

# The Role of Carbon Taxes in Achieving Nationally Determined Contributions

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Zurich



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# Hitting a Carbon Emissions Target

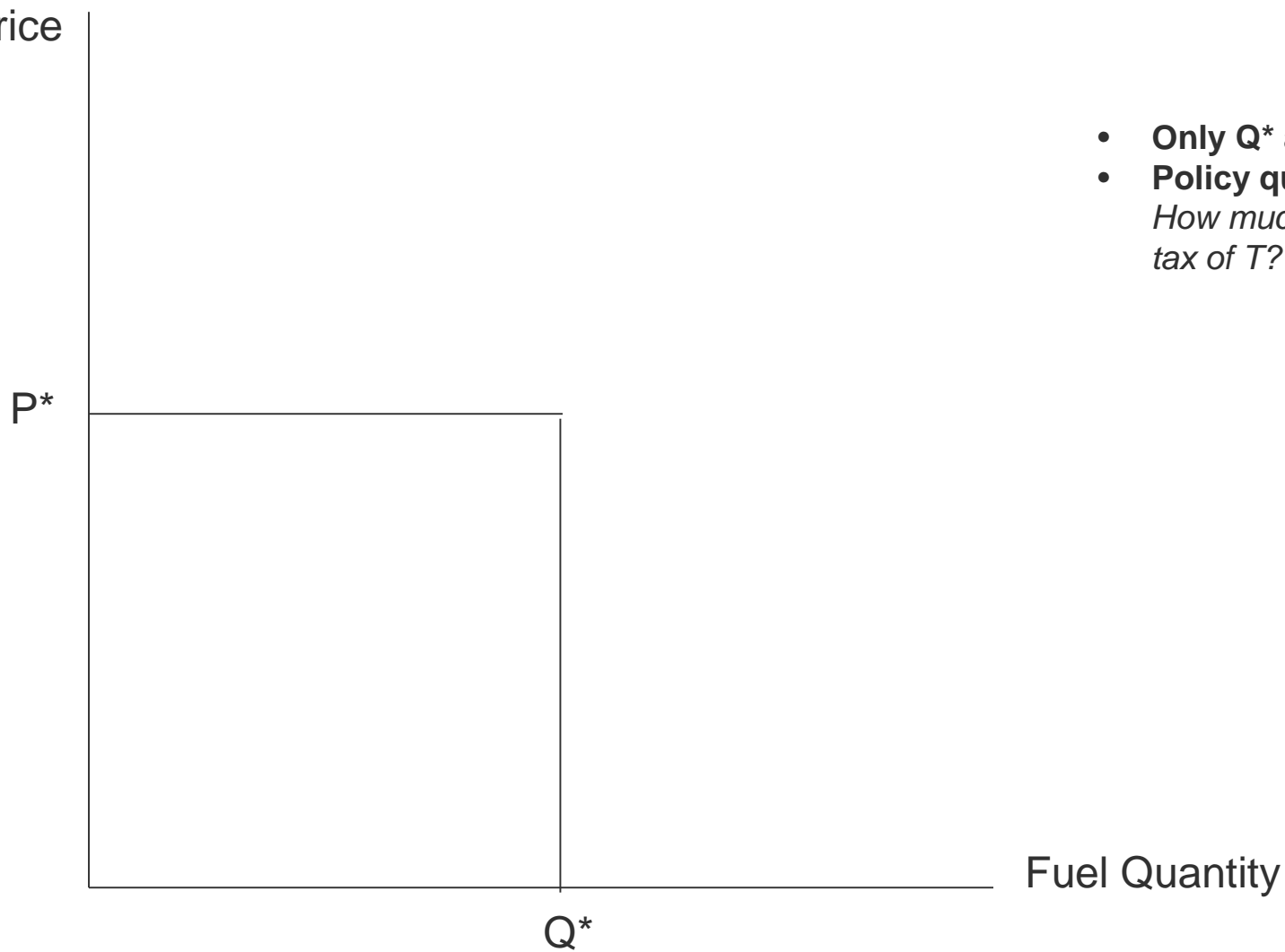
“Policy is very easy.”

-- Donald Trump



# Hitting a Carbon Emissions Target

Fuel Price

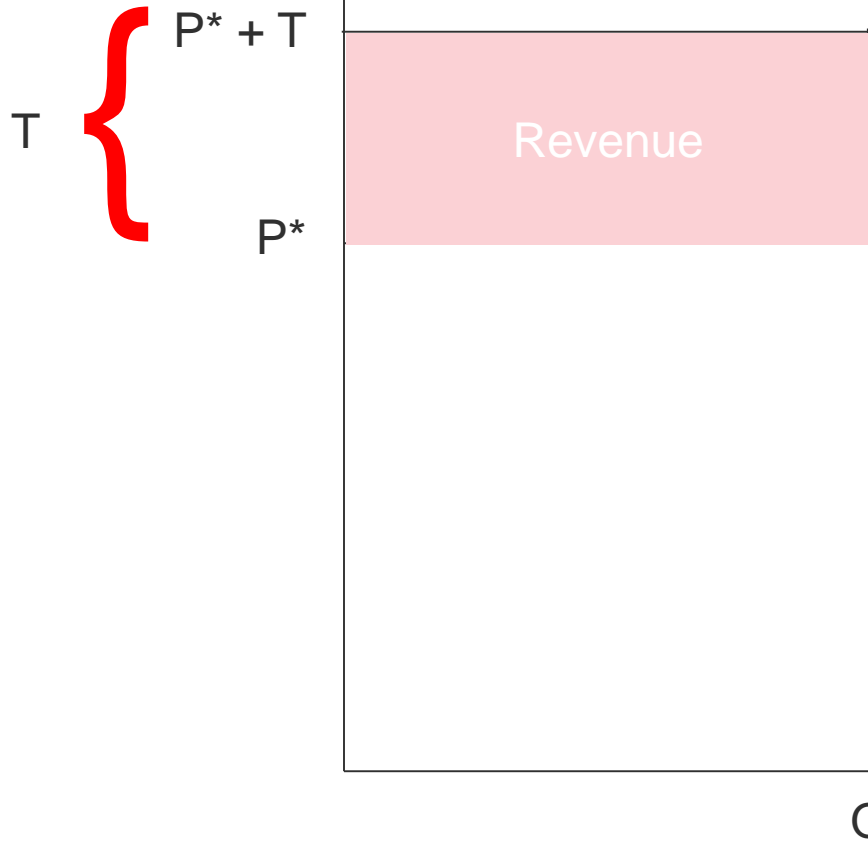


- Only  $Q^*$  and  $P^*$  are observed
- **Policy question:**  
*How much revenue from a fuel tax of  $T$ ?*



