The Role of Carbon Taxes in Achieving Nationally Determined Contributions

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Zurich
Hitting a Carbon Emissions Target

“Policy is very easy.”

-- Donald Trump
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Fuel Price

Q*

P*

Fuel Quantity

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

\[ Q^* \]

Fuel Price

\[ P^* + T \]

Revenue

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

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Climate Focus
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Fuel Price

P*

Q*

Fuel Quantity

Only Q* and P* are observed
Policy question:
How much revenue from a fuel tax of T?
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• Only $Q^*$ and $P^*$ are observed
• Policy questions:
  - How much revenue from a fuel tax of $T$?
  - What tax, $T$, will reduce fuel consumption to $Q_T$?

![Graph showing fuel price vs. fuel quantity with points $Q^*$ and $Q_T$.](image-url)
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Fuel Price

Fuel Quantity

S

D

DT

- Only Q* and P* are observed
- Policy questions:
  - How much revenue from a fuel tax of T?
  - What tax will reduce fuel consumption to QT?
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- Only \( Q^* \) and \( P^* \) are observed
- 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?
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Fuel Quantity

Fuel Price

Reduction in Fuel Use = \( Q^* - Q_T \)
Revenue = \( T \times Q_T \)

Burden on Consumers
Burden on Producers

\( Q_T \rightarrow Q^* \)

\( S \)
\( D \)
\( D_T \)
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Fuel Quantity

Fuel Price

Reduction in Fuel Use = Q* - QT
Revenue = T * QT
Burden on Consumers
Burden on Producers

S
S_T

D

Q_T

Q*

T

P*
Hitting a Carbon Emissions Target

Fuel Price

Fuel Quantity

Reduction in Fuel Use = \( Q^* - Q_T \)
Revenue = \( T \times Q_T \)

Burden on Consumers
Burden on Producers

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Fuel Price

P*  

Fuel Quantity

Q_T  Q*

S

D

D_L

• 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?
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Fuel Price

Fuel Quantity

- 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 = $T \times Q_{T_L}$
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Fuel Price

Fuel Quantity

• 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

- 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?**