DYNAMIC MODELING
AND BORDER EFFECTS

Regional Economic Models, Inc.
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Session Agenda

REMI Backdrop

REMI Methodology

Residence Adjustment

Model Software

Pollution Taxes

what does REMI say? sm
About Us

Research and Data
• Services related to regional modeling, forecasting, and economic impacts
• Began as an offshoot of the University of Massachusetts-Amherst in the 1970s and 1980s and still is an ongoing research project

Customized Software
• Full service, “off-the-shelf,” Windows-based software and websites for economic and demographic research at the regional-level
• Model regions and capabilities customized to the users’ specific requirements

Services and Support
• Unlimited training and technical support for all software and website users from a dedicated team of economists and software technicians
• Issue-oriented policy research, consulting reports, and expert testimony

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Regional Customizations

- How REMI defines model regions:
  - A county (or equivalent statistical unit) or...
  - A collection of counties
    - e.g. an MSA or a state
    - Can cross state borders
  - Multiple regions
    - No requirement for contiguousness
  - Customized by needs
Four Methodologies

Input-Output (IO) Tabulation
• Industry-to-industry transactions and social accounting matrices (SAM)
• Supply-chains, regional purchase concepts (RPCs), and multipliers

Computable General Equilibrium (CGE)
• Long-term effects after markets “clear” back to a new equilibrium
• Dynamic adjustments to population, market shares, fuel mixtures, etc.

New Economic Geography
• Endogenous productivity adjustments from industry/labor clustering
• Full trade-flows by industry and interregional competitiveness

Econometrics
• Estimation of statistical parameters from observable data
• Strength of responses, elasticities, preferences, and “time-lags”
Dynamic Scoring

[Diagram showing the process of Dynamic Scoring, including Tax Policy Changes, Dynamic Economic Impacts, Fiscal and Economic Impact Results, Revenue Impacts, Expenditure Requirement Impacts, and Dynamic Feedback.]
what does REMI say?
Motivating Factors

- Previous methodology uses the Journey-to-Work (JTW) data on commuting from the U.S. Census
  - Historical with periodic updates
  - Relied on “fixed-shares” — no internal adjustments to changing consumer prices or transportation costs
  - Tended to overestimate “downtown” growth and underestimate aggregate housing supply
- New methodology makes commuting shares adjust endogenously to economic conditions
  - More accurate reflection of location decisions
  - Allows for novel simulations on transportation and taxes
Commuting Equation

\[ rS_{t}^{k,l} = \frac{LF_{t}^{l}*(P_{t}^{l})^{(1-\sigma)}*(D_{k,l})^{-\beta}}{\sum_{k \neq l}^{n} LF_{t}^{l}*(P_{t}^{l})^{(1-\sigma)}*(D_{j,k})^{-\beta}} \] (4)

- \( rS_{t}^{k,l} \) is the share of commuters who live in region \( l \) and work in region \( k \) in time period \( t \).
- \( LF_{t}^{l} \) is labor force in region \( l \) in time period \( t \).
- \( P_{t}^{l} \) is the consumer price index including housing price in region \( l \) in time period \( t \).
- \( D_{k,l} \) is the commute distance from region \( l \) to region \( k \).
- \( \sigma \) is Sigma value, the estimated parameter for consumer price.
- \( \beta \) is Beta value, the estimated parameter for distance decay.
Commuter Volumes

\[ C_{t}^{l,k} = C I_{t}^{k,l} \times \frac{(EMPT_{t}^{k} - EMP_{t}^{nFM,k})}{(COMPT_{t}^{k} - COMP_{t}^{nFM,k} - TWPER_{t}^{k} - EGSI_{t}^{k})} \]  \hspace{1cm} (7)

Where

- \( C_{t}^{l,k} \) = the commuters who live in region \( l \) and work in region \( k \) in time period \( t \).
- \( EMPT_{t}^{k} \) = total number of jobs in region \( k \) in time period \( t \).
- \( EMP_{t}^{nFM,k} \) = number of military jobs in region \( k \) in time period \( t \).
MA Carbon Tax

- Linking two models
- Three scenarios
  - $5/ton initial rate
  - Increased $10/year
  - Peaks at either:
    - $15/ton, $30/ton, or $45/ton
- How does this impact the economy and emissions?

**REMI PI⁺ Model**
- Regional economic impacts
- Jobs, GDP, cost of living
- Broad applications

**CTAM Model**
- Projected tax revenues
- Changes in energy prices
- Specific application
Employment by Industry
(average year under $30/ton carbon tax)

- Health Care and Social Assistance
- Construction
- Accommodation and Food Services
- Professional, Scientific, and Technical Services
- Other Services, except Public Administration
- Administrative and Waste Management Services
- Educational Services
- Finance and Insurance
- Manufacturing
- Arts, Entertainment, and Recreation
- Real Estate and Rental and Leasing
- Retail Trade
- Wholesale Trade
- Information
- Transportation and Warehousing
- Management of Companies and Enterprises
- Forestry, Fishing, and Related Activities
- Mining
- Utilities

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Carbon Emissions

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