

Trade, Leakage, and the Design of a Carbon Tax

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Policy Goal

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- Reduce **global** carbon emissions
 - at minimum economic cost

Challenge

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- Globally harmonized carbon price is a dream
 - a country or coalition will need to act on its own

Question

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- What are principles of design for a carbon tax?
 - in this world of trade and potential **carbon leakage**

Principle I

Principle I

- Tax both supply and demand for fossil fuels
 - more tax on supply if foreign extraction is inelastic
- (idea implicit in analysis by James Markusen, 1975)

Principle I in Practice

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- Impose nominal tax on fossil-fuel extraction
 - add **partial border adjustments** on fuel imports & exports

Principle I in Practice

- Impose nominal tax on fossil-fuel extraction
 - add **partial border adjustments** on fuel imports & exports
- Partial BAs are at **lower rate** than nominal tax
 - even lower if foreign supply is inelastic
 - **current proposals** have full BAs; hence supply untaxed

Principle II

Principle II

- Tax carbon in goods production and consumption
 - tax imports at same rate as domestic consumption
 - tax exports at a lower rate, dictated by **leakage rate**

Principle II in Practice

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- Impose nominal tax on fossil-fuel extraction
 - partial border adjustments on fuels (Principle I)

Principle II in Practice

- Impose nominal tax on fossil-fuel extraction
 - partial border adjustments on fuels (Principle I)
- Add BAs on carbon in goods
 - impose on imports at same rate as for fuels
 - rebate on exports at lower rate, in proportion to leakage

Principle III

Principle III

- If foreign supply elasticity and leakage rate are low
 - tax only extraction and production
 - minimizes administrative costs

Principle III in Practice

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- Impose nominal tax on fossil-fuel extraction
 - partial border adjustments on fuels (Principle I)
 - low foreign extraction elasticity \rightarrow tax mostly supply
 - low leakage \rightarrow leave tax on goods exports (Principle II)

Principle III in Practice

- Impose nominal tax on fossil-fuel extraction
 - partial border adjustments on fuels (Principle I)
 - low foreign extraction elasticity -> tax mostly supply
 - low leakage -> leave tax on goods exports (Principle II)
- No BAs on goods, so no sweat!
 - maintain partial BAs on fuels, but that's easy

