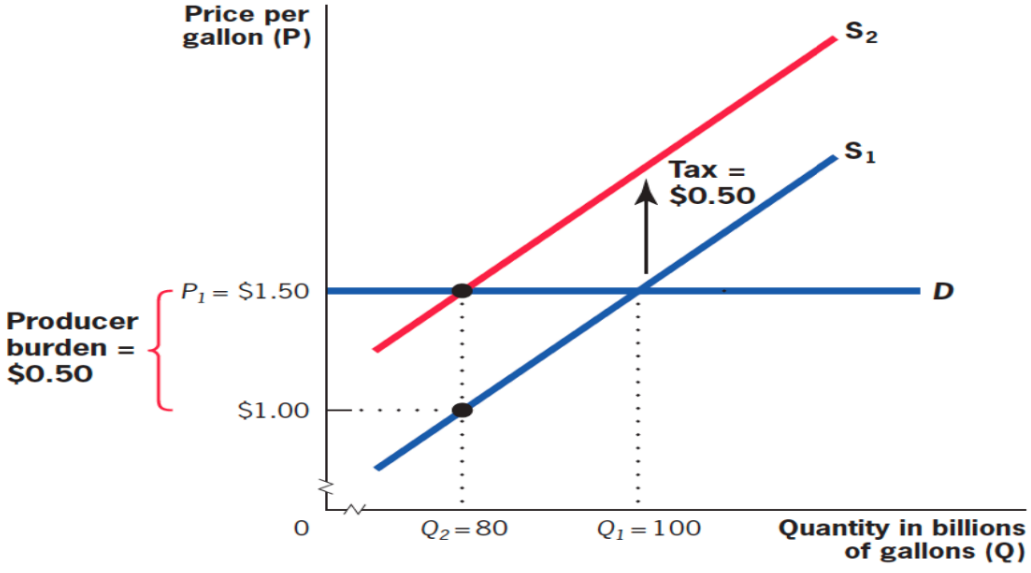
When do producers bear the entire burden of the tax? ($dp/dt = -1$ and $dp^c/dt = 0$)

1. $\varepsilon^S = 0$ [inelastic supply]. Example: fixed quantity supplied
2. $\varepsilon^D = -\infty$ [perfectly elastic demand]. Example: there is a close substitute.

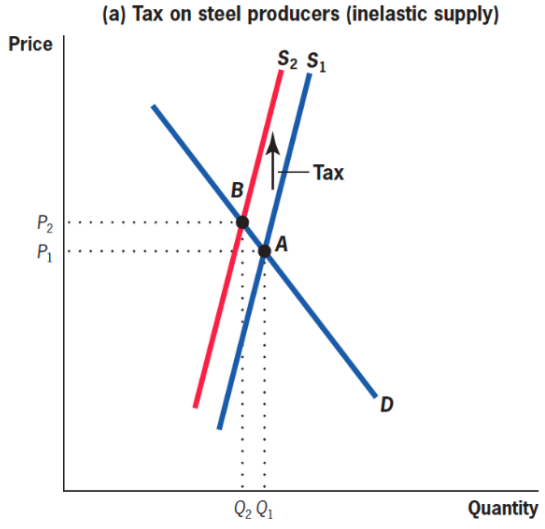
Tax Incidence and Elasticity

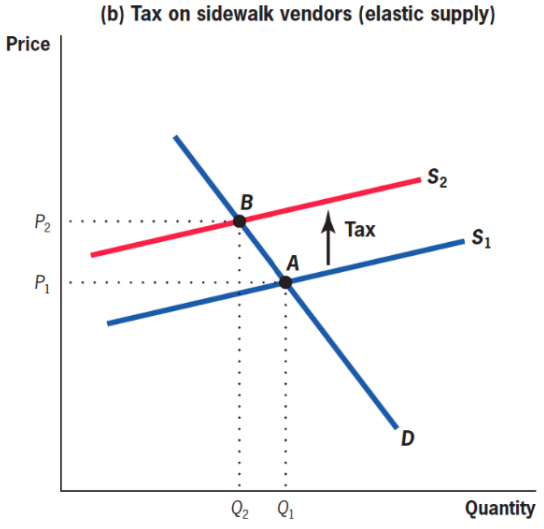


Tax Incidence and Elasticity



Tax Incidence and Elasticity



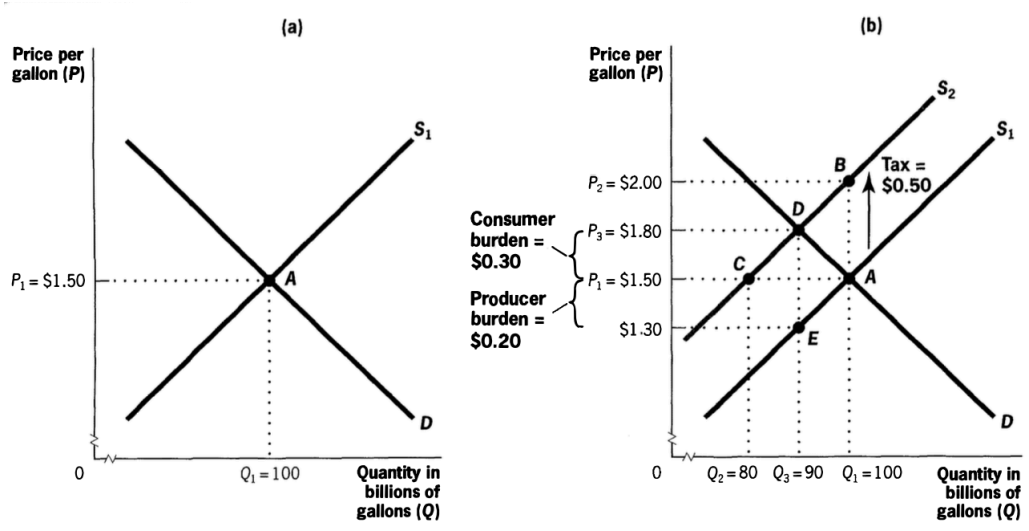


Tax Incidence: Key Results

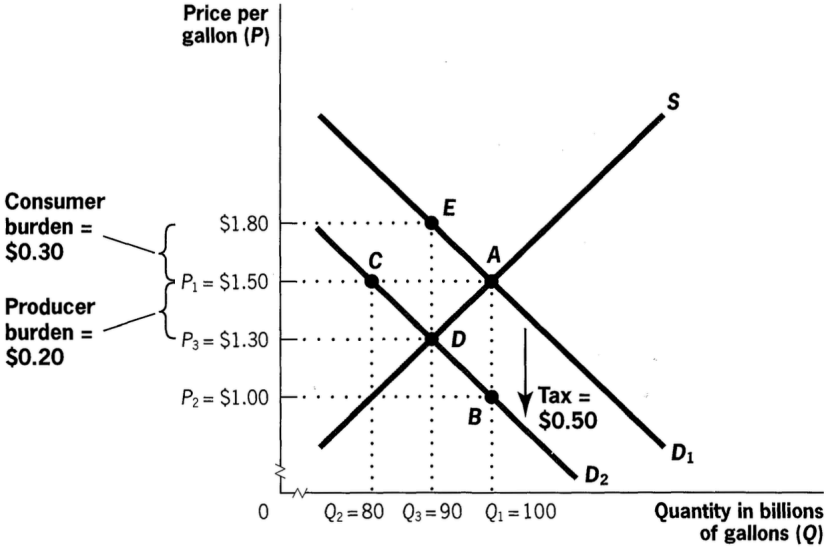
1. statutory incidence not equal to economic incidence (statutory burden of a tax does not determine who truly bears the burden)
2. equilibrium is independent of who nominally pays the tax: the side of the market on which the tax is imposed is irrelevant to the distribution of tax burdens.
3. more inelastic parties (on either demand or supply side) bear more of the tax; more elastic parties avoid them.

These are robust conclusions that hold with more complicated models

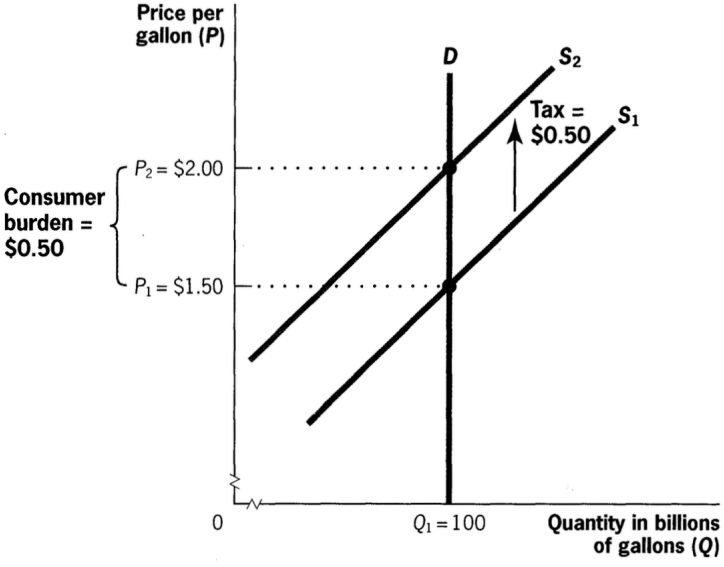
Result 1: Statutory incidence $\neq$ economic incidence



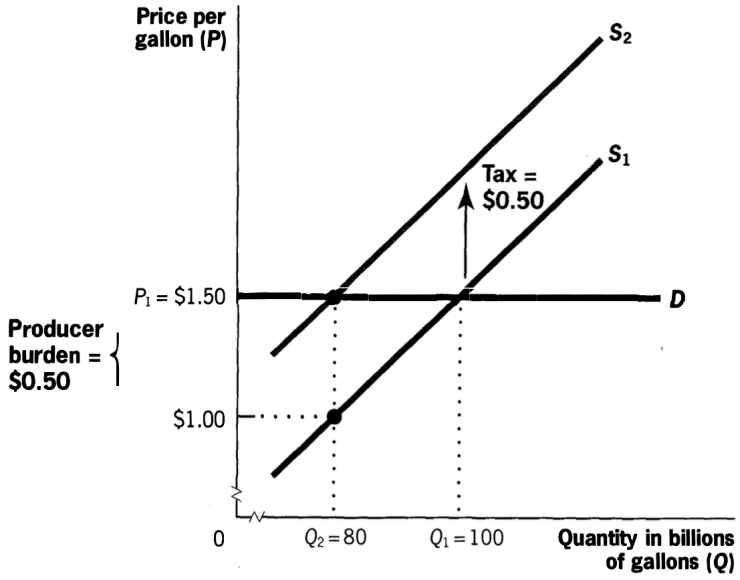
Result 2: Side of the market on which the tax is imposed is irrelevant



Result 3: (More) elastic party will bear (less) none of the burden



Result 3: (More) elastic party will bear (less) none of the burden



Efficiency Costs of Taxation

Deadweight burden (also called excess burden) of taxation is defined as the welfare loss (measured in dollars) created by a tax over and above the tax revenue generated by the tax

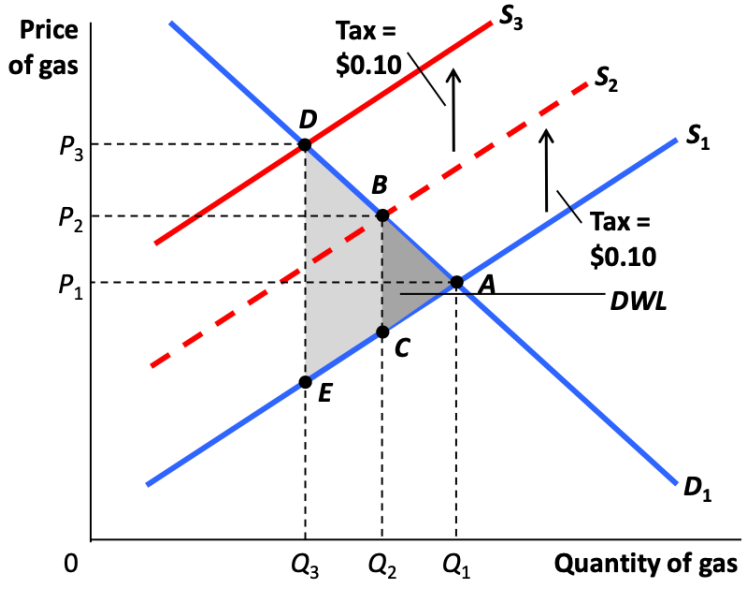
In the simple supply and demand diagram, welfare is measured by the sum of the consumer surplus and producer surplus

The welfare loss of taxation is measured as change in consumer+producer surplus minus tax collected: it is the triangle on the figure

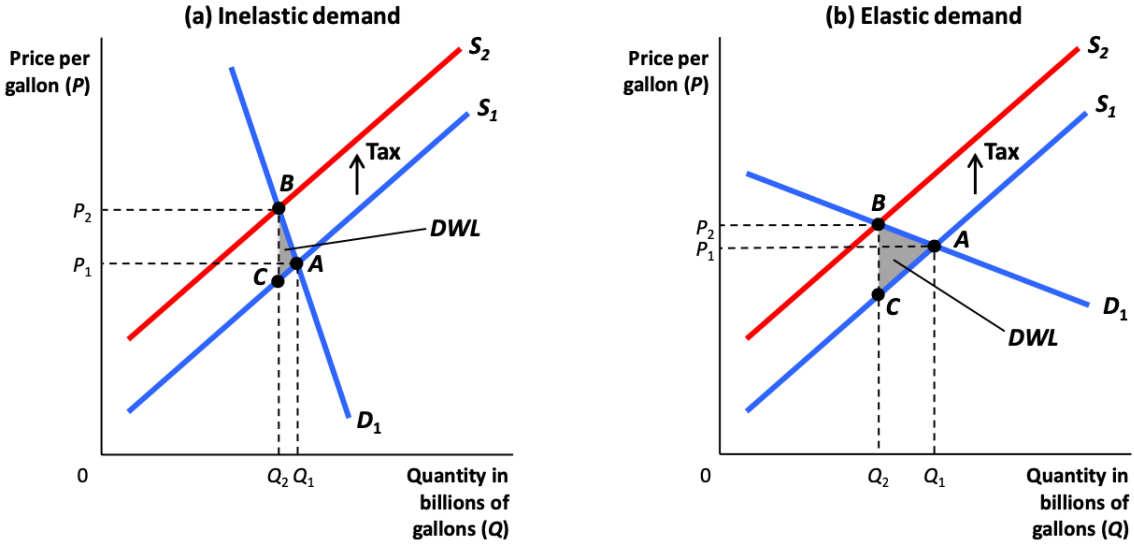
The inefficiency of any tax is determined by the extent to which consumers and producers change their behavior to avoid the tax; deadweight loss is caused by individuals and firms making inefficient consumption and production choices in order to avoid taxation.