# Hitting a Carbon Emissions Target

Fuel Price

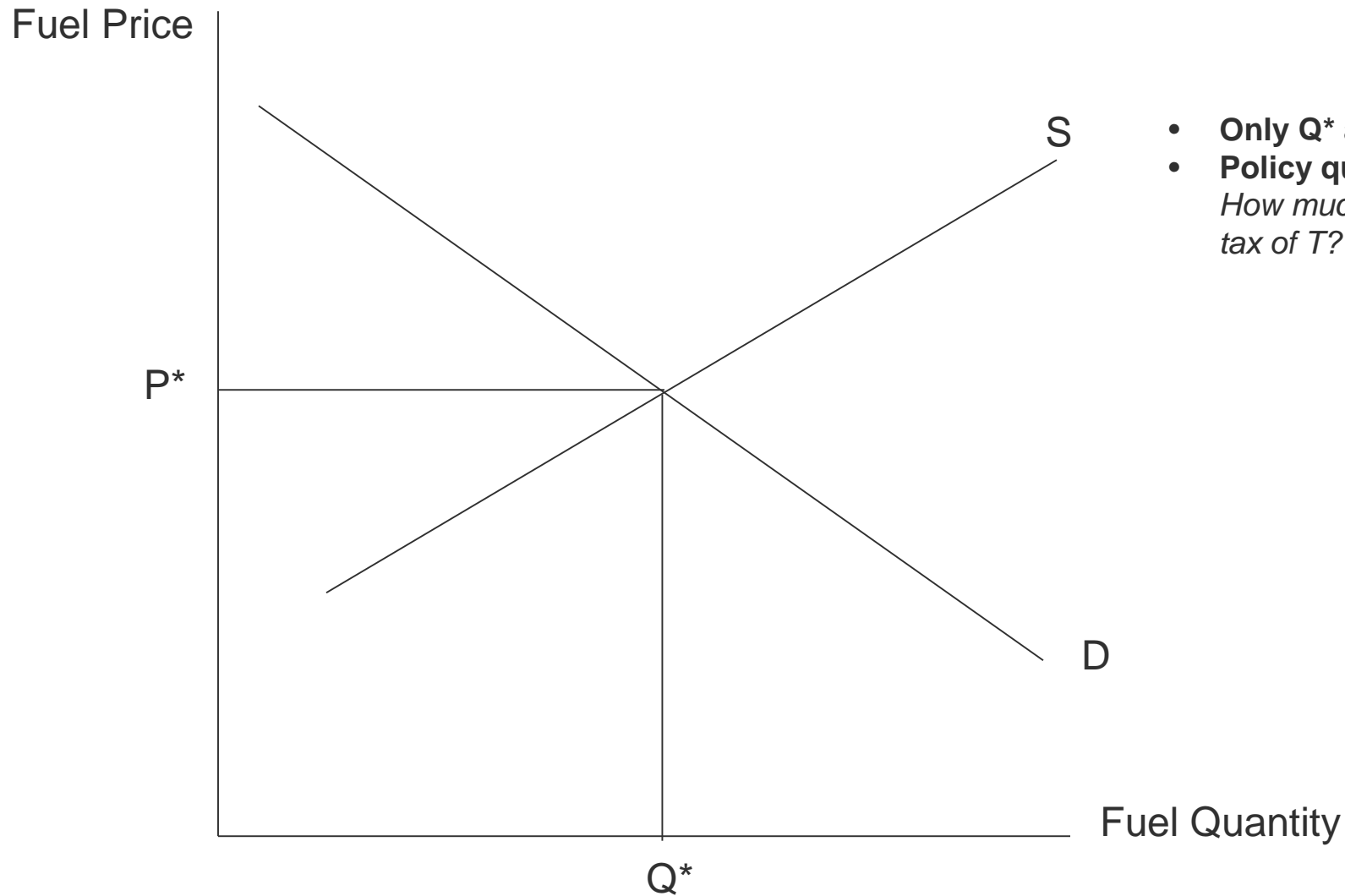


Fuel Quantity

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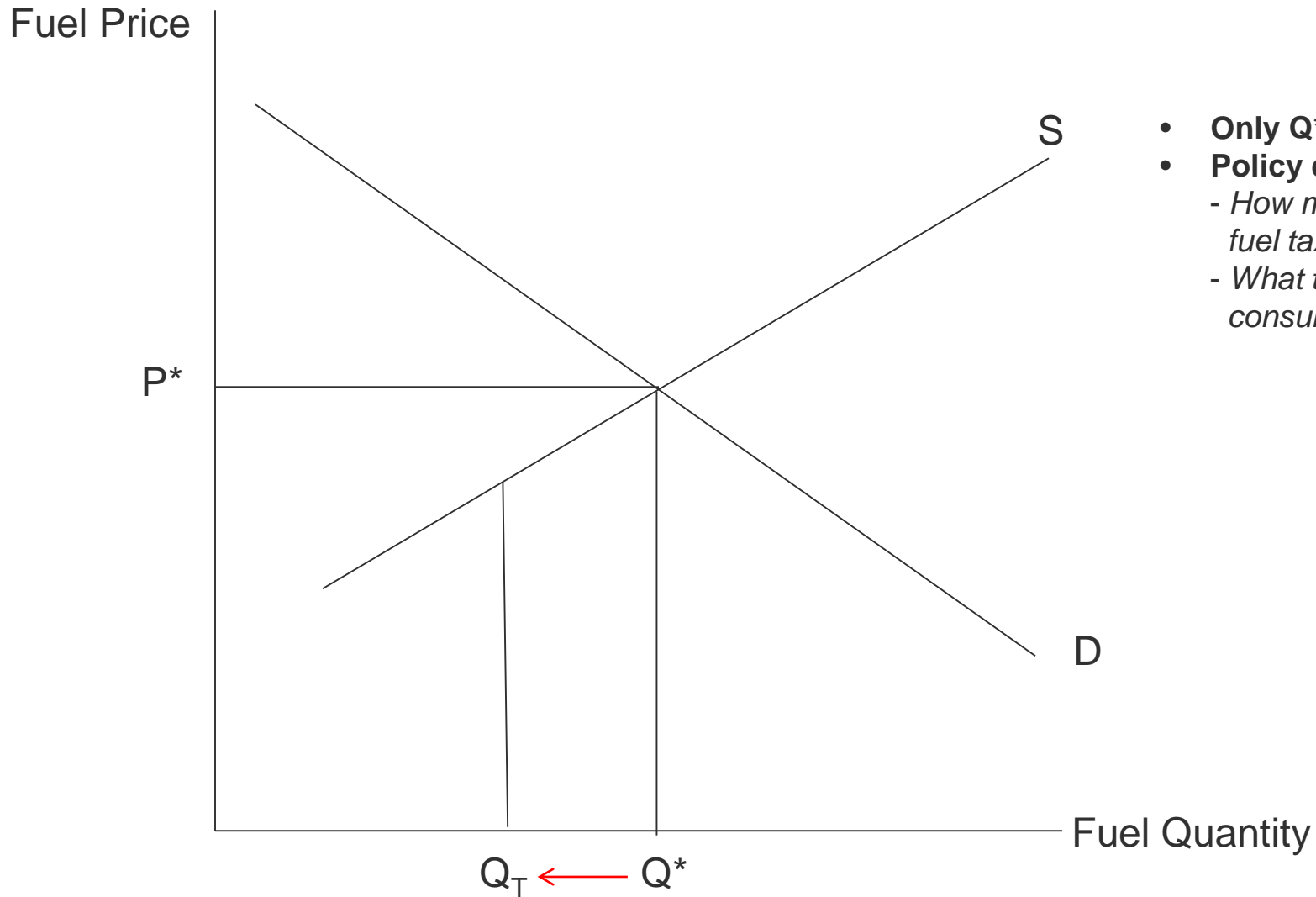
# Hitting a Carbon Emissions Target