Economic Rationale

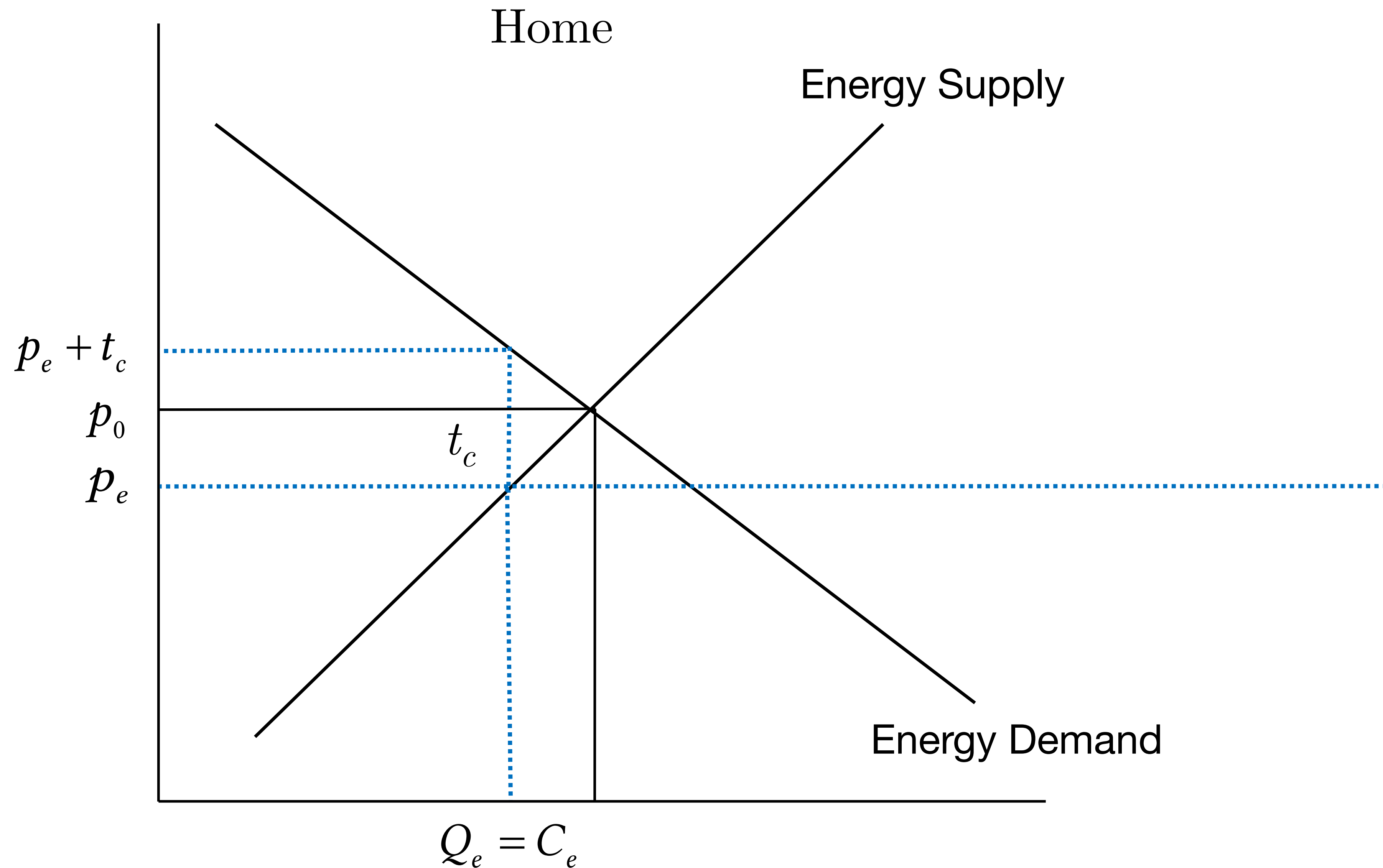
Economic Rationale

- Remainder of the presentation
 - justify and illustrate these three principles