If there is no change in quantities consumed, the tax has no efficiency costs

Marginal DWL rises with Tax Rate



Elasticities Determine Tax Inefficiency



Application: Optimal Commodity Taxation

Ramsey (1927) asked by Pigou to solve the following problem: Consider one consumer who consumes K different goods

What are the tax rates $t_1, \ldots, t_K$ of each good that raise a given amount of revenue while minimizing the welfare loss to the individual?

Uniform tax rates $t = t_1 = \ldots = t_K$ is not optimal if the individual has more elastic demand for some goods than for others

Optimum is called the Ramsey tax rule: optimal tax rates are such that the marginal DWB for last dollar of tax collected is the same across all goods

$\Rightarrow$ Tax more the goods that have inelastic demands [and tax less the goods that have elastic demands]

Note: this abstracts from redistribution and focuses solely on efficiency

Who Bears True Incidence of Major US Taxes?

1. Labor taxes borne by workers if wages set as in competitive model and labor supply less elastic than labor demand

   In practice, wages are rigid in short-run so employer vs. employee payroll tax don't have the same effect (evidence from France and Greece). In long-run incidence likely on wages (as employer payroll taxes haven't reduced macro capital share)

2. Consumption taxes borne by consumers if prices set competitively and demand for goods less elastic than supply

   VAT evidence and salience evidence show non-standard incidence in short and medium-run but long-run incidence likely on consumers

3. Capital taxes borne by owners of capital if supply of capital (savings) less elastic than demand for capital (investment)

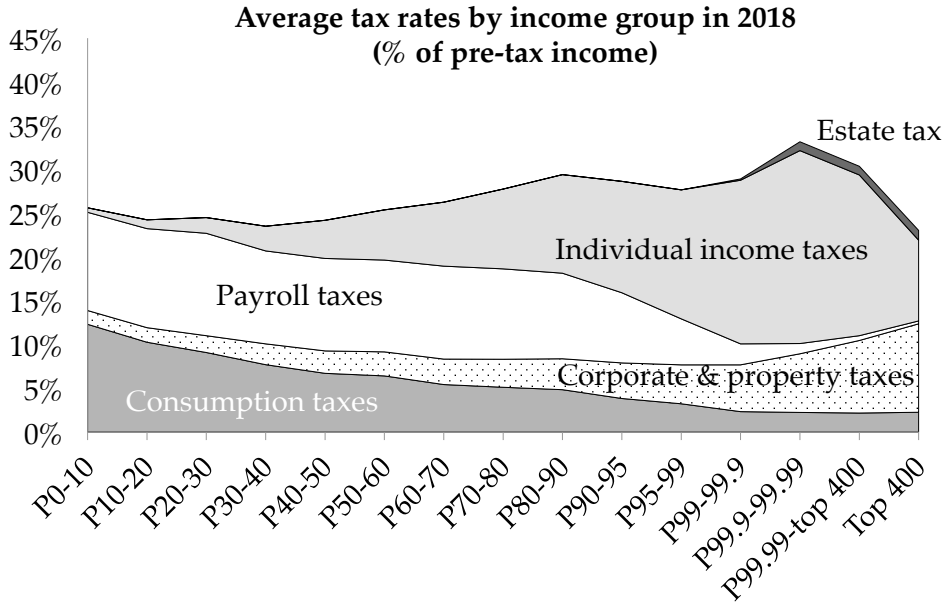
   Evidence here is most disputed. Official CBO statistics shift 1/4 of corporate tax on workers without much evidence (see corp tax lecture)

Saez-Zucman (2019) distribute taxes by factor. At Taxjusticenow.org, you can explore changing the current tax system.

1. Labor taxes (payroll taxes and individual income taxes) assigned to corresponding workers (whether tax remitted by the workers or employers)
2. Consumption taxes (excise and sales) assigned to corresponding consumers
3. Capital taxes (corporate tax, property tax, taxes on capital income) assigned to corresponding owners of the capital assets

This distribution by factor does not capture ultimate incidence nor DWB if taxes are shifted through incidence

Tax Progressivity in the U.S.



Labor Income Taxation

Key question: By how much should government reduce inequality using taxes and transfers?

1. Governments use taxes to raise revenue
2. This revenue funds transfer programs:

    a) Universal Transfers: Public Education, Health Care Benefits (only 65+ in the US), Retirement and Disability Benefits, Unemployment benefits

    b) Means-tested Transfers: In-kind (Medicaid, public housing, food stamps in the US) and cash benefits

Modern governments raise large fraction of GDP in taxes (30-45%) and spend significant fraction of GDP on transfers

Tax Brackets: Federal US Income Tax

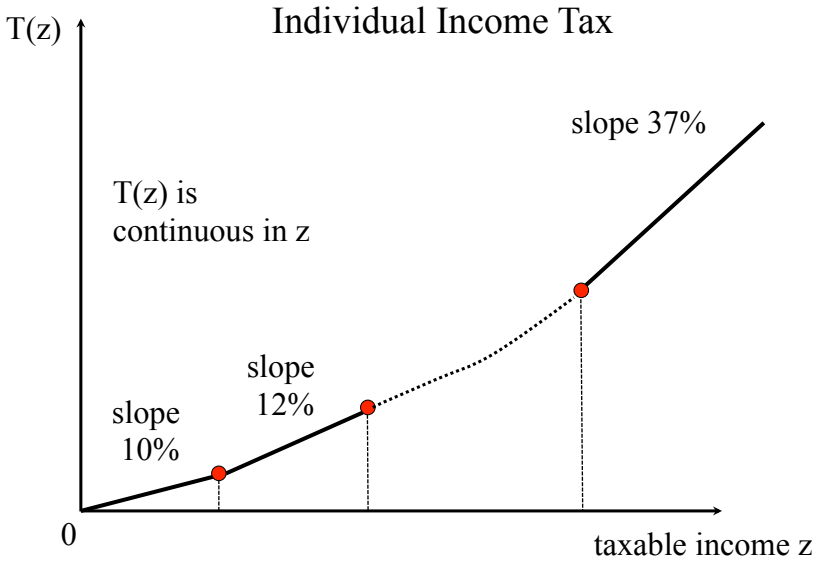
Tax $T(z)$ is piecewise linear and continuous function of taxable income z with constant marginal tax rates (MTR) $T'(z)$ by brackets

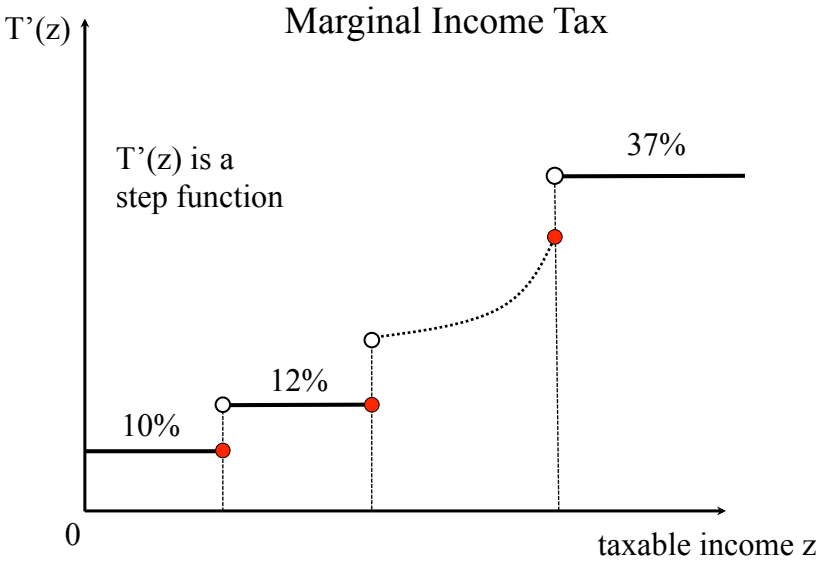
In 2018+, 7 brackets with MTR 10%,12%,22%,24%,32%,35%, 37% (top bracket for z above $600K), indexed on price inflation

Lower preferential rates (up to a max of 20%) apply to dividends (since 2003), realized capital gains [in part to offset double taxation of corporate profits].

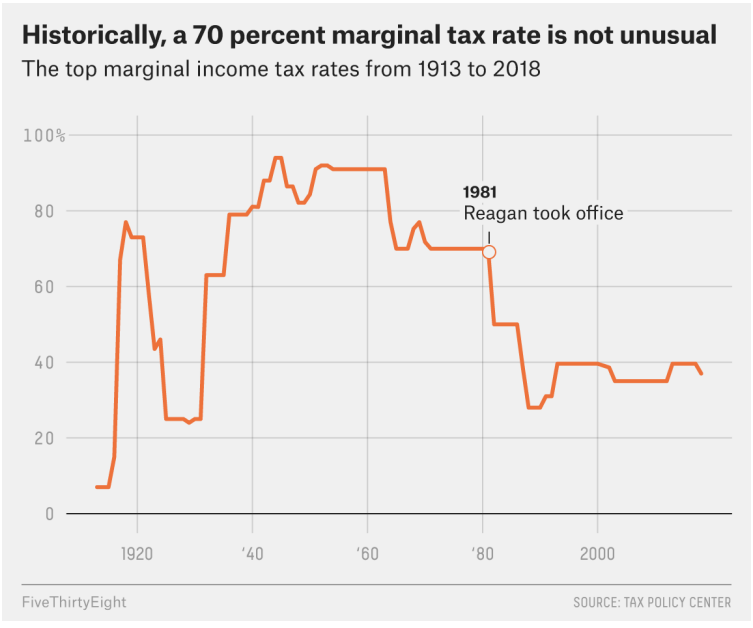
20% of business profits are exempt since 2018

Tax rates change frequently over time. Top MTRs have declined drastically since 1960s (as in many OECD countries)


Individual Income Tax
T(z)
slope 37%
T(z) is
continuous in z
slope
12%
slope
10%
0
taxable income z


Marginal Income Tax
T'(z)
T'(z) is a
step function
37%
12%
10%
0
taxable income z

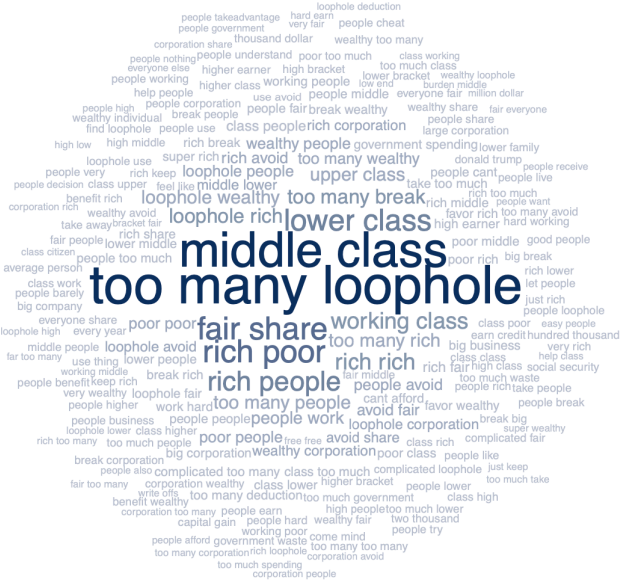
Tax Brackets: Federal US Income Tax



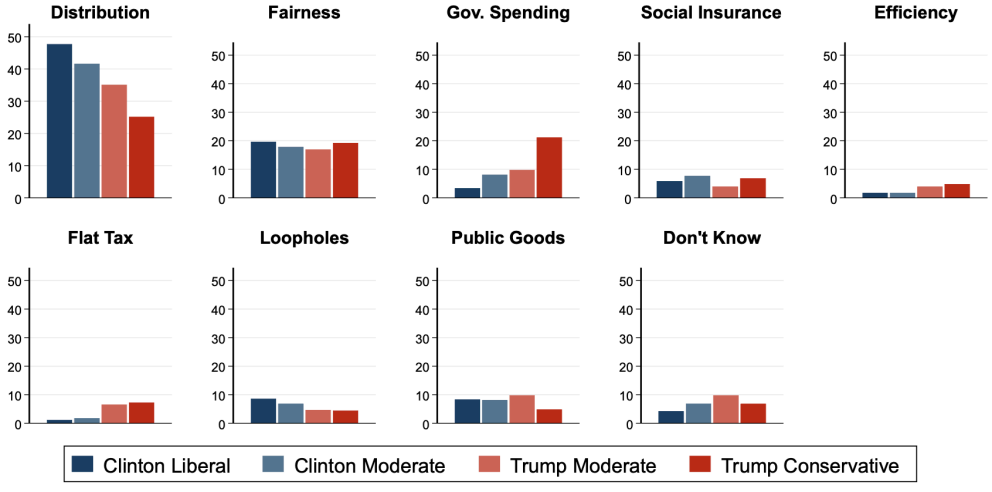
For Some Fun: What Do People Actually Know and How do they Think about Taxes?

