RESILIENCY & DEMONSTRATING THE VALUE OF INFRASTRUCTURE INVESTMENTS

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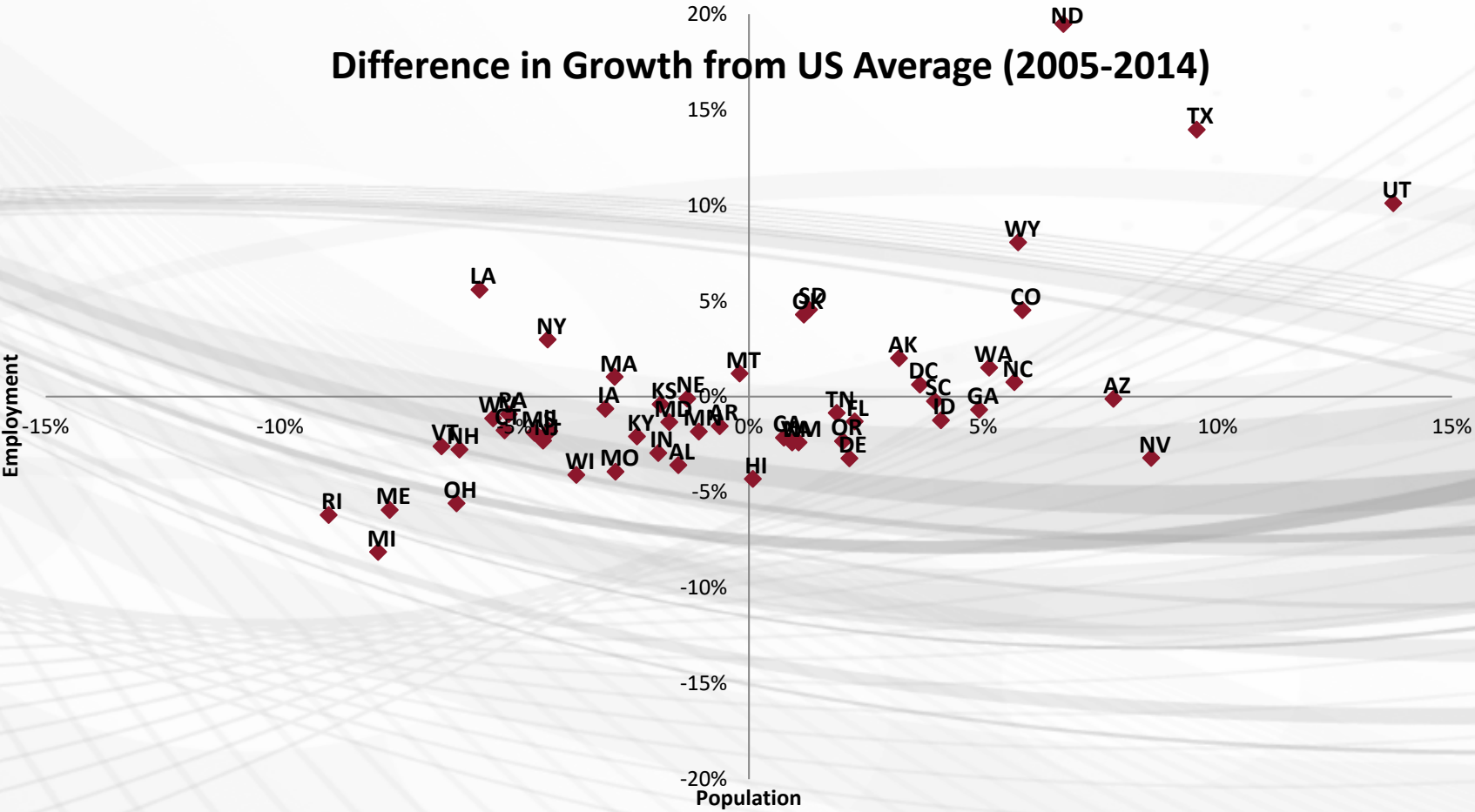**Presented by Frederick Treyz, *REMI***

Defining Resilience

□ Resilience: The ability to recover from or adjust quickly to a change in circumstances

  ◘ Examples Include:

    ■ Natural disasters (flood, wildfire, earthquake)

    ■ Infrastructure failures (power outage, bridge collapse)

    ■ Recessions/Industry shifts (loss of manufacturing/oil jobs)

Resiliency Prioritization

- I-35W Bridge collapse in Minnesota in 2007
  - Senator Amy Klobuchar spoke about bridge in presidential announcement

- Focus on resiliency in California budget
  - – The May Revision also continues to bolster the state's fiscal resilience by building up reserves and paying down state debts and liabilities.