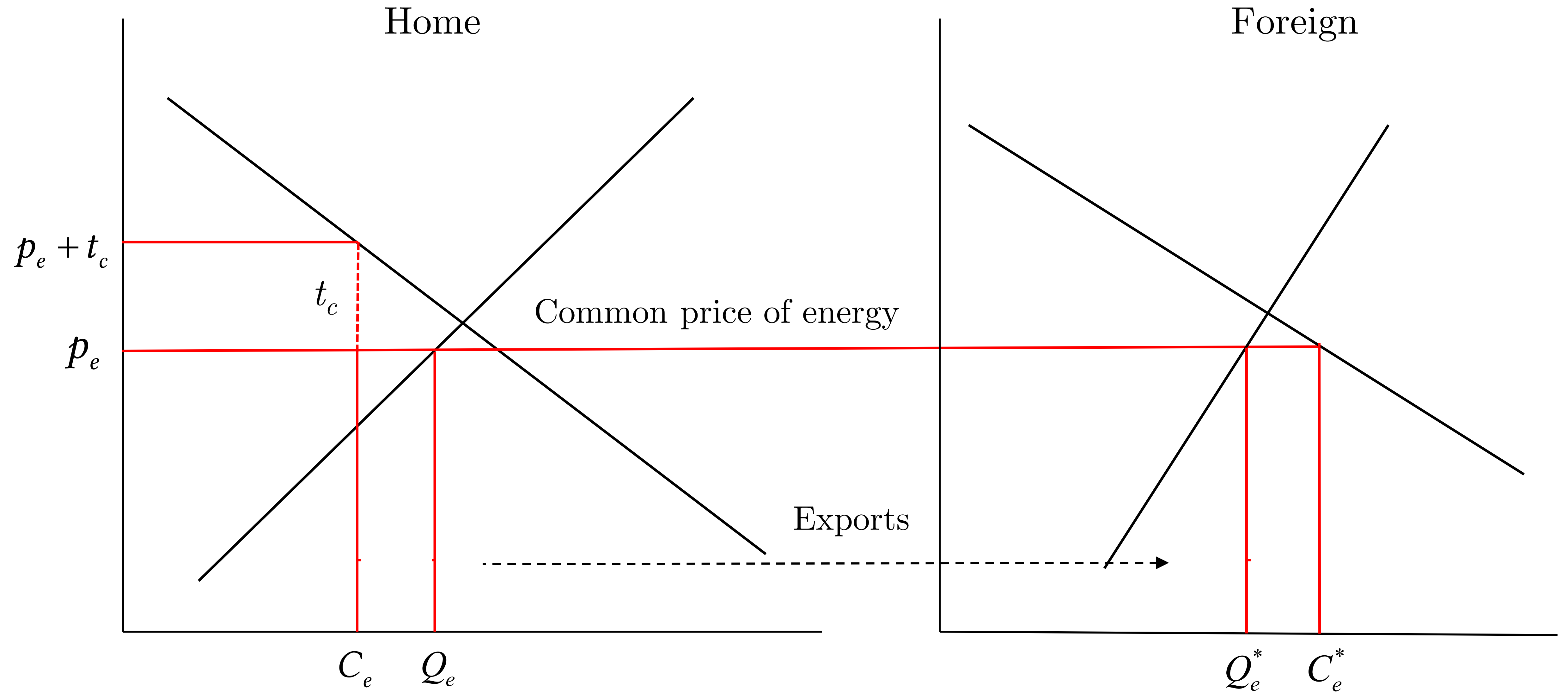
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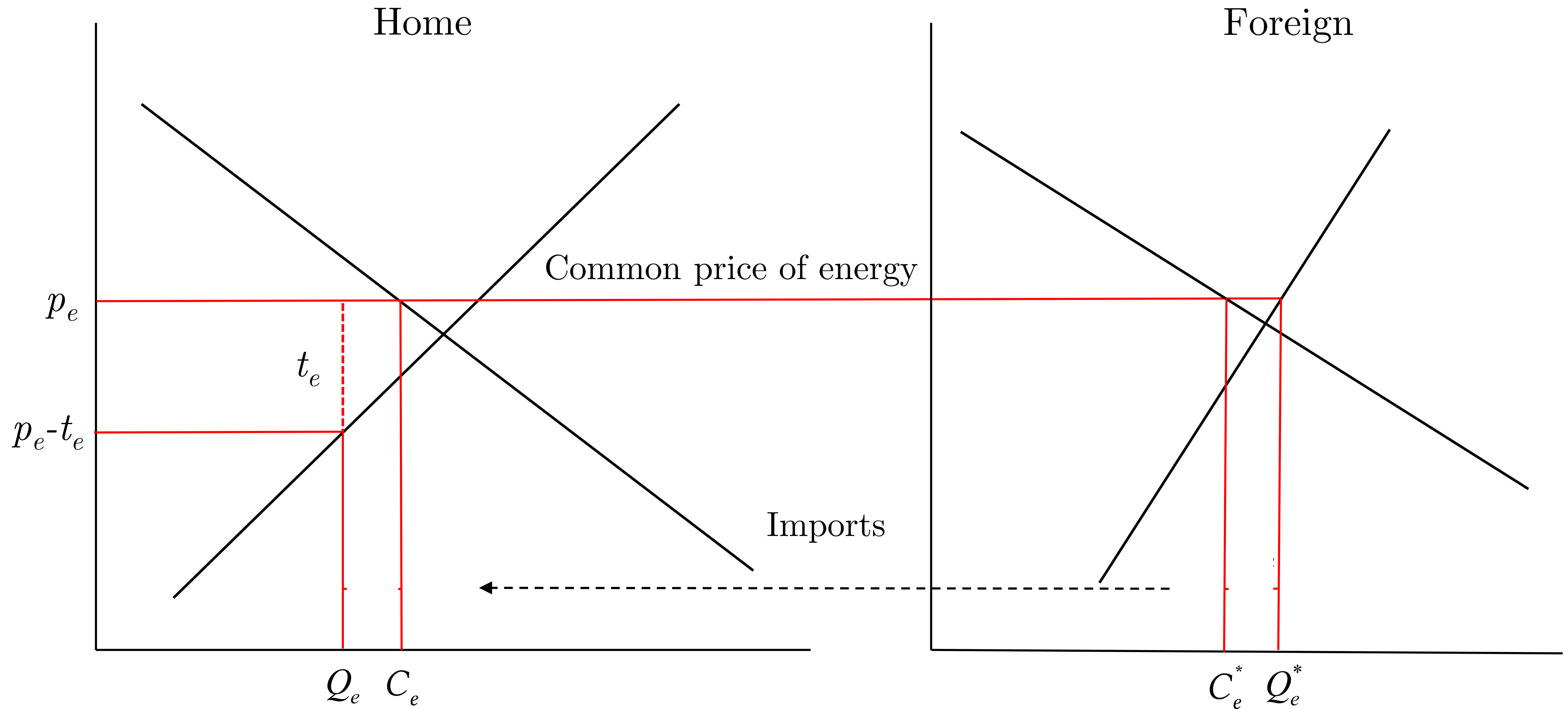
Closed-Economy Equilibrium