... Some brand new evidence from the Social Economics Lab and understandingeconomics.org

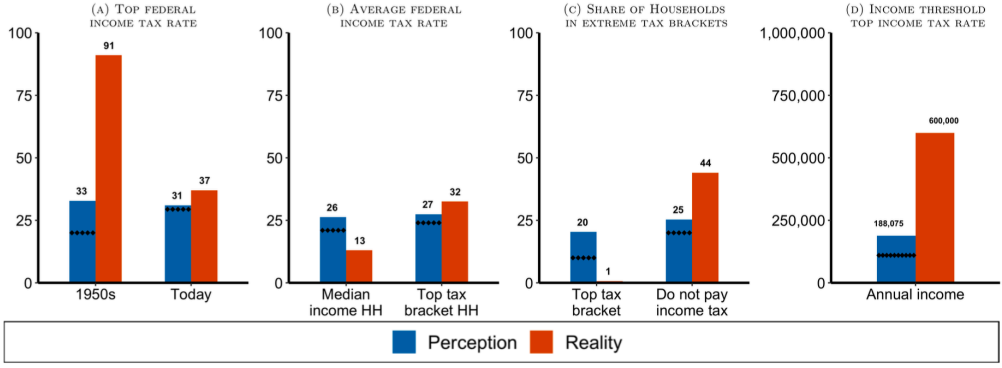
What are the Shortcomings of the Income Tax System?



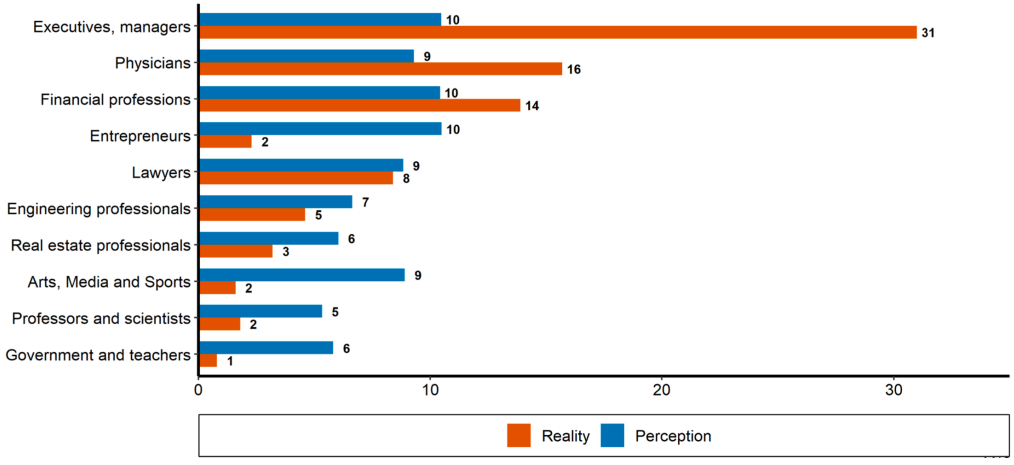
What are your Main Considerations about the Income Tax?
Relative Frequency of Topics by Political Views



People believe top bracket starts much lower, inflate extremes, and "schmedule"



Perceived Composition of the Top 1%:
so many entrepreneurs, scientists, government, teachers, arts, media & sports!



Social Determinants of Labor Supply

Concern that taxes funding social state could discourage work. Strong evidence that labor supply model of an individual decision based on standard invariant utility u(c, l) is highly incomplete.

Social norms play large role: e.g. women's market labor supply

a) Youth labor is regulated by labor laws/education

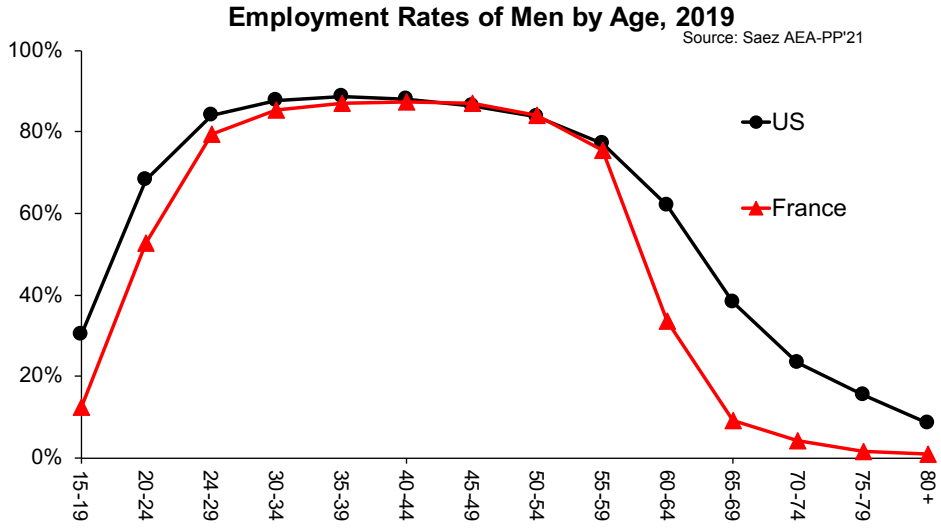
b) Old age labor regulated by retirement programs

c) Female market labor driven by norms + child care policy

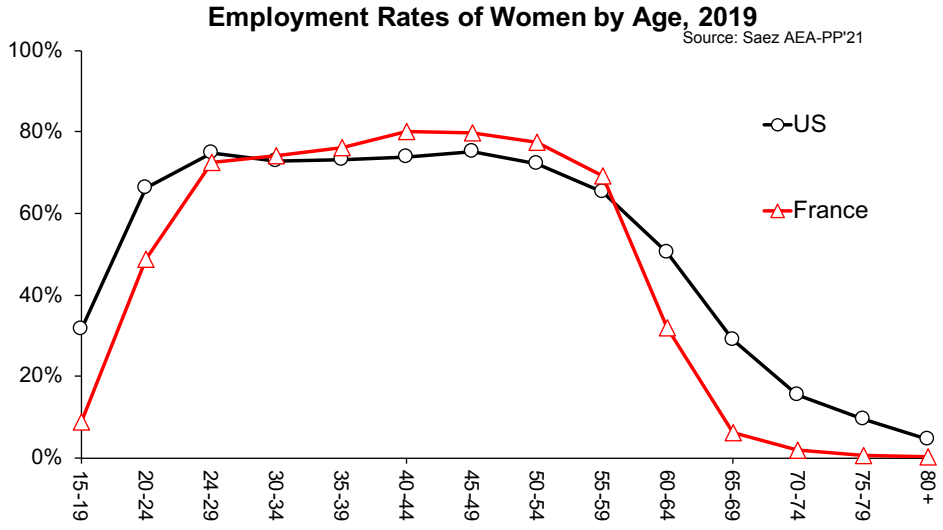
US female labor force participation during World War II: 50

d) Hours of work regulated by overtime + vacation mandates

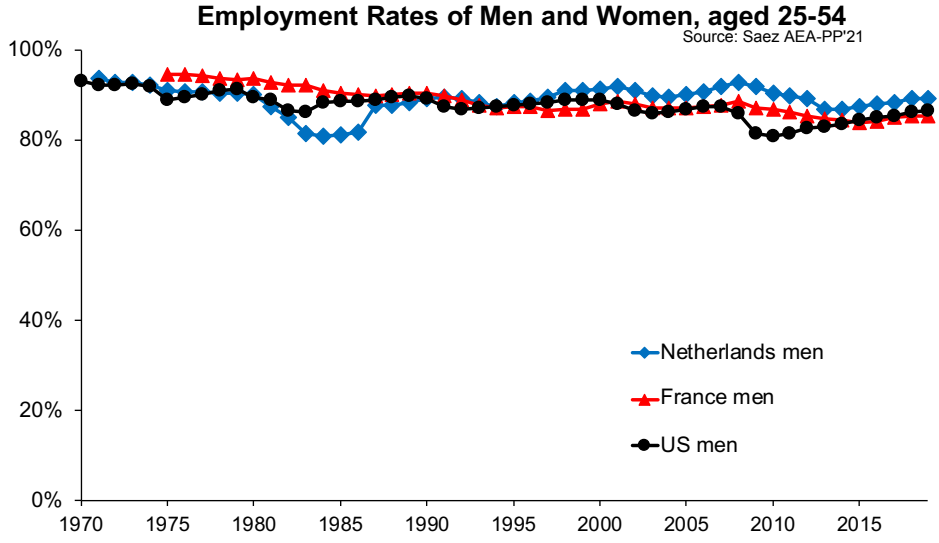
Responses to taxes and transfers likely affected by social norms



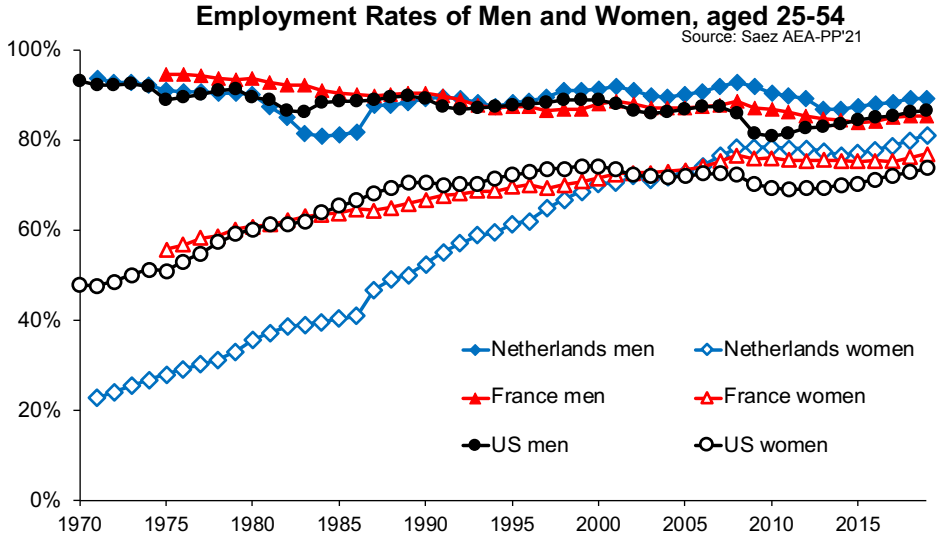
Source: OECD database online. Employment to population ratios.



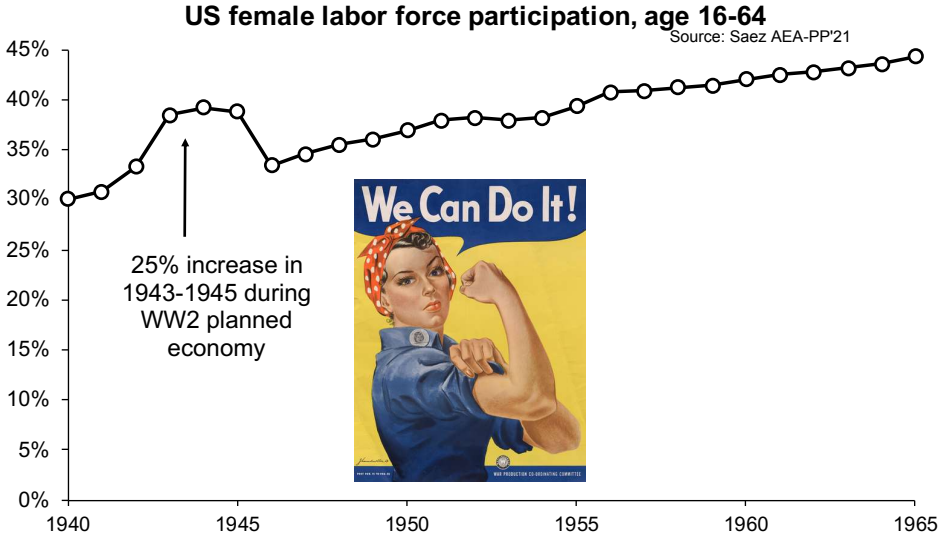
Source: OECD database online. Employment to population ratios.