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Source: Office of Governor Gavin Newsom

Resilience and the REMI Regional Growth Matrix

Difference in Growth from US Average (2005-2014)

I-35W Bridge Collapse

- Collapse caused $17 million reduction in state's economic output in 2007 and $43 million reduction in 2008

- $247,000 daily loss of auto travel time through longer commutes

- Typical, slower process of rebuilding bridge would mean continued reduction in output and loss of travel time

Photo: Jim Mone/AP

Source: Minnesota Department of Employment and Economic Development

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REMI's Involvement in Bridge Analysis

- Through REMI analysis with the Transight and PI+ models, it was found that an expedited process in rebuilding the bridge would improve the economic implications of the collapse

- Based off analysis, policy makers opted for the expedited reconstruction and the bridge was rebuilt in 14 months

Photo: SRF Consulting Group

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Transportation & Economic Development

Construction O&M → **Employment Opportunities**

Labor Accessibility → **Commuting; Labor productivity**

Intermediates Accessibility → **Materials to factories**

Final Goods Accessibility → **Goods and services to consumers**

Resiliency in Transportation

- Improved Transportation Systems Impact:
  - Employment and Output
  - Regional Competitiveness
  - Socioeconomic factors like safety and emissions
  - Insurance against future disruption and ability to recover from shocks

State and Local Transportation Investments

- Federal government has not raised its gas tax since 1993
- By comparison, 28 states and the District of Columbia passed legislation since 2013 designed to bolster states gas tax revenue
- Voters in Broward County, Florida approved a "penny tax" that raises the county's sales tax to pay for transportation investments
- Voters in Hillsborough County approved penny sales tax, to pay for transportation investments

Source: National Conference of State Legislatures, South Florida Business Journal

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Resiliency in Environmental

□ Wildfires in Florida have devastating effects on economy

□ Mitigation & Resiliency planning necessary to ensure stability

□ REMI Model allows for planning

□ Other 21st century concerns:

　◼ Climate Change & Sea Level Rise

Central Florida Regional Wildfire Potential
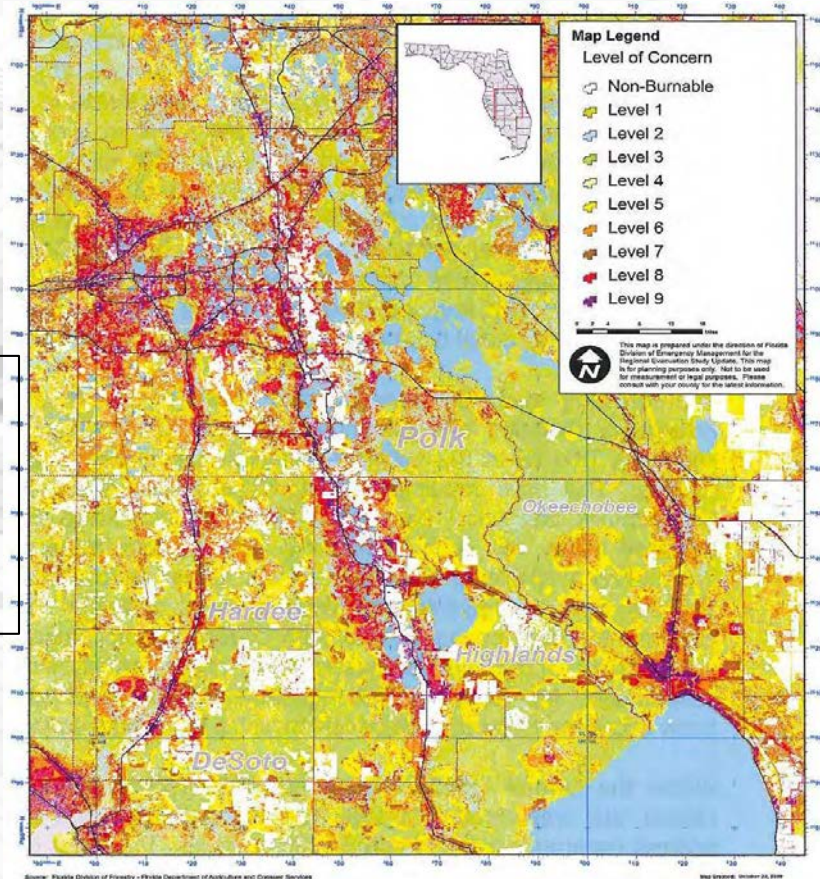
Photo: Central Florida Regional Planning Council: Economic Analysis & Disaster Resiliency Study