Trade Equilibrium: Consumption Tax



Trade Equilibrium: Extraction Tax



Optimal Policy: Equations

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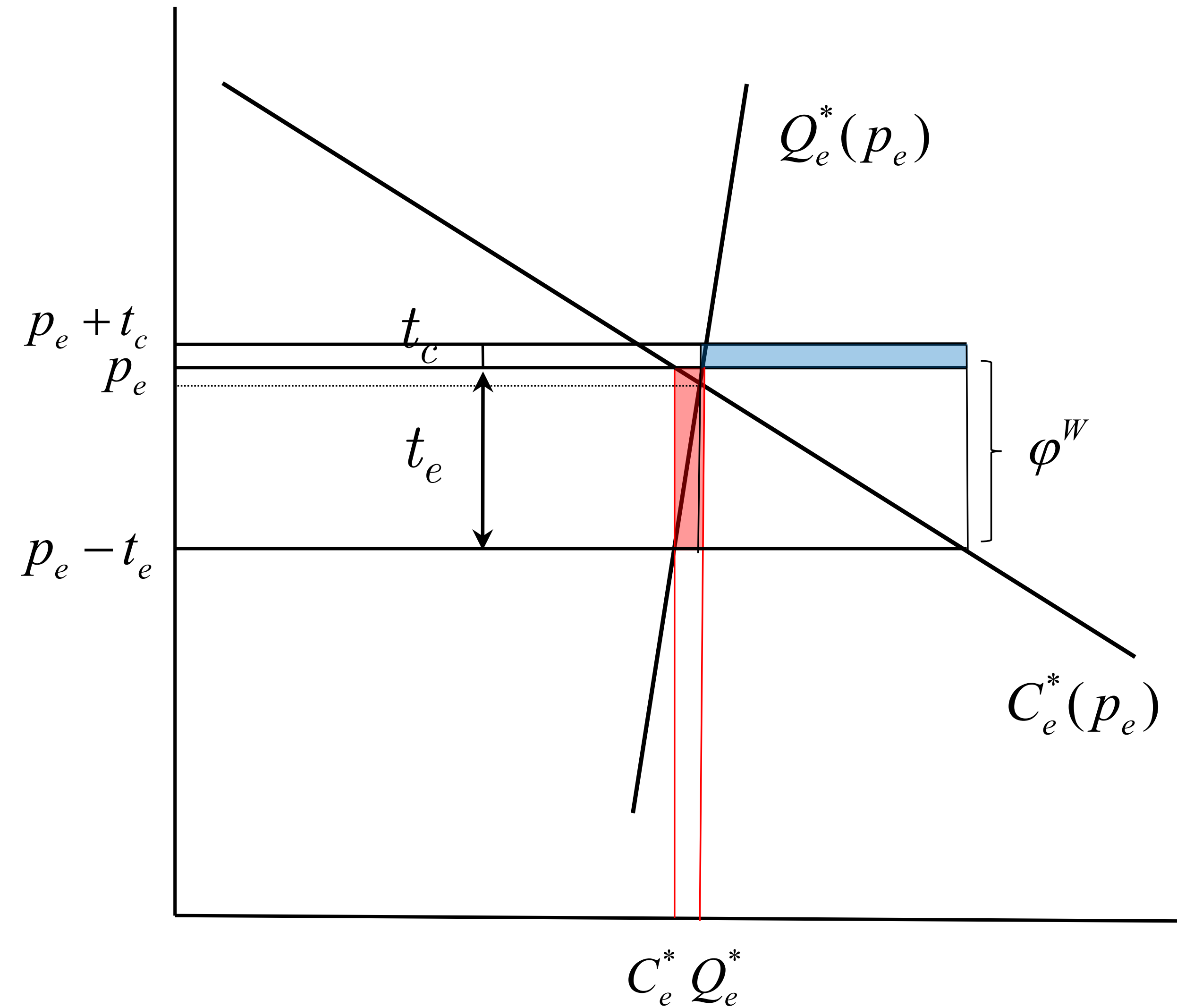
$$\frac{t_e}{t_c} = \frac{|C_e^{*'}|}{Q_e^{*'}}$$