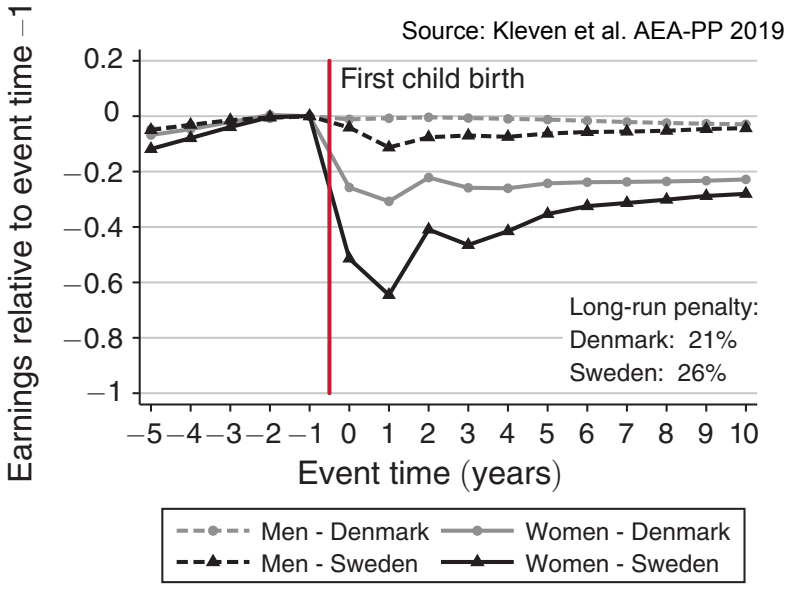
Source: OECD database online.

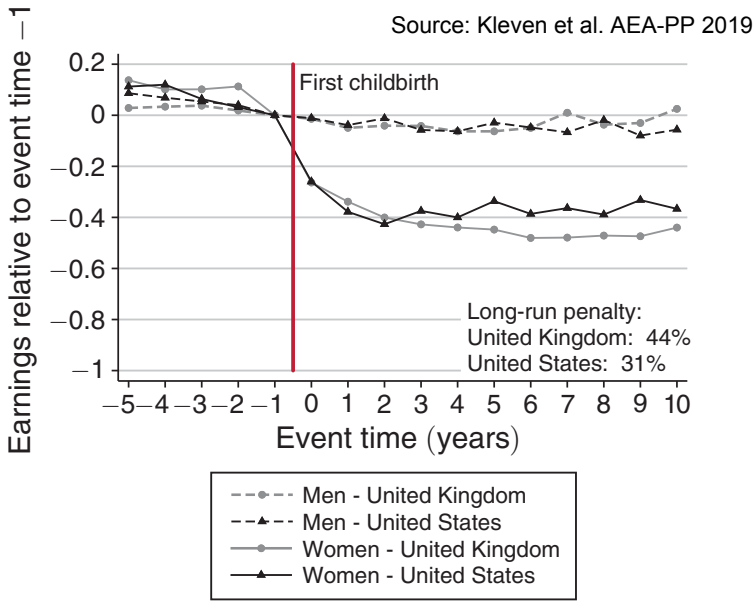


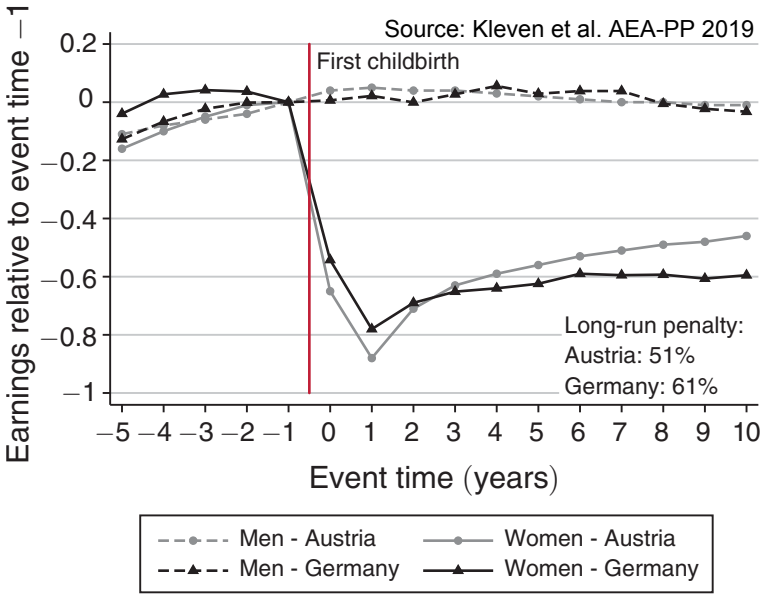
Source: OECD database online.



Source: Historical Statistics of the United States (Current Population Reports).


Source: Kleven et al. AEA-PP 2019
Earnings relative to event time −1
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
First child birth
Long-run penalty:
Denmark: 21%
Sweden: 26%
−5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
Event time (years)
Men - Denmark
Women - Denmark
Men - Sweden
Women - Sweden


Source: Kleven et al. AEA-PP 2019
Earnings relative to event time −1
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
First childbirth
Long-run penalty:
United Kingdom: 44%
United States: 31%
−5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
Event time (years)
Men - United Kingdom
Men - United States
Women - United Kingdom
Women - United States


Source: Kleven et al. AEA-PP 2019
First childbirth
Earnings relative to event time −1
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
Event time (years)
Long-run penalty:
Austria: 51%
Germany: 61%
Men - Austria
Men - Germany
Women - Austria
Women - Germany

Diamond and Saez (JEP'11): In practice, individual income tax is progressive with brackets with increasing marginal tax rates. What is the optimal top tax rate?

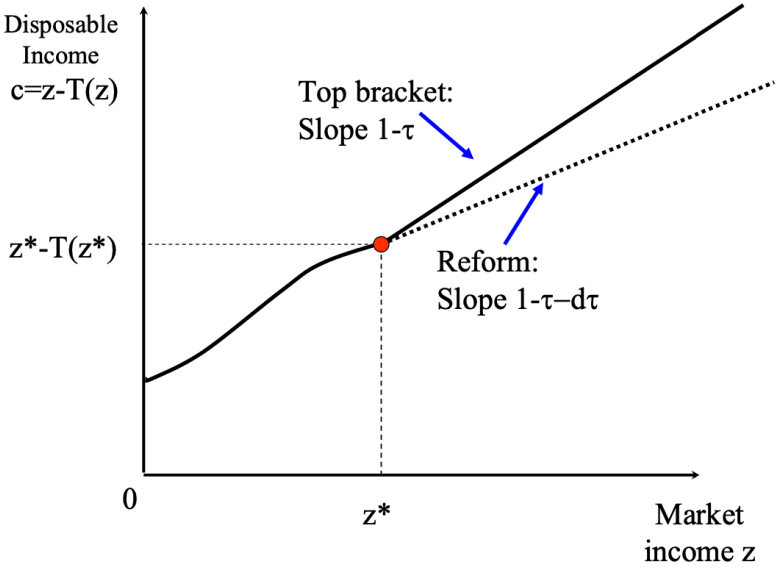
Consider constant MTR τ above fixed z^*. Goal is to derive optimal τ

In the US in 2018+, $\tau = 37\%$ and $z^* \approx \$600,000$ ($\approx$ top 1%)

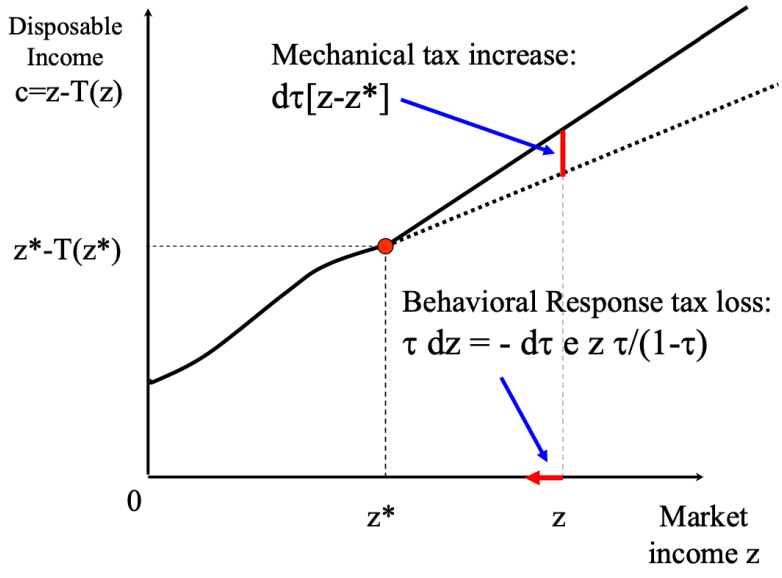
Denote by z average income of top bracket earners [depends on net-of-tax rate $1-\tau$], with elasticity $e = [(1-\tau)/z] \cdot dz/d(1-\tau)$

Suppose the government wants to maximize tax revenue collected from top bracket taxpayers (marginal utility of consumption of top 1% earners is small)

Diving into optimal taxation: Optimal Top Income Tax Rate



Diving into optimal taxation: Optimal Top Income Tax Rate



Optimal Top Income Tax Rate

Consider small $d\tau > 0$ reform above z^*

1. **Mechanical increase** in tax revenue: $dM = [z - z^*]d\tau$
2. **Behavioral response** reduces tax revenue: $dB = \tau dz$

Optimal τ such that $dM + dB = 0$

Can show that, optimal tax rate is: $\tau = \frac{1}{1+a \cdot e}$ with $a = \frac{z}{z-z^*}$

Optimal τ decreases with e [efficiency]

Optimal τ decrease with a [thinness of top tail]

Empirically $a \approx 1.5$, easy to estimate using distributional data [mean income above $z^* = \$.5m$ is about \$1.5m in the US]

Empirically e is harder to estimate [controversial]

Example: If $e = .25$ then $\tau = 1/(1 + 1.5 0.25) = 1/1.375 = 73\%$

Externalities

Market failure: A problem that violates one of the assumptions of the 1st welfare theorem and causes the market economy to deliver an outcome that does not maximize efficiency

Externality: Externalities arise whenever the actions of one economic agent directly affect another economic agent outside the market mechanism

Externality example: a steel plant that pollutes a river used for recreation

Not an externality example: a steel plant uses more electricity and bids up the price of electricity for other electricity customers

Externalities are one important case of market failure

Negative production externality: When a firm's production reduces the well-being of others who are not compensated by the firm.

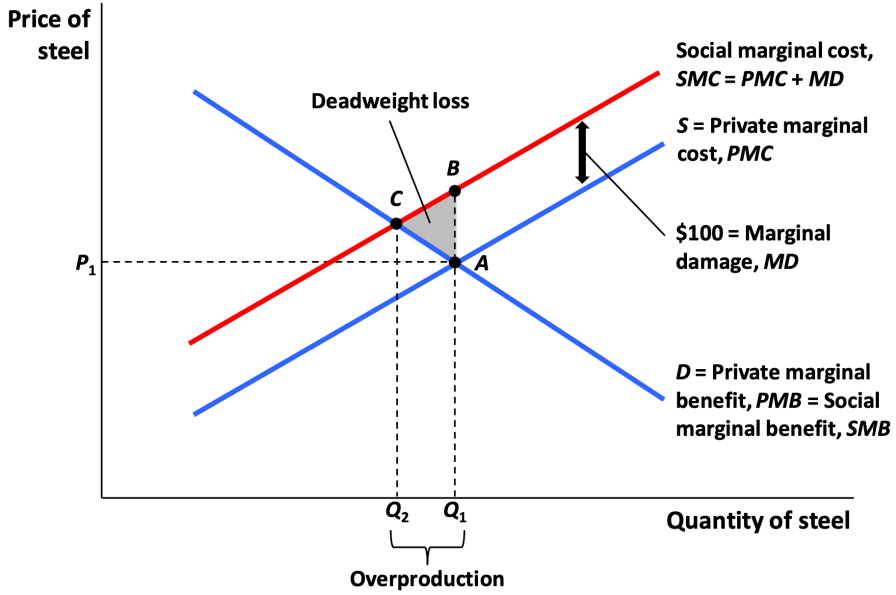
Private marginal cost (PMC): The direct cost to producers of producing an additional unit of a good

Marginal Damage (MD): Any additional costs associated with the production of the good that are imposed on others but that producers do not pay

Social marginal cost (SMC = PMC + MD): The private marginal cost to producers plus marginal damage

Example: steel plant pollutes a river but plant does not face any pollution regulation (and hence ignores pollution when deciding how much to produce)

Economics of Negative Production Externalities: Steel Production



Negative consumption externality: When an individual's consumption reduces the well-being of others who are not compensated by the individual.