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Fiscal Resiliency

☐ Budget Instability due to recession

☐ Budget deficits due to funds being too dependent on small subset of the population

    ☐ Example: California's heavy reliance on Income and Capital Gains taxes

        ■ Over 50% of all income tax revenue comes from 1% of taxpayers

Share of Taxes

● $0-$20K   ● $20K-$50K   ● $50K-$100K   ● $100K-$200K
● $200K-$300K   ● $300K-$500K   ● $500K-$1M   ● Over $1M
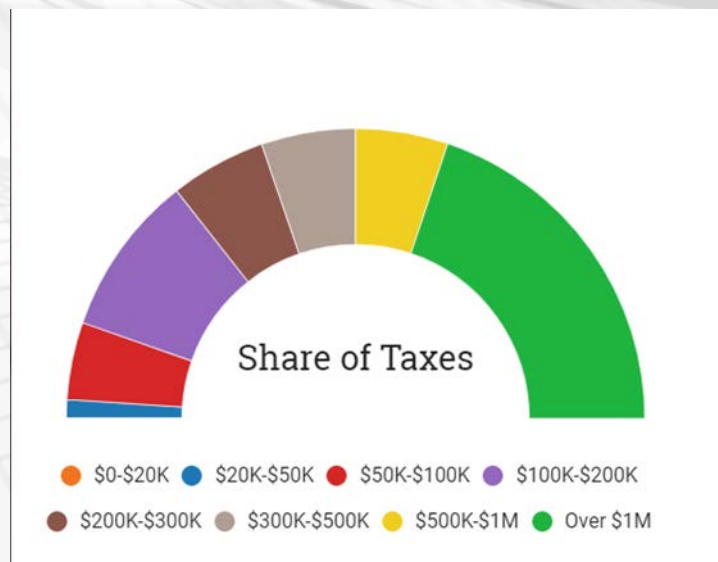
Source:
Lin, Judy. "The Open Secret about California Taxes." CALmatters, 3 June 2019, calmatters.org/articles/the-open-secret-about-california-taxes/.

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Adam Rose & Dan Wei's Metric for Resilience Loss Reduction Potential

□ *Resilience Loss Reduction Potential=* $\dfrac{\textit{Avoided Losses}}{\textit{Maximum Potential Losses}}$

□ Metric: averted losses as % of potential losses

□ Can be measured in terms of GDP, Output, or Employment

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Adam Rose & Dan Wei's Presentation on Modeling Economic Resilience to Disasters

Modeling Approaches for Resilience Tactics in REMI

Resilience Tactic	Simulation Method in REMI	Additional Notes
Export Diversion for Import Use	Adjust import and export shocks	Using goods that were intended for export as substitutions for the lack of availability of imports.
Conservation	Assume a 2% conservation rate: - Import shocks remain the same - Reduce the increased price of composite commodities by 2% (from 0.3% to 0.294%) - Export shocks remain the same	Conservation only helps deal with import disruption
Inherent Input Substitution	Not performed for this simulation	Inherent input substitution between labor and capital is captured by the REMI model automatically through its Cobb-Douglas Production Function. However, input substitution among intermediate goods must be performed manually. All adaptive input substitution must be calculated manually.
Import Substitution	Automatic	Inherent import substitution (replacing foreign imports with domestic production) is captured by the REMI model by increasing the share of domestic demand that is supplied from within the nation when there is a shock on imports.
Ship Rerouting	Adjust import and export shocks in different regions	Steering ships to other ports in California or along the Western Coast; can be simulated in a multi-region REMI Model.
Inventory Use	Adjust import shocks by sector	Can only help deal with import disruption; can be simulated by reducing the direct import disruption for a given commodity by the amount of inventory.
Production Recapture	Application of sectoral "Recapture Factors" to sectoral output changes	A side-calculation to adjust total output losses of each sector for rescheduling of production once the disruption is over.