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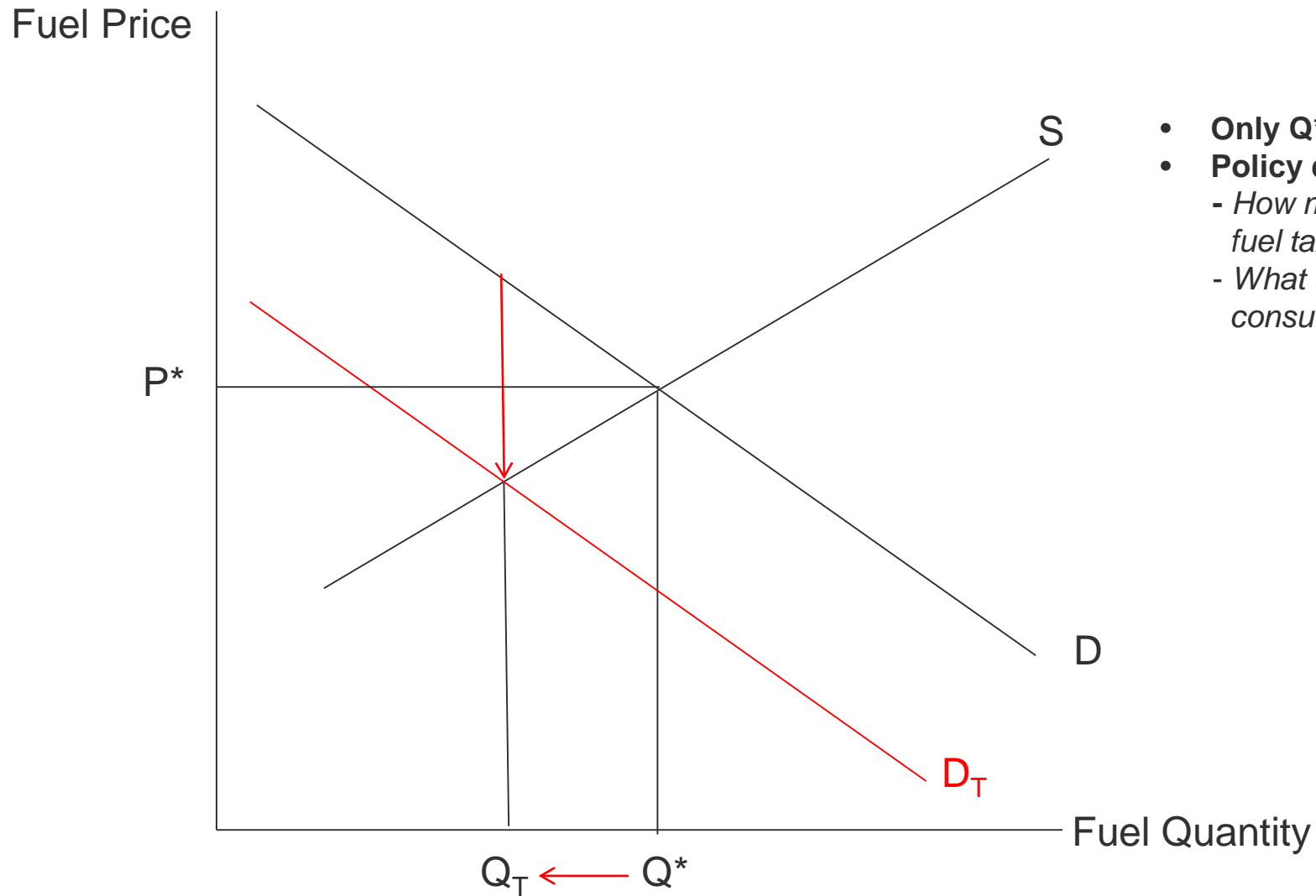
# Hitting a Carbon Emissions Target



- Only  $Q^*$  and  $P^*$  are observed
- Policy questions:
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  - What tax,  $T$ , will reduce fuel consumption to  $Q_T$ ?