Private marginal benefit (PMB): The direct benefit to consumers of consuming an additional unit of a good by the consumer.

Social marginal benefit (SMB): The private marginal benefit to consumers plus any costs associated with the consumption of the good that are imposed on others

Example: Using a car and emitting carbon contributing to global warming

Externality Theory: Market Outcome is Inefficient

With a free market, quantity and price are such that $PMB = PMC$

Social optimum is such that $SMB = SMC$

$\Rightarrow$ Private market leads to an inefficient outcome (1^{st} welfare theorem does not work)

Negative production externalities $\rightarrow$ over production (*SMC* curve above *PMC* curve)

Positive production externalities $\rightarrow$ under production (*SMC* curve below *PMC* curve)

Negative consumption externalities $\rightarrow$ over consumption (*SMB* curve lies below *PMB* curve)

Positive consumption externalities: $\rightarrow$ under consumption (*SMB* curve lies above *PMB* curve)

Coase Theorem (Part I): When there are well-defined property rights and costless bargaining, then negotiations between the party creating the externality and the party affected by the externality can bring about the socially optimal market quantity.

Coase Theorem (Part II): The efficient quantity for a good producing an externality does not depend on which party is assigned the property rights, as long as someone is assigned those rights.

But **limitations**:

> Internalization might not always work, in particular with large-scale, global externalities (assignment problem, transaction costs and negotiating problem,...)

Coase Theorem Example

Firms producing steel pollute a river enjoyed by swimmers. If the firms ignore swimmers, there is too much pollution

1. Swimmers own river: If river is owned by swimmers, then swimmers can charge firms for polluting the river. They will charge firms the marginal damage (*MD*) per unit of pollution. (Shifts up the PMC of the firm to the level of *SMC*).

   > Why price pollution at *MD*? If price is above *MD*, swimmers would want to sell an extra unit of pollution and get hit by pollution damage *MD*, so price must fall. *MD* is the equilibrium efficient price in the newly created pollution market.

2. Firms own river: If river is owned by firms, then swimmers are willing to pay firms MD for each unit of steel it does NOT produce. This increases the firms' cost of producing each unit of steel. Their cost shifts from *PMC* to $SMC = PMC + MD$ for each quantity of steel produced.

Final level of pollution will be the same in 1) and 2)

Public policy makers employ two types of remedies to resolve the problems associated with negative externalities:

1. **quantity regulation**: government limits use of externality producing chemicals. Example CFCs [chlorofluorocarbons] that deplete ozone layer
2. **corrective taxation**: corrective tax or subsidy equal to marginal damage per unit. Example: Carbon tax to fight global warming due to CO_2 emissions

1) and 2) can be combined with tradable emissions permits to firms that can then be traded (cap-and-trade for carbon emissions)

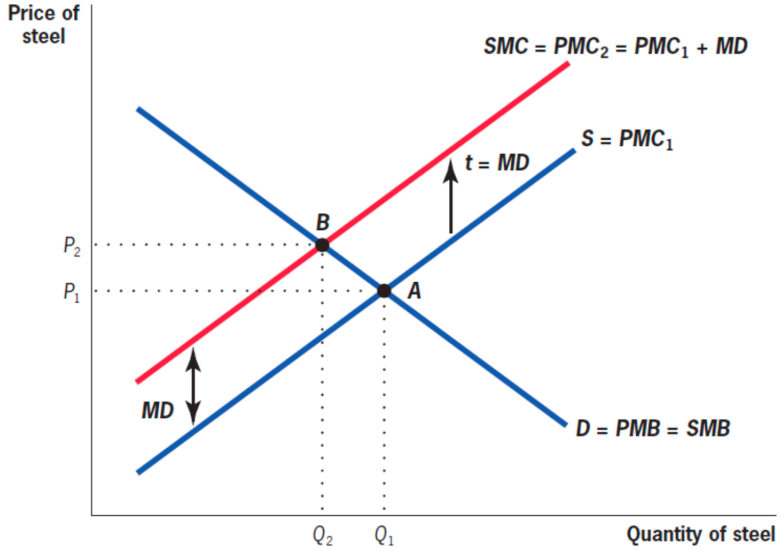
Corrective Taxes vs. Tradable Permits

Two differences between corrective taxes and tradable permits (carbon tax vs. cap-and-trade in the case of CO_2 emissions)

1. **Uncertainty in marginal costs** : With uncertainty in costs of reducing pollution, taxes preferable when MD curve is flat. Tradable permits are preferable when MD curve is steep.
2. **Initial allocation of permits**: If the government sells them to firms, this is equivalent to the tax

If the government gives them to current firms for free, this is like the tax + large transfer to initial polluting firms.

Corrective Taxation



Climate Change and CO_2 Emissions

Industrialization has dramatically increased CO2 emissions and atmospheric CO2 generates global warming

Four factors make this challenging (Wagner-Weitzman 2015):

1. **Global**: Emissions in one country affect the full world
2. **Irreversible**: Atmospheric CO2 has long life (centuries) [absent carbon capture tech breakthrough]
3. **Long-term**: Costs of global warming are decades/centuries away [how should this be discounted?]
4. **Uncertain**: Great uncertainty in costs of global warming [mitigation vs. amplifying feedback loops]

How fast should we start reducing emissions? [Stern-Weitzman want a fast reduction, Nordhaus advocates a slower path]

Main costs of Global Warming

Enormous variation across geographical areas and economic development. Pace of change makes adaptation daunting

1. Sea rise will flood low lying coasts and major population centers in many countries (e.g., Miami, Florida; value of real estate subject to regular flooding has dropped)
2. Impact on bio-diversity (mass extinctions)
3. Agricultural production could be disrupted by climate change and the increased weather variability it generates:

   demand for food is very inelastic in the short-run $\Rightarrow$ Spikes in prices if agricultural output falls $\Rightarrow$ disruption/famines possible in low income countries
4. Droughts and heat waves will make many places less livable Some societies may collapse and generate mass migration movements

Empirical Example: Costs of Global Warming

Estimating costs of Global warming is daunting because society will adapt and reduce costs (relative to a scenario with no adaptation)

Example: heat waves and mortality analysis of Barreca et al. (2016)

1. The mortality effect of an extremely hot day (80° F+) declined by about 75% between 1900-1959 and 1960-2004.
2. Adoption of residential air conditioning (AC) explains the entire decline
3. Worldwide adoption of AC will speed up the rate of climate change (if fossil fuel powered)

If we view global warming as a classical externality, it poses challenges because it is such a long-run problem.

CO_2 emissions impose a global warming externality $\Rightarrow$ Solution is to impose a carbon tax equal to the marginal damage of CO_2 emissions and let market forces work their magic

But what is the marginal damage of CO_2? It depends greatly on how you discount the future

Economists use interest rate r to discount future: \$1 today is worth $\$(1+r)T$ in T years (long-distance future heavily discounted: e.g., $r = 4\%$ and $T = 1000 \Rightarrow (1+r)T = 1017$)

If interest rate is high, it is desirable to let global warming happen and societies collapse!

Global Warming: Broader View

Massive CO_2 emissions pose existential civilizational risk (like CFC destroying vital ozone layer)

Only solution is to decarbonize and we need to do it fast (within decades not centuries)

Decarbonization is within sight: renewable electricity (solar/wind) + grid + big batteries could power most energy needs and replace most fossil fuels

$\Rightarrow$ could it be done without killing economic growth and without huge short-term disruptions?

Economists' useful point: some sectors are easier to decarbonize than others (e.g. cars easier than planes)

$\Rightarrow$ start decarbonizing easiest sectors first (Sachs 2020)

Understanding Attitudes toward Climate Policies

Fighting Climate Change: International Attitudes toward Climate Policies

Antoine Dechezleprêtre, Adrien Fabre, Tobias Kruse, Bluebery Planterose, Ana Sanchez-Chico, and Stefanie Stantcheva

SOCIAL ECONOMICS LAB

OECD
BETTER POLICIES FOR BETTER LIVES

Motivation: Understanding international attitudes toward climate change and climate policies

Climate change is a pressing yet unresolved issue

To limit avg. temperature increase to <2°C above pre-industrial levels, must drastically reduce global emissions by 2050

Over 140 countries, representing 90% of global GHG emissions, have adopted or announced climate neutrality targets by mid-century

Given current policies, expect avg. temp rise of about 2.7°C by 2100

What drives support for or opposition to important climate policies across the world?

Lack of knowledge?

Effects on own budget and lifestyle?

Broader concerns about the impact on others and the economy?

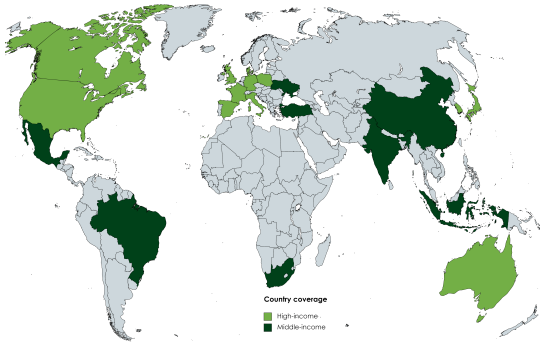
Struggle to assess how a given policy affects climate change?

Address these questions using surveys and experiments.

An international survey

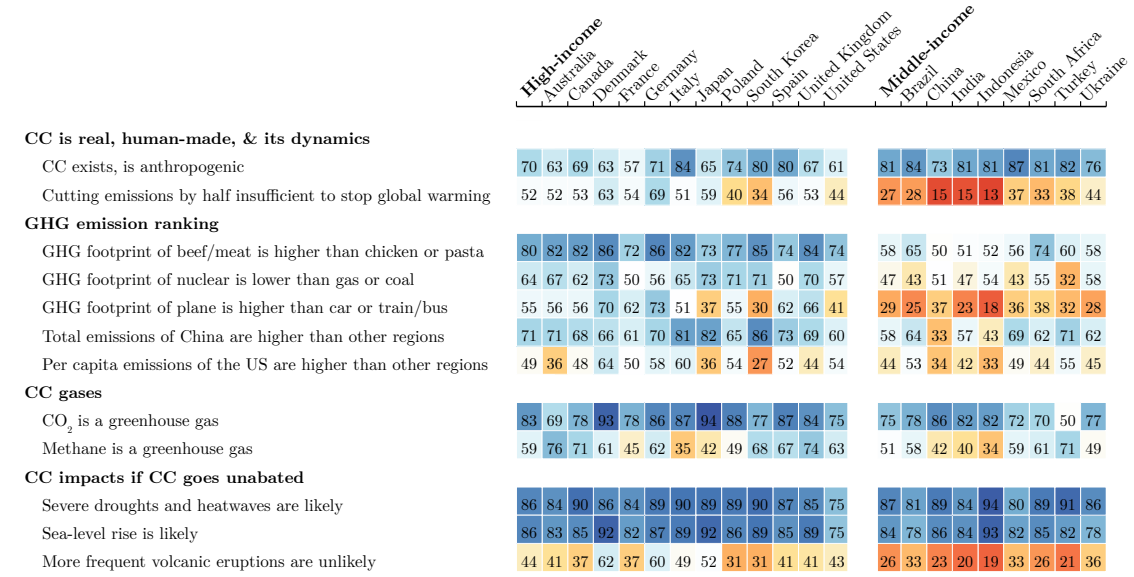
Large-scale, cross-country survey with +40,000 respondents to analyze attitudes on climate change and climate policies with wide country coverage:

20 countries in all world regions, middle-income as well as high-income countries, covering 72% of global CO_2 emissions, including 18 out of the 21 largest emitters. [1]

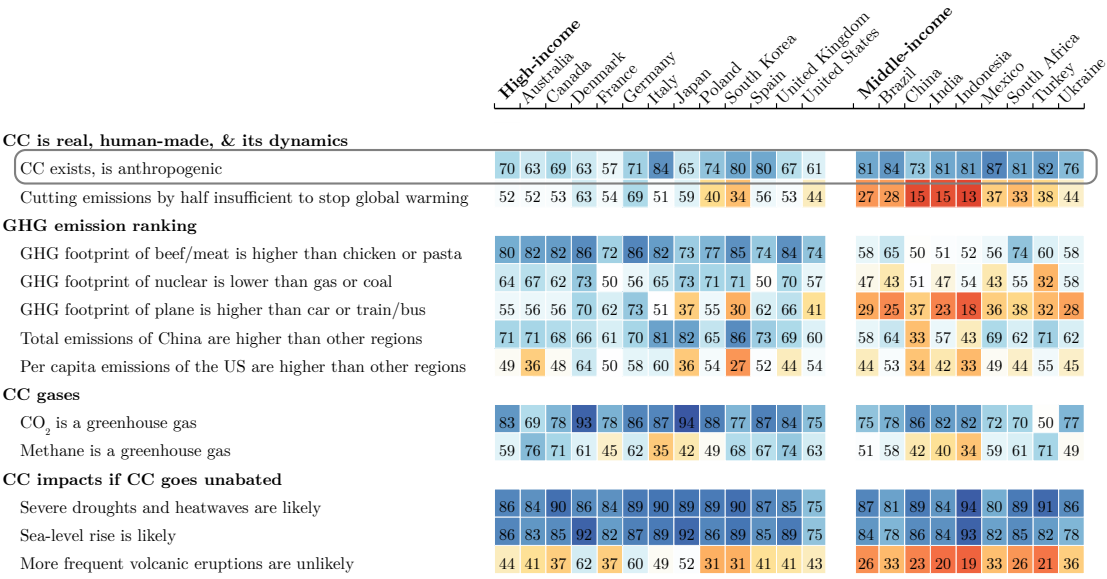


[1] The three missing countries are Russia, Iran, and Saudi Arabia.