- By Plugging Shocks into the model, the disruption severity is predictable

- Able to forecast Employment, GDP, Gross Output

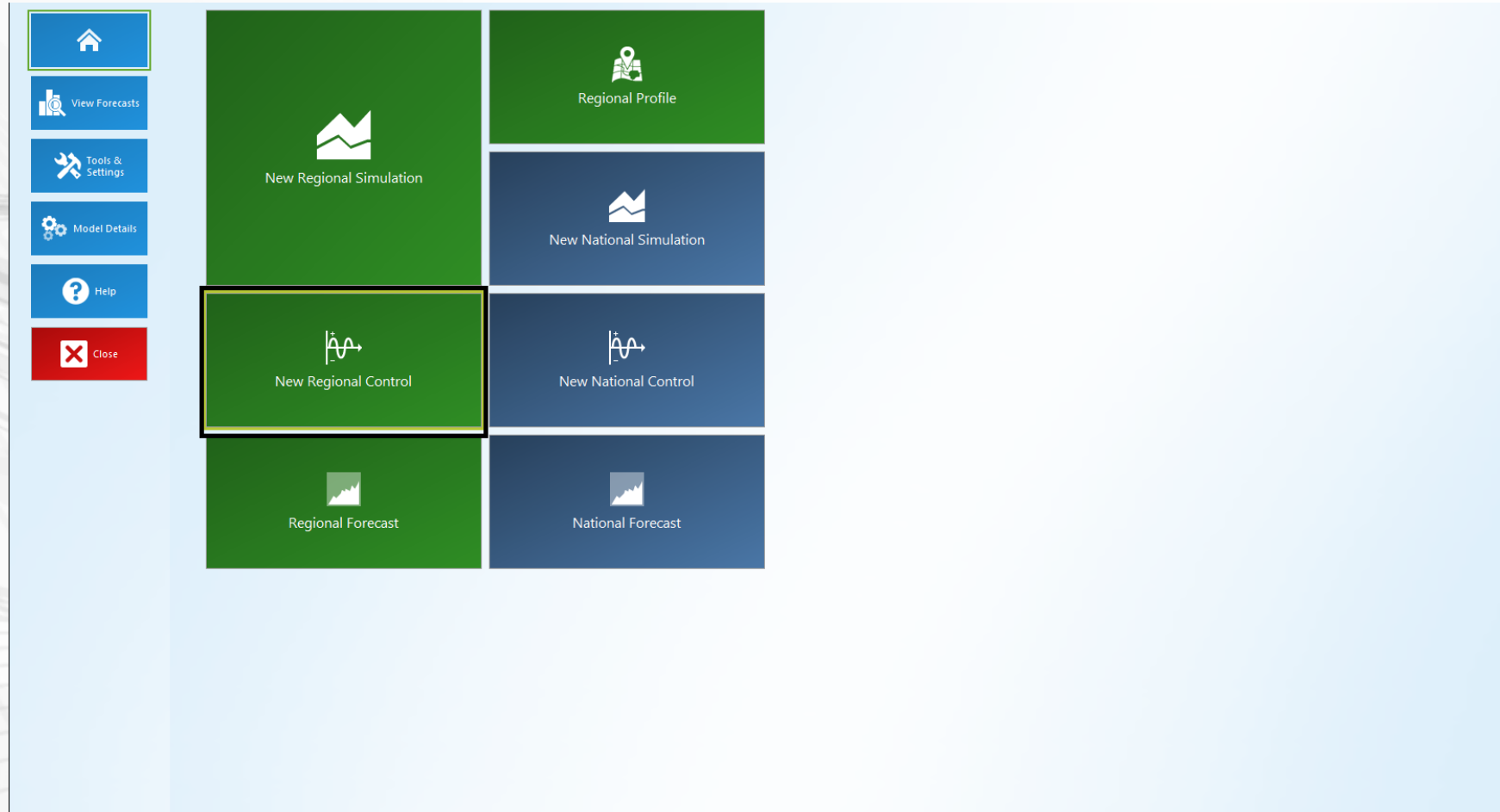Source: *Modeling Economic Resilience to Disasters, Adam Rose and Dan Wei, Sol Price School of Public Policy and Center for Risk and Economic Analysis of Terrorism Events University of Southern California, June 2019*