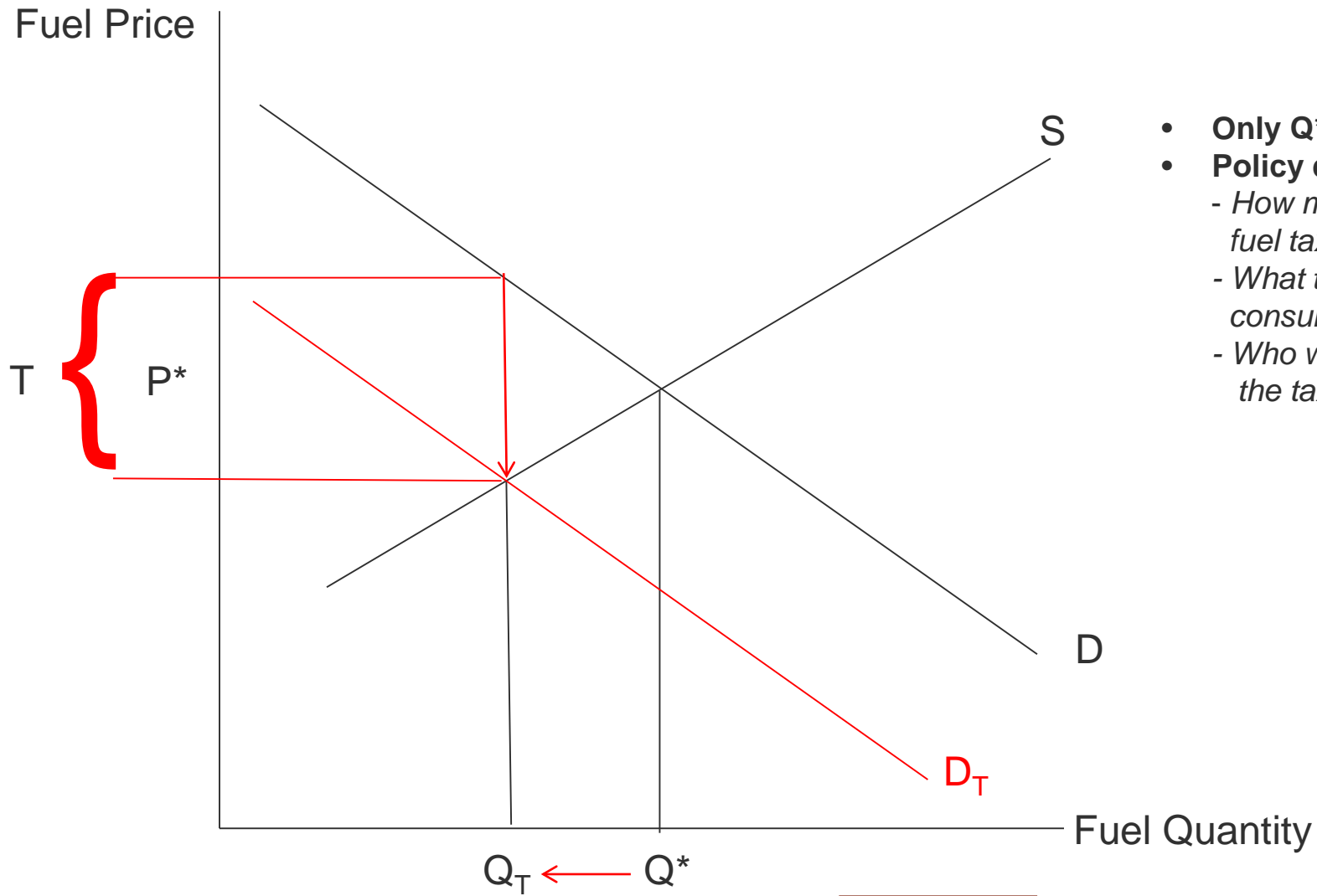


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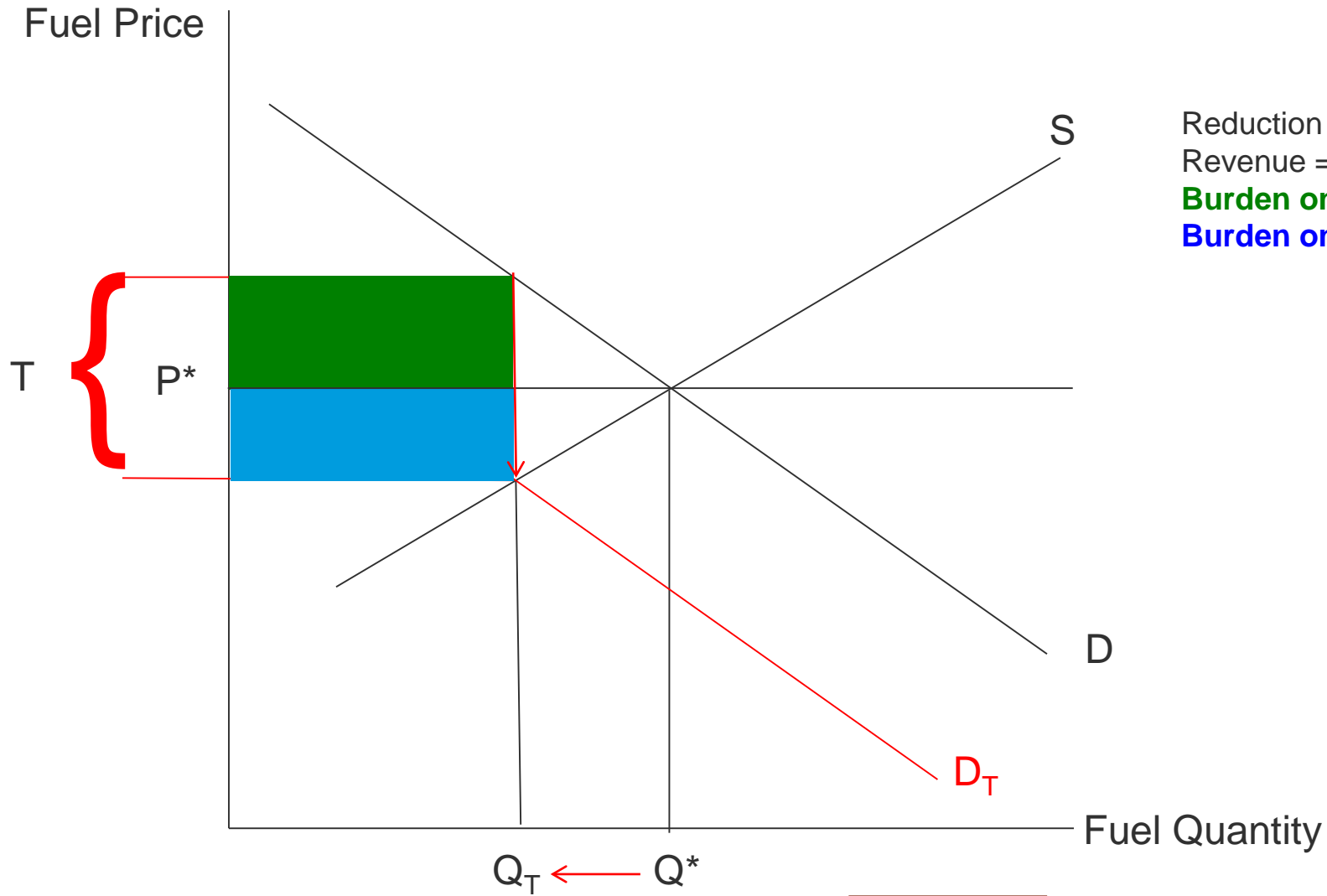