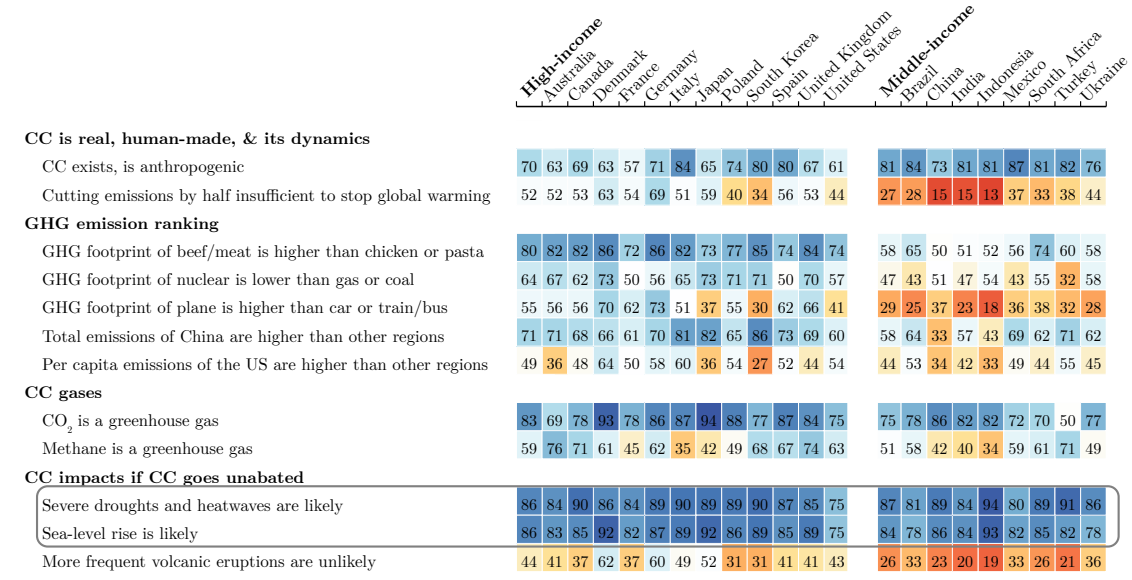
Knowledge across countries: Share of correct answers



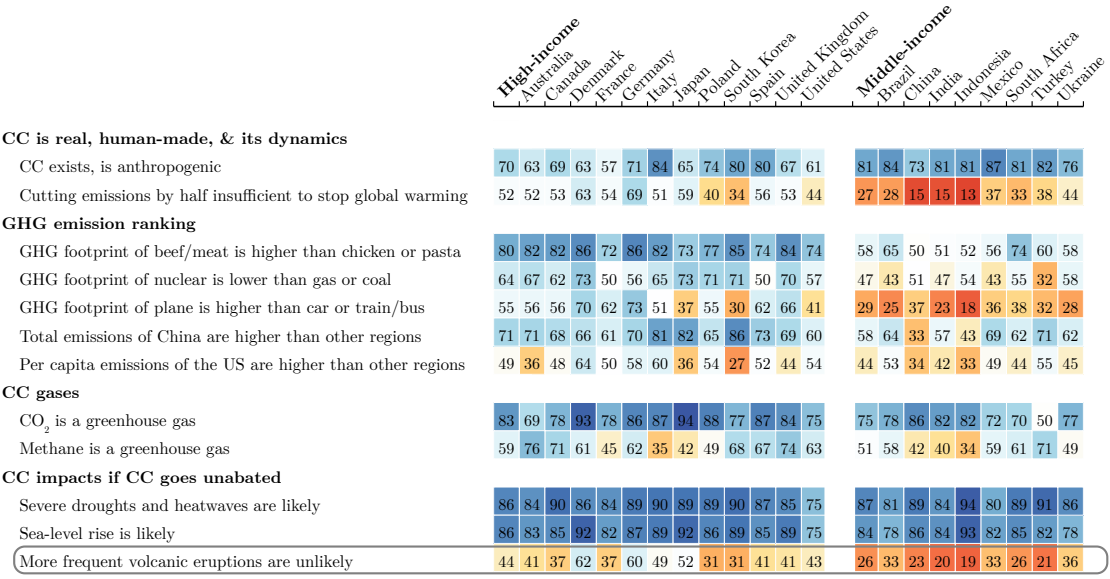
Few outright deny of climate change; most believe it is anthropogenic



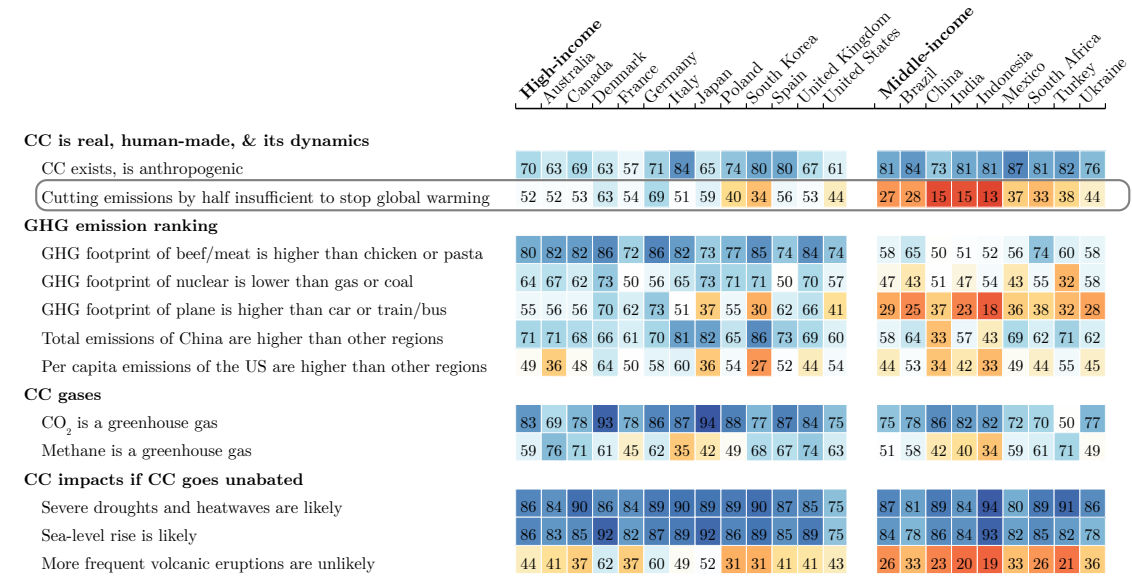
People correctly foresee consequences of climate change



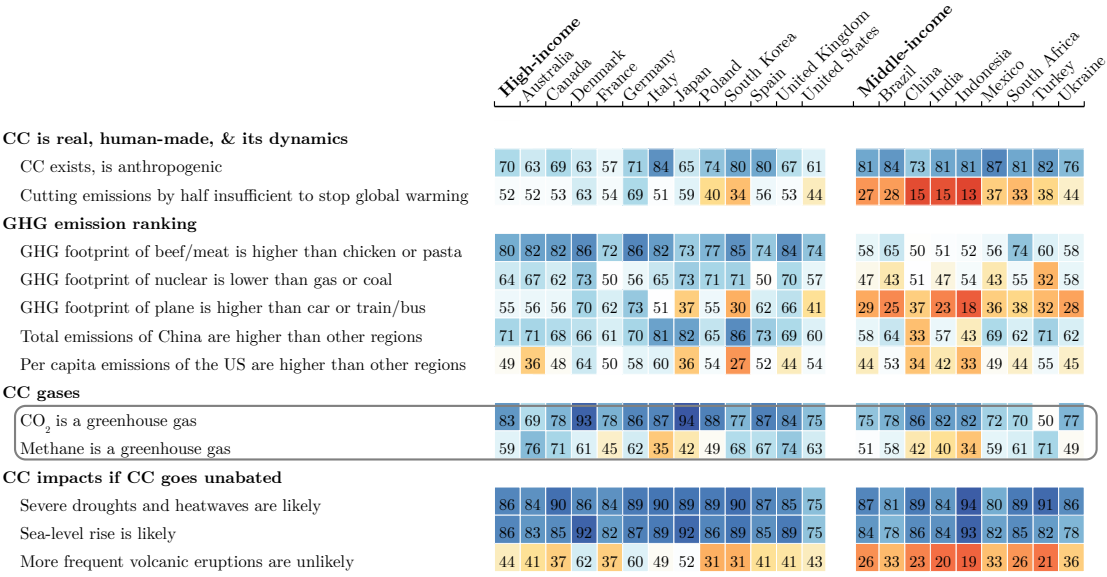
People make insufficient distinction between disaster types



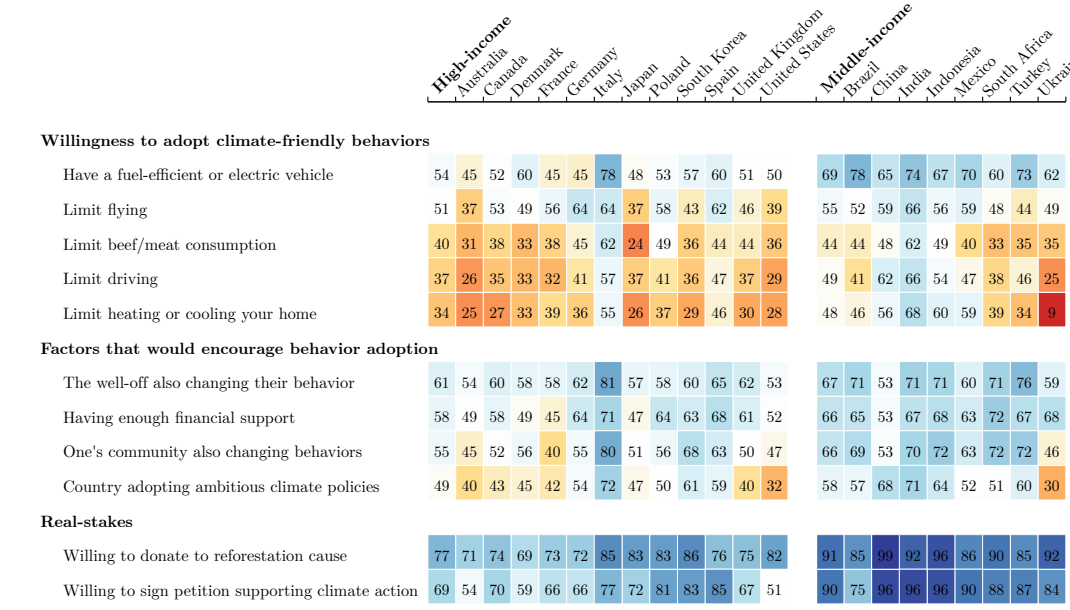
People are too optimistic about level of decarbonization needed



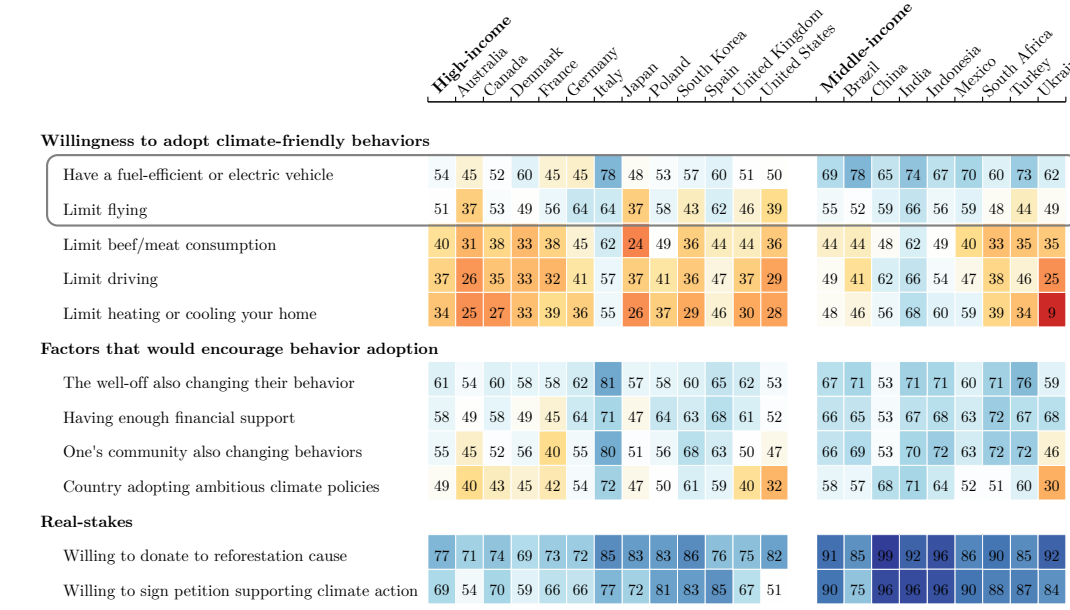
Most people are aware of the factors that cause climate change