Optimal Policy: Equations

$$\frac{t_e}{t_c} = \frac{|C_e^{*'}|}{Q_e^{*'}}$$

$$t_e + t_c = \varphi^W$$

Optimal Policy: Picture



Policy Coordination

Policy Coordination

- Foreign taxes

$$t_e^* + t_c^* = \mu^*$$

Policy Coordination

- Foreign taxes
- Optimal policy

$$t_e^* + t_c^* = \mu^*$$

$$t_e = t_e^* + (\varphi^W - \mu^*) \frac{|C_e^{*'}|}{Q_e^{*'} + |C_e^{*'}|}$$

$$t_c = t_c^* + (\varphi^W - \mu^*) \frac{Q_e^{*'}}{Q_e^{*'} + |C_e^{*'}|}$$

Principle II

- Tax carbon in goods production and consumption
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Carbon Flows: OECD and Foreign

	Home	Foreign	Total
Home	$C_e^d = 11.3$	$C_e^m = 2.5$	$C_e = 13.8$
Foreign	$C_e^x = 0.9$	$C_e^f = 17.6$	$C_e^* = 18.5$
Total	$G_e = 12.2$	$G_e^* = 20.1$	$C_e^W = 32.3$
Extraction	$Q_e = 8.6$	$Q_e^* = 23.7$	$Q_e^W = 32.3$

Taxing the Demand Side

Taxing the Demand Side

- Three places to tax demand C_e^d, C_e^m, C_e^x
- want to equalize tax on Home consumption $t_d = t_m = t_c$
- expands tax base and doesn't distort consumption

Taxing Exports

Taxing Exports

- Want to tax exports, but beware of leakage!

- optimal tax rate is $t_x = (1 - \Lambda^*)t_c$

- leakage rate

$$\Lambda^* = - \frac{\partial C_e^f / \partial t_x}{\partial C_e^x / \partial t_x} > 0$$