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- Policy questions:
  - How much revenue from a fuel tax of  $T$ ?
  - What tax will reduce fuel consumption to  $Q_T$ ?
  - Who will bear the burden of the tax?





# Hitting a Carbon Emissions Target



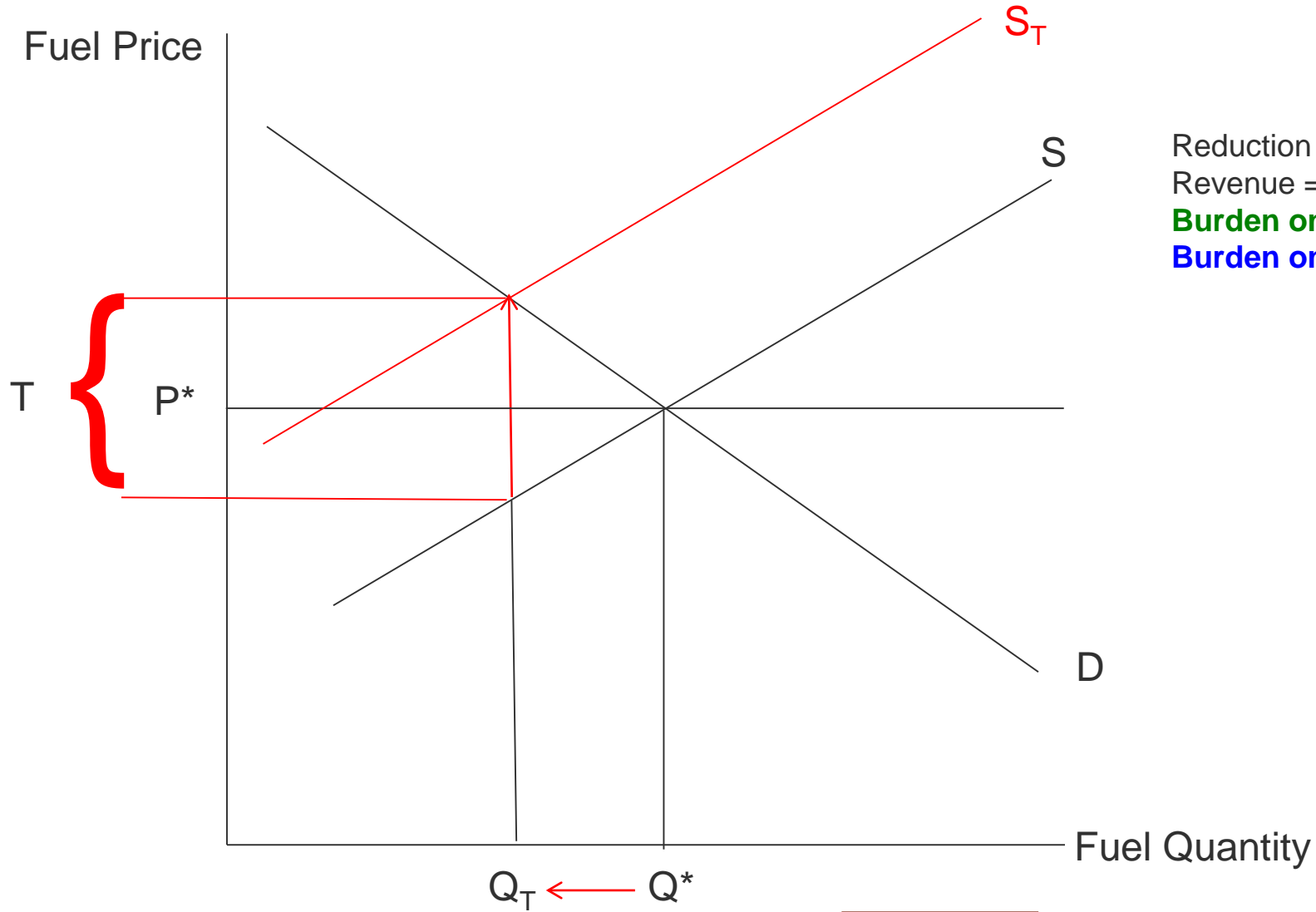
Reduction in Fuel Use =  $Q^* - Q_T$   
Revenue =  $T * Q_T$