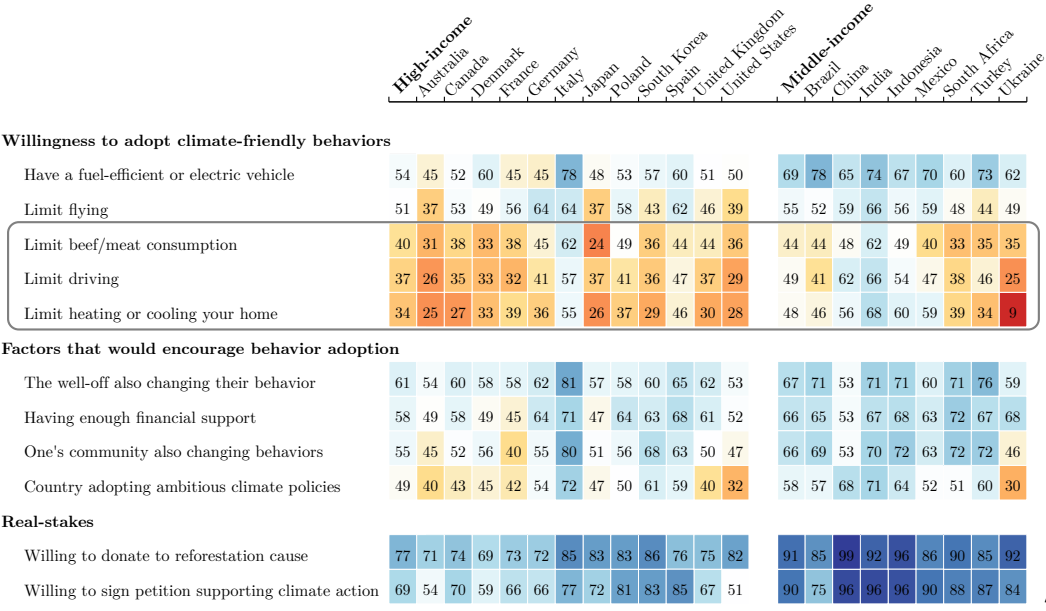
Share of people willing to adopt climate-friendly behaviors



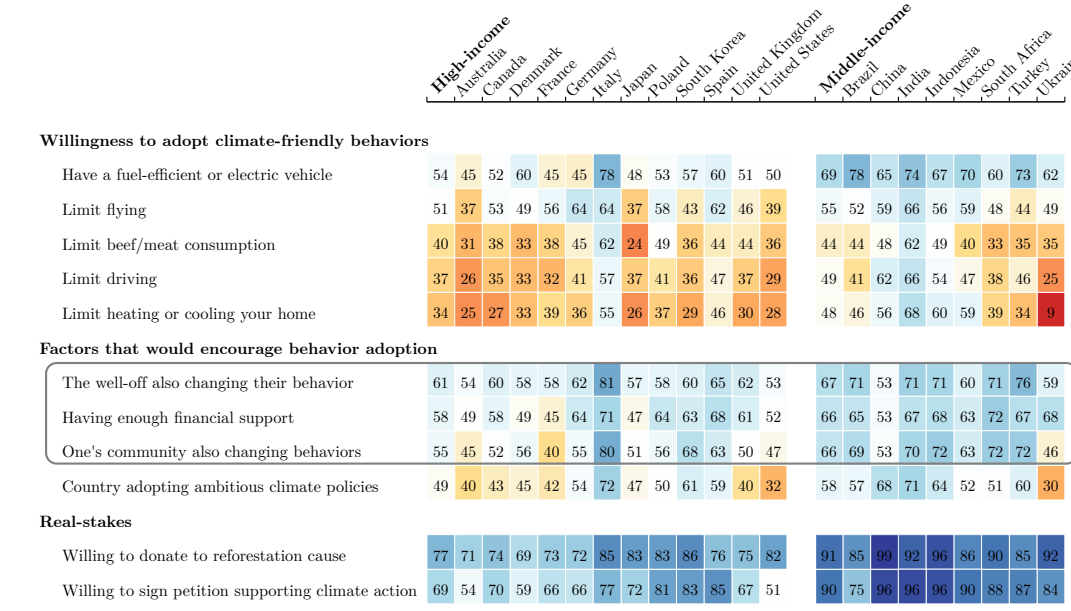
Around half are willing to buy fuel-efficient car or to limit flying



People are unwilling to limit some behaviors



People are willing to change behavior with financial support and if others do



Who support more climate action?

Political leanings very strong predictors (left-leaning respondents support more climate action).

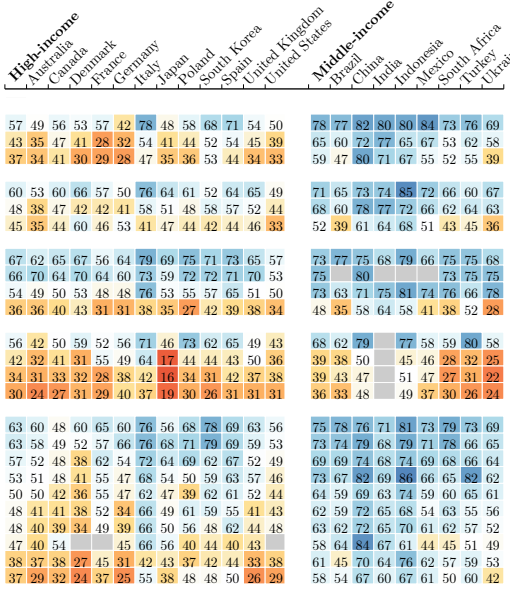
Those with higher levels of education, particularly college degree (even conditional on income).

Those whose lifestyle allows them to do so: i) have access to high-quality public transportation; ii) rely less on a car; iii) have lower gas expenses.

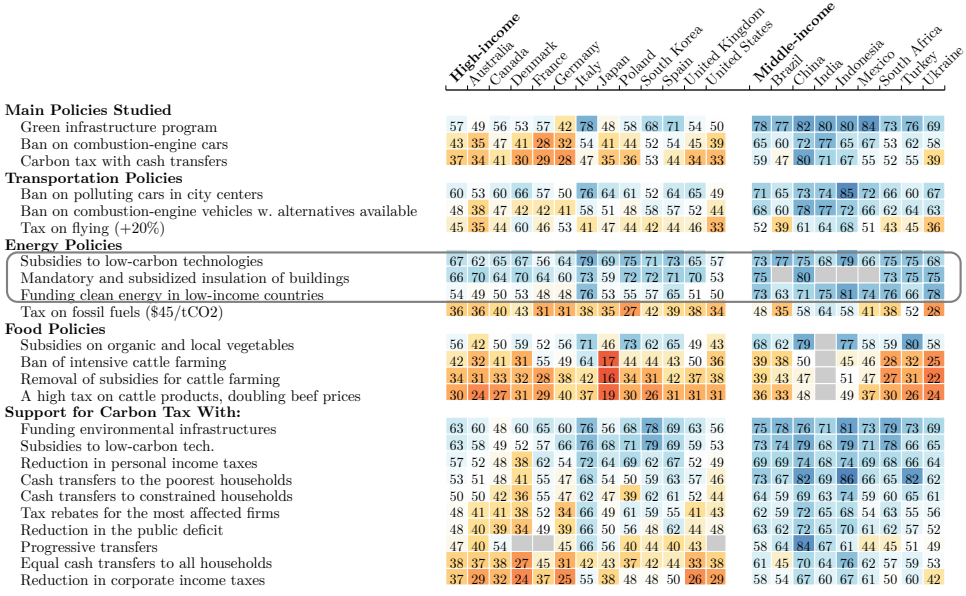
What explains support for climate action?

1. Effectiveness belief: the policy is helpful in reducing emissions.
2. Inequality concern: the policy will not disproportionately hurt lower-income or vulnerable households.
3. Self-interest: the policy will not financially hurt my household.

Share of respondents who support climate change policies



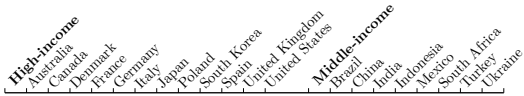
More than half support subsidies to low-carbon technology and infrastructure



Many support banning polluting vehicles in city centers

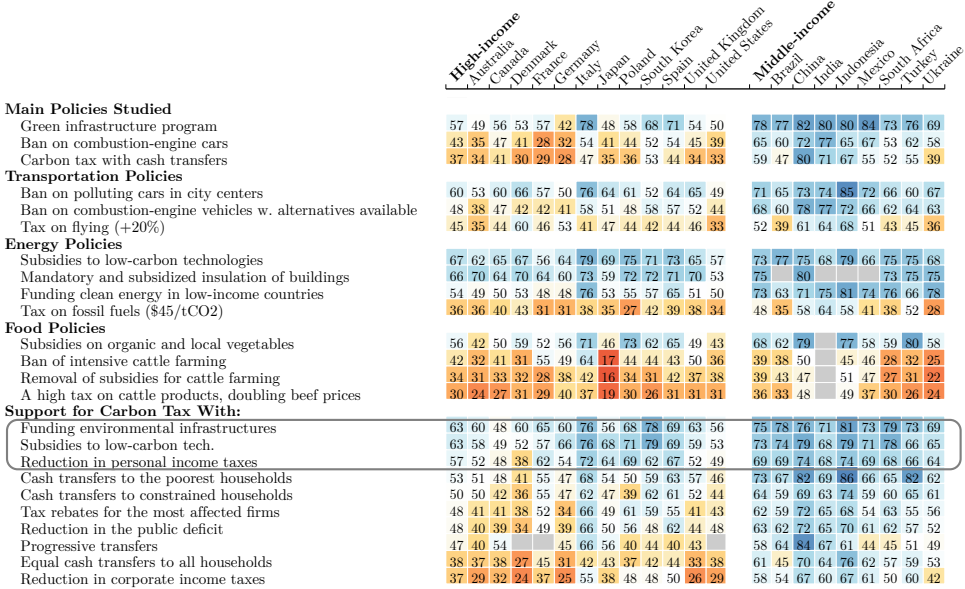
	High-income												Middle-income									
	Australia	Canada	Denmark	France	Germany	Italy	Japan	Poland	South Korea	Spain	United Kingdom	United States	Brazil	China	India	Indonesia	Mexico	South Africa	Turkey	Ukraine
Main Policies Studied																				
Green infrastructure program	57	49	56	53	57	42	78	48	58	68	71	54	50	78	77	82	80	80	84	73	76	69
Ban on combustion-engine cars	43	35	47	41	28	32	54	41	44	52	54	45	39	65	60	72	77	65	67	53	62	58
Carbon tax with cash transfers	37	34	41	30	29	28	47	35	36	53	44	34	33	59	47	80	71	67	55	52	55	39
Transportation Policies																						
Ban on polluting cars in city centers	60	53	60	66	57	50	76	64	61	52	64	65	49	71	65	73	74	85	72	66	60	67
Ban on combustion-engine vehicles w. alternatives available	48	38	47	42	42	41	58	51	48	58	57	52	44	68	60	78	77	72	66	62	64	63
Tax on flying (+20%)	45	35	44	60	46	53	41	47	44	42	44	46	33	52	39	61	64	68	51	43	45	36
Energy Policies																						
Subsidies to low-carbon technologies	67	62	65	67	56	64	79	69	75	71	73	65	57	73	77	75	68	79	66	75	75	68
Mandatory and subsidized insulation of buildings	66	70	64	70	64	60	73	59	72	72	71	70	53	75		80				73	75	75
Funding clean energy in low-income countries	54	49	50	53	48	48	76	53	55	57	65	51	50	73	63	71	75	81	74	76	66	78
Tax on fossil fuels ($45/tCO2)	36	36	40	43	31	31	38	35	27	42	39	38	34	48	35	58	64	58	41	38	52	28
Food Policies																						
Subsidies on organic and local vegetables	56	42	50	59	52	56	71	46	73	62	65	49	43	68	62	79		77	58	59	80	58
Ban of intensive cattle farming	42	32	41	31	55	49	64	17	44	44	43	50	36	39	38	50		45	46	28	32	25
Removal of subsidies for cattle farming	34	31	33	32	28	38	42	16	34	31	42	37	38	39	43	47		51	47	27	31	22
A high tax on cattle products, doubling beef prices	30	24	27	31	29	40	37	19	30	26	31	31	31	36	33	48		49	37	30	26	24
Support for Carbon Tax With:																						
Funding environmental infrastructures	63	60	48	60	65	60	76	56	68	78	69	63	56	75	78	76	71	81	73	79	73	69
Subsidies to low-carbon tech.	63	58	49	52	57	66	76	68	71	79	69	59	53	73	74	79	68	79	71	78	66	65
Reduction in personal income taxes	57	52	48	38	62	54	72	64	69	62	67	52	49	69	69	74	68	74	69	68	66	64
Cash transfers to the poorest households	53	51	48	41	55	47	68	54	50	59	63	57	46	73	67	82	69	86	66	65	82	62
Cash transfers to constrained households	50	50	42	36	55	47	62	47	39	62	61	52	44	64	59	69	63	74	59	60	65	61
Tax rebates for the most affected firms	48	41	41	38	52	34	66	49	61	59	55	41	43	62	59	72	65	68	54	63	55	56
Reduction in the public deficit	48	40	39	34	49	39	66	50	56	48	62	44	48	63	62	72	65	70	61	62	57	52
Progressive transfers	47	40	54			45	66	56	40	44	40	43		58	64	84	67	67	61	44	45	51	49
Equal cash transfers to all households	38	37	38	27	45	31	42	43	37	42	44	33	38	61	45	70	64	76	62	57	59	53
Reduction in corporate income taxes	37	29	32	24	37	25	55	38	48	48	50	26	29	58	54	67	60	67	61	50	60	42