Principle III

Principle III

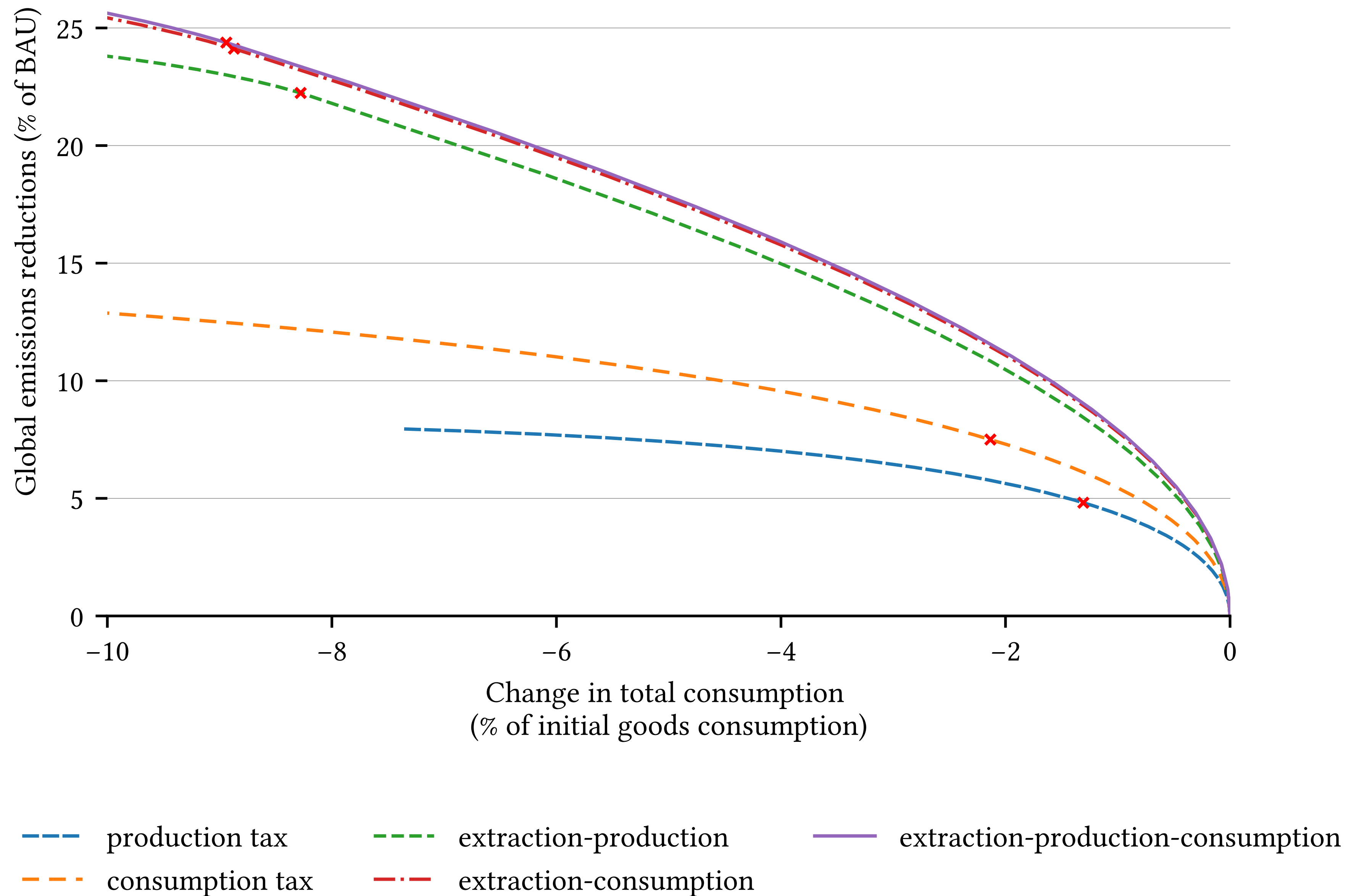
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Simulating the Model