**Burden on Consumers**

**Burden on Producers**



# Hitting a Carbon Emissions Target



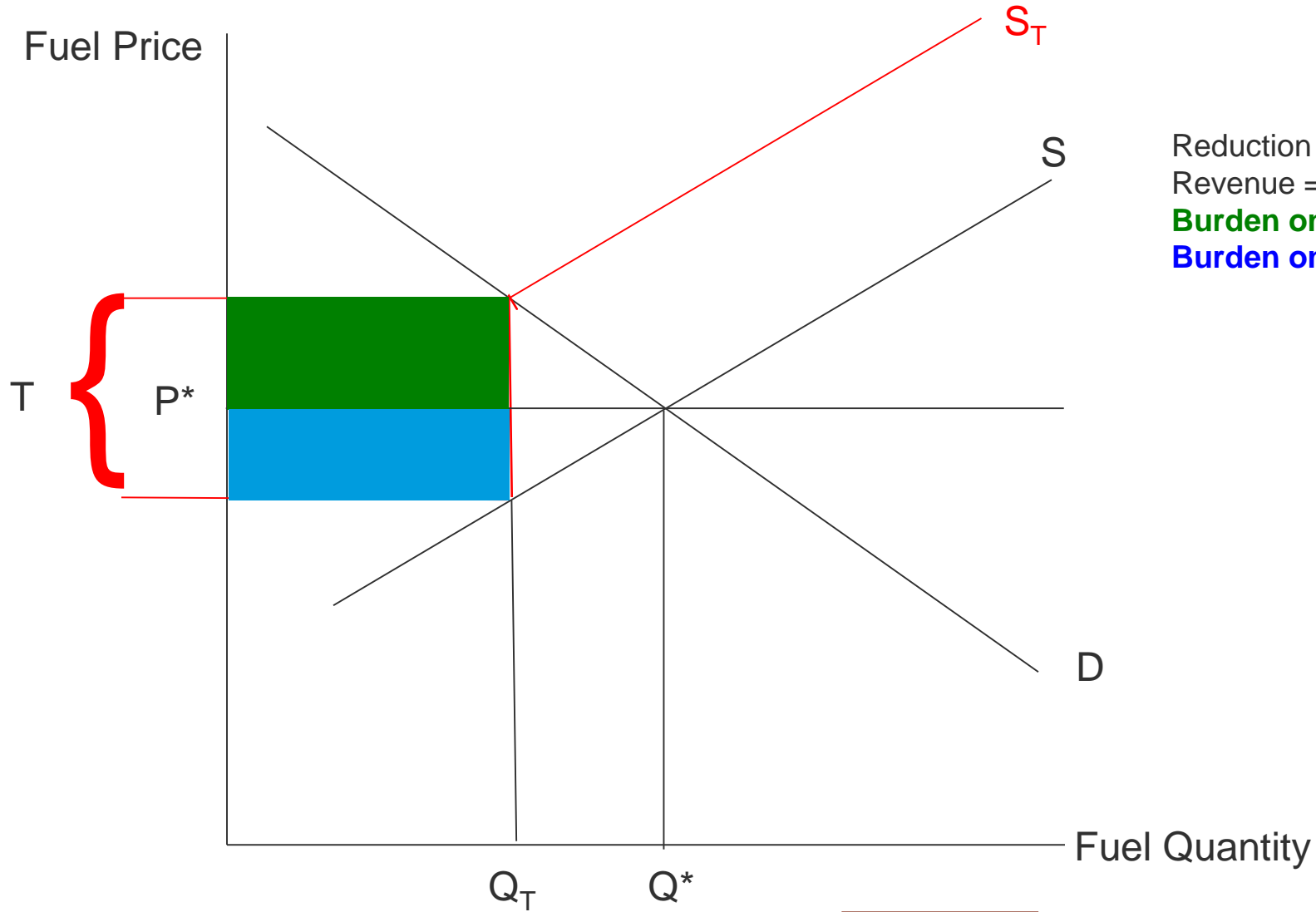
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