Carbon taxes appear to be least popular at first glance



Main Policies Studied																				
Green infrastructure program	57	49	56	53	57	42	78	48	58	68	71	54	50	78	77	82	80	80	84	73	76	69
Ban on combustion-engine cars	43	35	47	41	28	32	54	41	44	52	54	45	39	65	60	72	77	65	67	53	62	58
Carbon tax with cash transfers	37	34	41	30	29	28	47	35	36	53	44	34	33	59	47	80	71	67	55	52	55	39
Transportation Policies																				
Ban on polluting cars in city centers	60	53	60	66	57	50	76	64	61	52	64	65	49	71	65	73	74	85	72	66	60	67
Ban on combustion-engine vehicles w. alternatives available	48	38	47	42	42	41	58	51	48	58	57	52	44	68	60	78	77	72	66	62	64	63
Tax on flying (+20%)	45	35	44	60	46	53	41	47	44	42	44	46	33	52	39	61	64	68	51	43	45	36
Energy Policies																				
Subsidies to low-carbon technologies	67	62	65	67	56	64	79	69	75	71	73	65	57	73	77	75	68	79	66	75	75	68
Mandatory and subsidized insulation of buildings	66	70	64	70	64	60	73	59	72	72	71	70	53	75		80				73	75	75
Funding clean energy in low-income countries	54	49	50	53	48	48	76	53	55	57	65	51	50	73	63	71	75	81	74	76	66	78
Tax on fossil fuels ($45/tCO2)	36	36	40	43	31	31	38	35	27	42	39	38	34	48	35	58	64	58	41	38	52	28
Food Policies																				
Subsidies on organic and local vegetables	56	42	50	59	52	56	71	46	73	62	65	49	43	68	62	79		77	58	59	80	58
Ban of intensive cattle farming	42	32	41	31	55	49	64	17	44	44	43	50	36	39	38	50		45	46	28	32	25
Removal of subsidies for cattle farming	34	31	33	32	28	38	42	16	34	31	42	37	38	39	43	47		51	47	27	31	22
A high tax on cattle products, doubling beef prices	30	24	27	31	29	40	37	19	30	26	31	31	31	36	33	48		49	37	30	26	24
Support for Carbon Tax With:																				
Funding environmental infrastructures	63	60	48	60	65	60	76	56	68	78	69	63	56	75	78	76	71	81	73	79	73	69
Subsidies to low-carbon tech.	63	58	49	52	57	66	76	68	71	79	69	59	53	73	74	79	68	79	71	78	66	65
Reduction in personal income taxes	57	52	48	38	62	54	72	64	69	62	67	52	49	69	69	74	68	74	69	68	66	64
Cash transfers to the poorest households	53	51	48	41	55	47	68	54	50	59	63	57	46	73	67	82	69	86	66	65	82	62
Cash transfers to constrained households	50	50	42	36	55	47	62	47	39	62	61	52	44	64	59	69	63	74	59	60	65	61
Tax rebates for the most affected firms	48	41	41	38	52	34	66	49	61	59	55	41	43	62	59	72	65	68	54	63	55	56
Reduction in the public deficit	48	40	39	34	49	39	66	50	56	48	62	44	48	63	62	72	65	70	61	62	57	52
Progressive transfers	47	40	54			45	66	56	40	44	40	43		58	64	84	67	61	44	45	51	49
Equal cash transfers to all households	38	37	38	27	45	31	42	43	37	42	44	33	38	61	45	70	64	76	62	57	59	53
Reduction in corporate income taxes	37	29	32	24	37	25	55	38	48	48	50	26	29	58	54	67	60	67	61	50	60	42

Use of revenue matters substantially for support of carbon taxes



Least support for carbon tax with equal transfers or to reduce corporate tax

Main Policies Studied																				
Green infrastructure program	57	49	56	53	57	42	78	48	58	68	71	54	50	78	77	82	80	80	84	73	76	69
Ban on combustion-engine cars	43	35	47	41	28	32	54	41	44	52	54	45	39	65	60	72	77	65	67	53	62	58
Carbon tax with cash transfers	37	34	41	30	29	28	47	35	36	53	44	34	33	59	47	80	71	67	55	52	55	39
Transportation Policies																				
Ban on polluting cars in city centers	60	53	60	66	57	50	76	64	61	52	64	65	49	71	65	73	74	85	72	66	60	67
Ban on combustion-engine vehicles w. alternatives available	48	38	47	42	42	41	58	51	48	58	57	52	44	68	60	78	77	72	66	62	64	63
Tax on flying (+20%)	45	35	44	60	46	53	41	47	44	42	44	46	33	52	39	61	64	68	51	43	45	36
Energy Policies																				
Subsidies to low-carbon technologies	67	62	65	67	56	64	79	69	75	71	73	65	57	73	77	75	68	79	66	75	75	68
Mandatory and subsidized insulation of buildings	66	70	64	70	64	60	73	59	72	72	71	70	53	75		80				73	75	75
Funding clean energy in low-income countries	54	49	50	53	48	48	76	53	55	57	65	51	50	73	63	71	75	81	74	76	66	78
Tax on fossil fuels ($45/tCO2)	36	36	40	43	31	31	38	35	27	42	39	38	34	48	35	58	64	58	41	38	52	28
Food Policies																				
Subsidies on organic and local vegetables	56	42	50	59	52	56	71	46	73	62	65	49	43	68	62	79		77	58	59	80	58
Ban of intensive cattle farming	42	32	41	31	55	49	64	17	44	44	43	50	36	39	38	50		45	46	28	32	25
Removal of subsidies for cattle farming	34	31	33	32	28	38	42	16	34	31	42	37	38	39	43	47		51	47	27	31	22
A high tax on cattle products, doubling beef prices	30	24	27	31	29	40	37	19	30	26	31	31	31	36	33	48		49	37	30	26	24
Support for Carbon Tax With:																				
Funding environmental infrastructures	63	60	48	60	65	60	76	56	68	78	69	63	56	75	78	76	71	81	73	79	73	69
Subsidies to low-carbon tech.	63	58	49	52	57	66	76	68	71	79	69	59	53	73	74	79	68	79	71	78	66	65
Reduction in personal income taxes	57	52	48	38	62	54	72	64	69	62	67	52	49	69	69	74	68	74	69	68	66	64
Cash transfers to the poorest households	53	51	48	41	55	47	68	54	50	59	63	57	46	73	67	82	69	86	66	65	82	62
Cash transfers to constrained households	50	50	42	36	55	47	62	47	39	62	61	52	44	64	59	69	63	74	59	60	65	61
Tax rebates for the most affected firms	48	41	41	38	52	34	66	49	61	59	55	41	43	62	59	72	65	68	54	63	55	56
Reduction in the public deficit	48	40	39	34	49	39	66	50	56	48	62	44	48	63	62	72	65	70	61	62	57	52
Progressive transfers	47	40	54			45	66	56	40	44	40	43		58	64	84	67	61	44	45	51	49
Equal cash transfers to all households	38	37	38	27	45	31	42	43	37	42	44	33	38	61	45	70	64	76	62	57	59	53
Reduction in corporate income taxes	37	29	32	24	37	25	55	38	48	48	50	26	29	58	54	67	60	67	61	50	60	42

Policies to reduce cattle farming least popular in all countries

Main Policies Studied																				
Green infrastructure program	57	49	56	53	57	42	78	48	58	68	71	54	50	78	77	82	80	80	84	73	76	69
Ban on combustion-engine cars	43	35	47	41	28	32	54	41	44	52	54	45	39	65	60	72	77	65	67	53	62	58
Carbon tax with cash transfers	37	34	41	30	29	28	47	35	36	53	44	34	33	59	47	80	71	67	55	52	55	39
Transportation Policies																				
Ban on polluting cars in city centers	60	53	60	66	57	50	76	64	61	52	64	65	49	71	65	73	74	85	72	66	60	67
Ban on combustion-engine vehicles w. alternatives available	48	38	47	42	42	41	58	51	48	58	57	52	44	68	60	78	77	72	66	62	64	63
Tax on flying (+20%)	45	35	44	60	46	53	41	47	44	42	44	46	33	52	39	61	64	68	51	43	45	36
Energy Policies																				
Subsidies to low-carbon technologies	67	62	65	67	56	64	79	69	75	71	73	65	57	73	77	75	68	79	66	75	75	68
Mandatory and subsidized insulation of buildings	66	70	64	70	64	60	73	59	72	72	71	70	53	75		80				73	75	75
Funding clean energy in low-income countries	54	49	50	53	48	48	76	53	55	57	65	51	50	73	63	71	75	81	74	76	66	78
Tax on fossil fuels ($45/tCO2)	36	36	40	43	31	31	38	35	27	42	39	38	34	48	35	58	64	58	41	38	52	28
Food Policies																				
Subsidies on organic and local vegetables	56	42	50	59	52	56	71	46	73	62	65	49	43	68	62	79		77	58	59	80	58
Ban of intensive cattle farming	42	32	41	31	55	49	64	17	44	44	43	50	36	39	38	50		45	46	28	32	25
Removal of subsidies for cattle farming	34	31	33	32	28	38	42	16	34	31	42	37	38	39	43	47		51	47	27	31	22
A high tax on cattle products, doubling beef prices	30	24	27	31	29	40	37	19	30	26	31	31	31	36	33	48		49	37	30	26	24
Support for Carbon Tax With:																				
Funding environmental infrastructures	63	60	48	60	65	60	76	56	68	78	69	63	56	75	78	76	71	81	73	79	73	69
Subsidies to low-carbon tech.	63	58	49	52	57	66	76	68	71	79	69	59	53	73	74	79	68	79	71	78	66	65
Reduction in personal income taxes	57	52	48	38	62	54	72	64	69	62	67	52	49	69	69	74	68	74	69	68	66	64
Cash transfers to the poorest households	53	51	48	41	55	47	68	54	50	59	63	57	46	73	67	82	69	86	66	65	82	62
Cash transfers to constrained households	50	50	42	36	55	47	62	47	39	62	61	52	44	64	59	69	63	74	59	60	65	61
Tax rebates for the most affected firms	48	41	41	38	52	34	66	49	61	59	55	41	43	62	59	72	65	68	54	63	55	56
Reduction in the public deficit	48	40	39	34	49	39	66	50	56	48	62	44	48	63	62	72	65	70	61	62	57	52
Progressive transfers	47	40	54			45	66	56	40	44	40	43		58	64	84	67	61	44	45	51	49
Equal cash transfers to all households	38	37	38	27	45	31	42	43	37	42	44	33	38	61	45	70	64	76	62	57	59	53
Reduction in corporate income taxes	37	29	32	24	37	25	55	38	48	48	50	26	29	58	54	67	60	67	61	50	60	42

Policy Implications

1. Policies need to be effective and distributionally progressive: compensate low-income and vulnerable households.

2. There is a need for explanations of policies' effectiveness and distributional impacts, not just information about climate change impacts

3. People care about impact on their households, so need to provide alternatives and means to substitute before imposing punitive policies.

Help households transition out of fossil fuel equipment (cars, heating systems). Requires time and financial help.

Ensure a transition (e.g.: announce path of carbon tax increases in advance, especially in light of current energy prices)

THANK YOU!

These slides are available on my website: https://bluebery-planterose.com/teaching

These slides are partly based on courses by: Ghazala Azmat, Raj Chetty, Emmanuel Saez, Stefanie Stantcheva, and Gabriel Zucman.