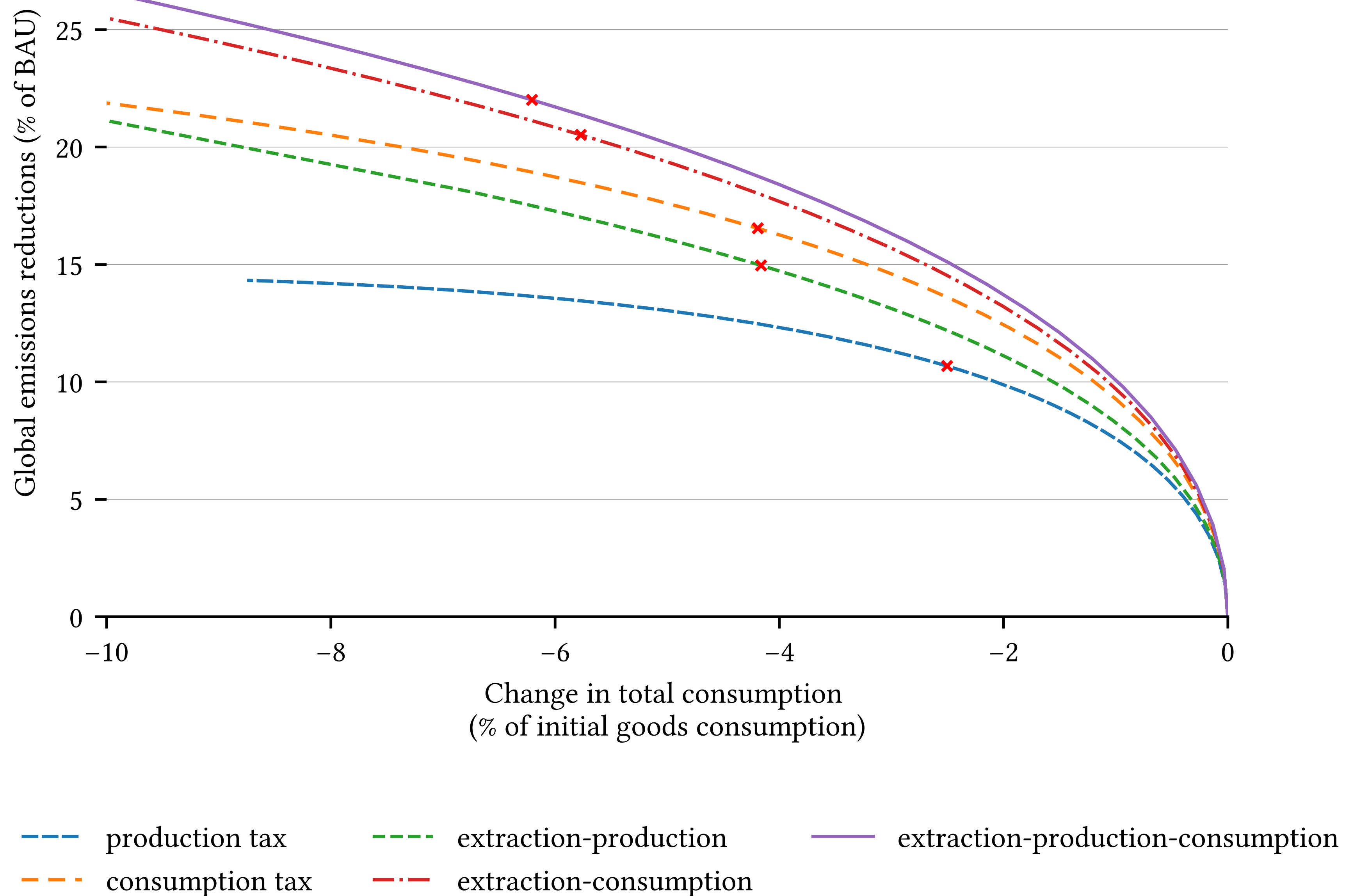
Simulating the Model

- Examine the performance of different policies
 - focus on combination of extraction and production tax