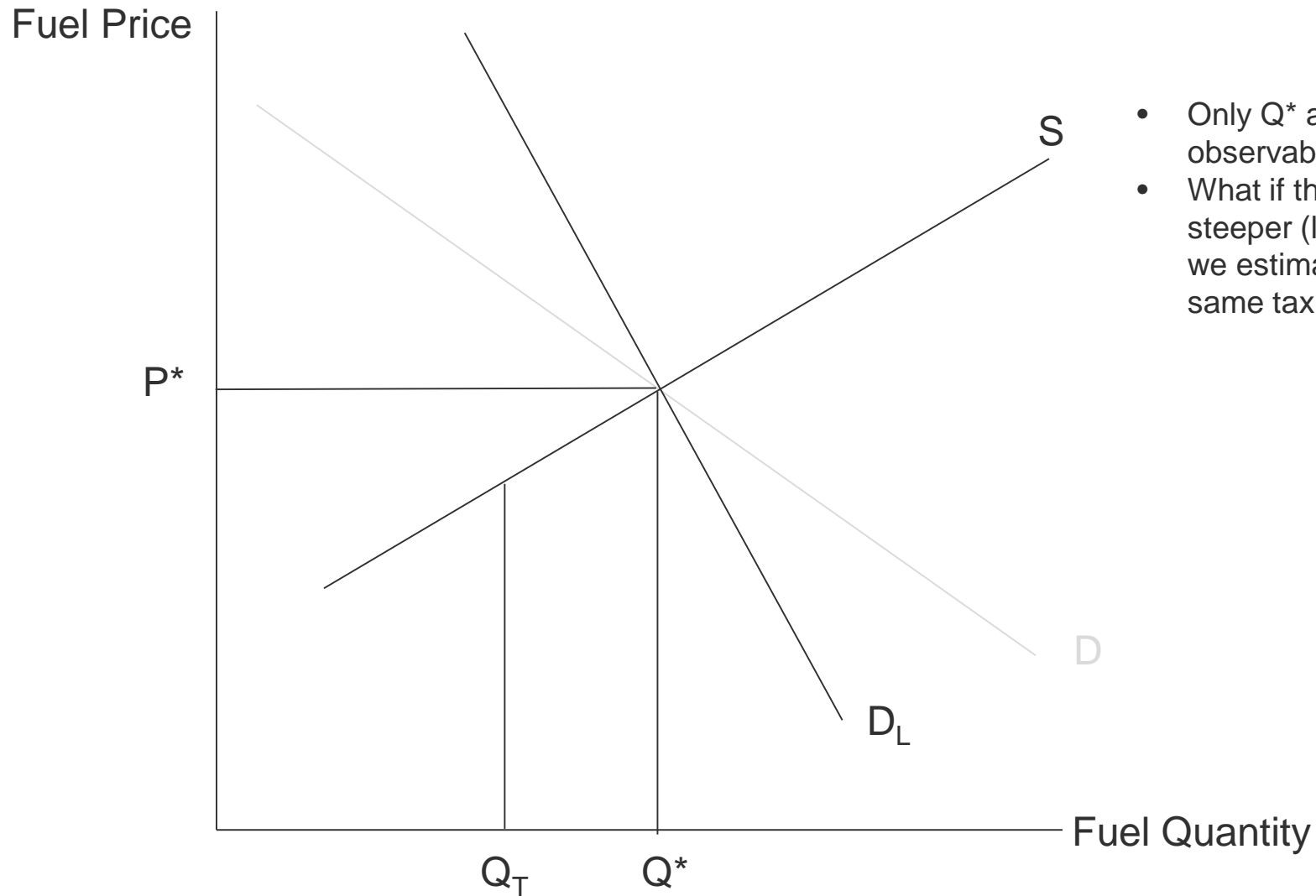
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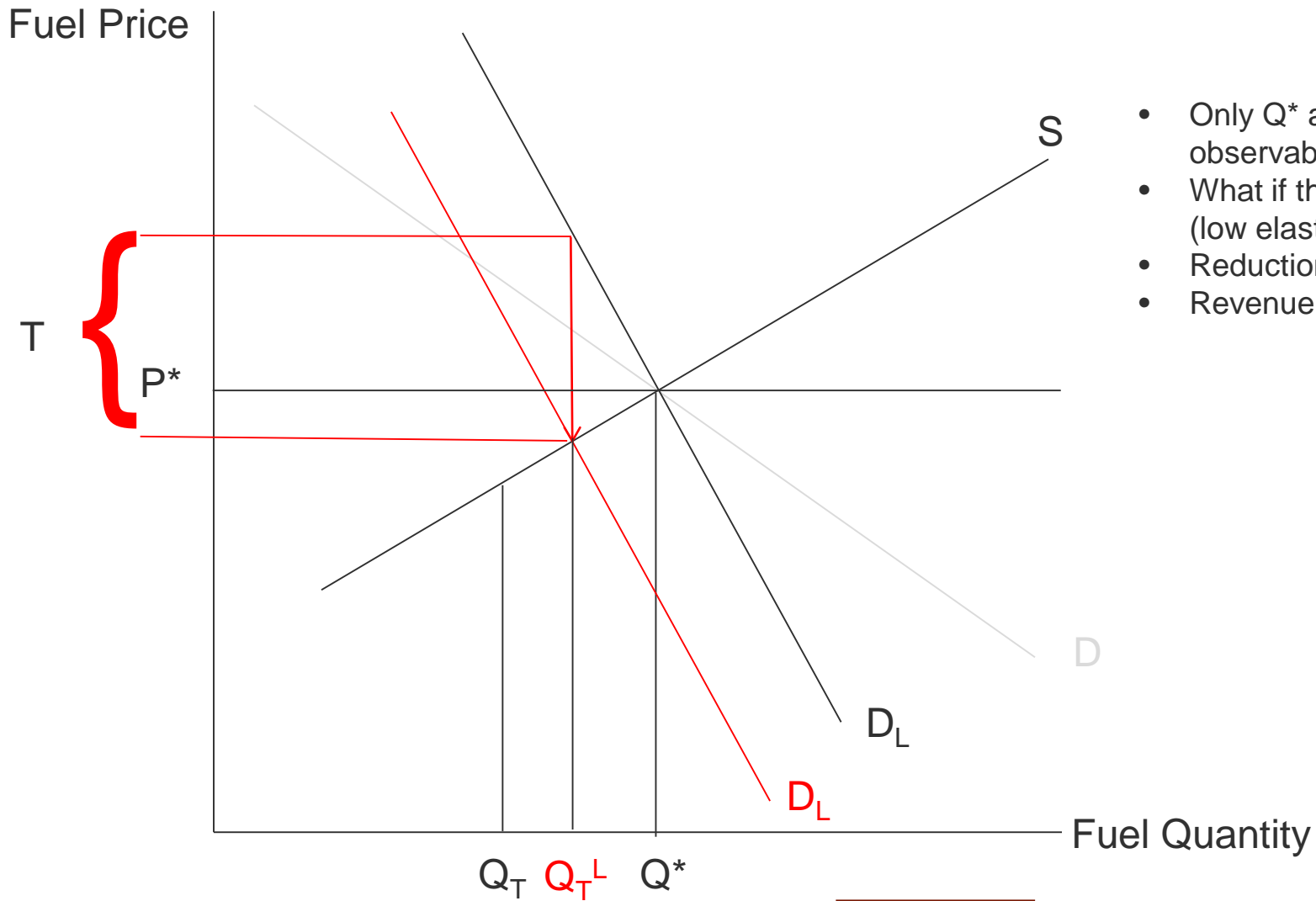
# Hitting a Carbon Emissions Target



- Only  $Q^*$  and  $P^*$  are directly observable. Not the slope of  $D$ .
- What if the slope is much steeper (lower elasticity) than we estimate, but we use the same tax,  $T$ ?

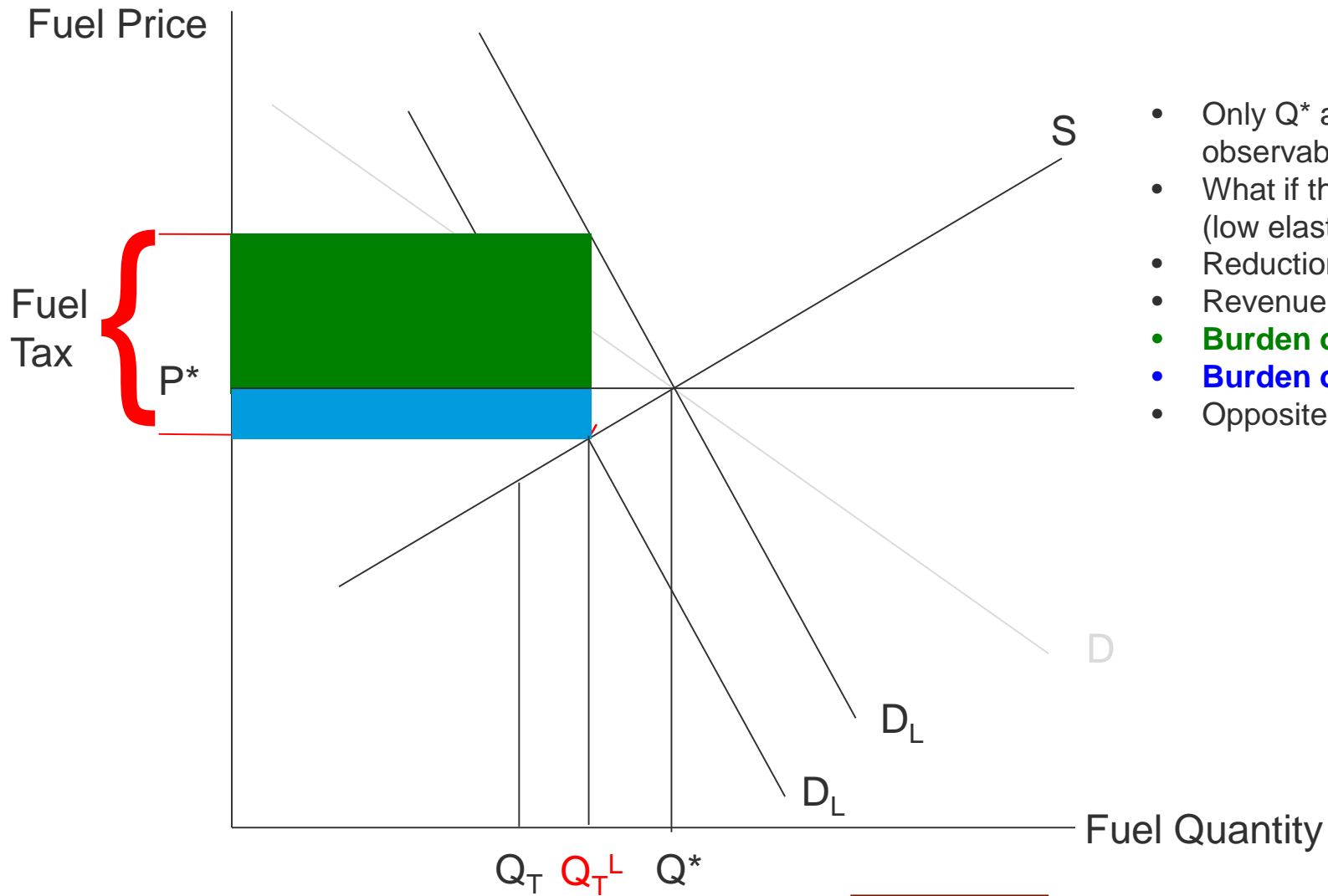


# Hitting a Carbon Emissions Target



- Only  $Q^*$  and  $P^*$  are directly observable. Not the slope of  $D$ .
- What if the slope is much steeper (low elasticity)?
- Reduction in Fuel Use =  $Q^* - Q_T^L$
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# Hitting a Carbon Emissions Target



- Only  $Q^*$  and  $P^*$  are directly observable. Not the slope of  $D$ .
- What if the slope is much steeper (low elasticity)?
- Reduction in Fuel Use =  $Q^* - Q_T^L$
- Revenue =  $T * Q_T^L$
- **Burden on Consumers**
- **Burden on Producers**
- Opposite result for high elasticity



# Hitting a Carbon Emissions Target: Why it is Difficult?

- Uncertain price elasticity of demand
- Uncertain price elasticity of supply
- Uncertain cross price elasticities
- Interaction with new and existing carbon policies
- Adjustment in world fuel prices
- Economic growth
- Technological advances (demand curve shifts in and supply curve shifts down)
- Feedback in economy (e.g., higher energy price => lower consumption of automobiles => higher consumption of ...?)
- Uncertain affect of revenue neutral use of tax (e.g., is energy a complement or substitute for labor?)
- Non-fossil GHG emissions can have more ambiguous market responses
- Taxes are often phased in



# Hitting a Carbon Emissions Target: Approaches to Setting the Tax

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- Benchmarking against peer countries
- Use elasticity of demand for each fuel
- Top-down models
  - General equilibrium models (GEM)
  - Econometric models
  - Input-output models
- Bottom up models
  - Cost curves
  - Engineering system models – e.g., TIMES – MARKAL
- Hybrid models





# Hitting a Carbon Emissions Target: Approaches to Setting the Tax

Bottom line:

- All modeling approaches provide insight and estimates of outcomes
- All involve modeling tradeoffs between detail and cost
- All involve modeling tradeoffs between economic and technological insight
- All of these models are uncertain
- It is unlikely that a tax will hit a particular target even if fully informed through detailed modeling
- Moreover, politics often trumps modeling



# Hitting a Carbon Emissions Target: Plan for Adjustments

- Legislature reviews performance and adjusts tax
- Legislature delegates authority to adjust tax to an agency or independent commission
- Develop *ex ante* formula for adjustments of tax in response to performance
- Phase in tax to give time for assessment and adjustment



# Hitting a Carbon Emissions Target: Questions for the Pioneers

- **How did your country derive its tax rate?**
  - How much modeling did you do?
  - Did your country examine tax rates of other countries?
  - What role did politics play relative to analysis?
- **What provisions does your country have for adjustments to the tax rate?**