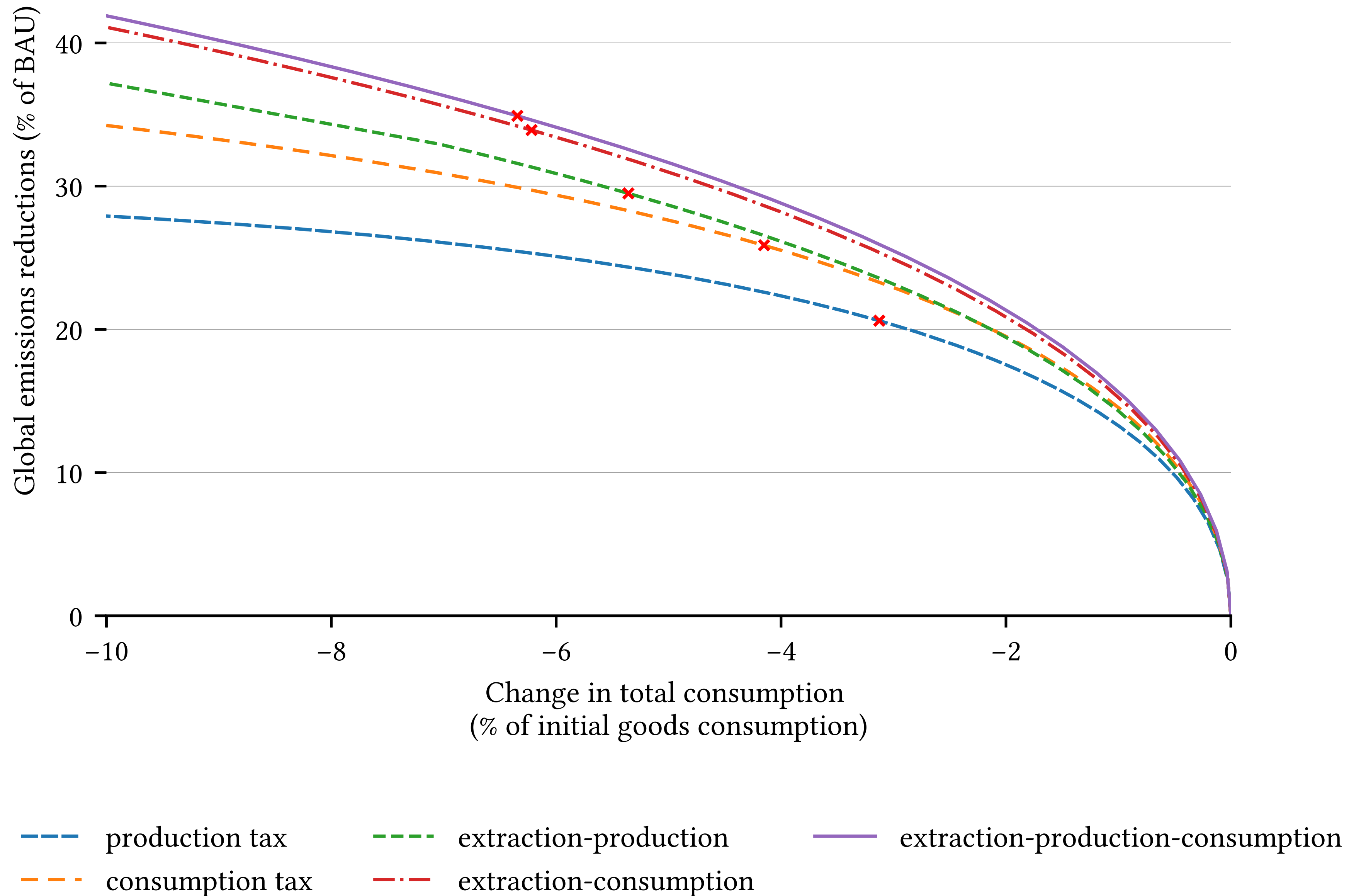
OECD: Low Foreign Supply Elasticity



OECD: High Foreign Supply Elasticity



OECD and China: High Foreign Supply Elasticity



Conclusions

- Ideas for tweaking current carbon tax proposals
 - to make them more effective or easier to administer
- Reduce BAs on fuels to leave a tax on supply
 - reduce BAs on goods exports to keep them in tax base
- Consider a simple extraction-production tax
 - partial BAs on fuels and no BAs on goods