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How to Analyze Resiliency with REMI Model

Step 1:
New Regional
Control

How to Analyze Resiliency with REMI Model

Step 2: Select
All Regions, All
Industries, and
Share of Output
on a Percentage
Scale

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How to Analyze Resiliency with REMI Model

Step 3: Import Shock into output value

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How to Analyze Resiliency with REMI Model

Step 4: Run the Forecast

How to Analyze Resiliency with REMI Model
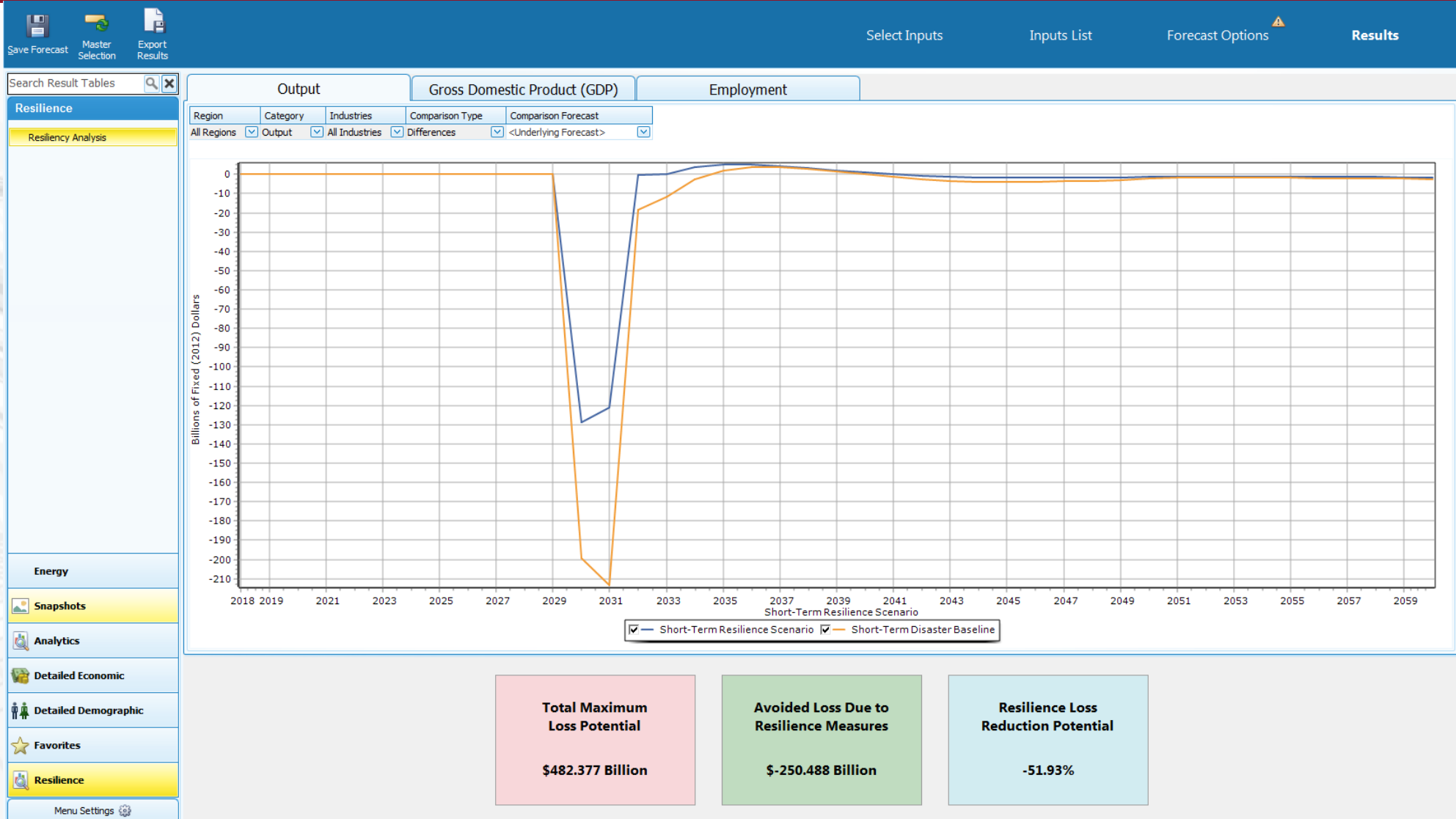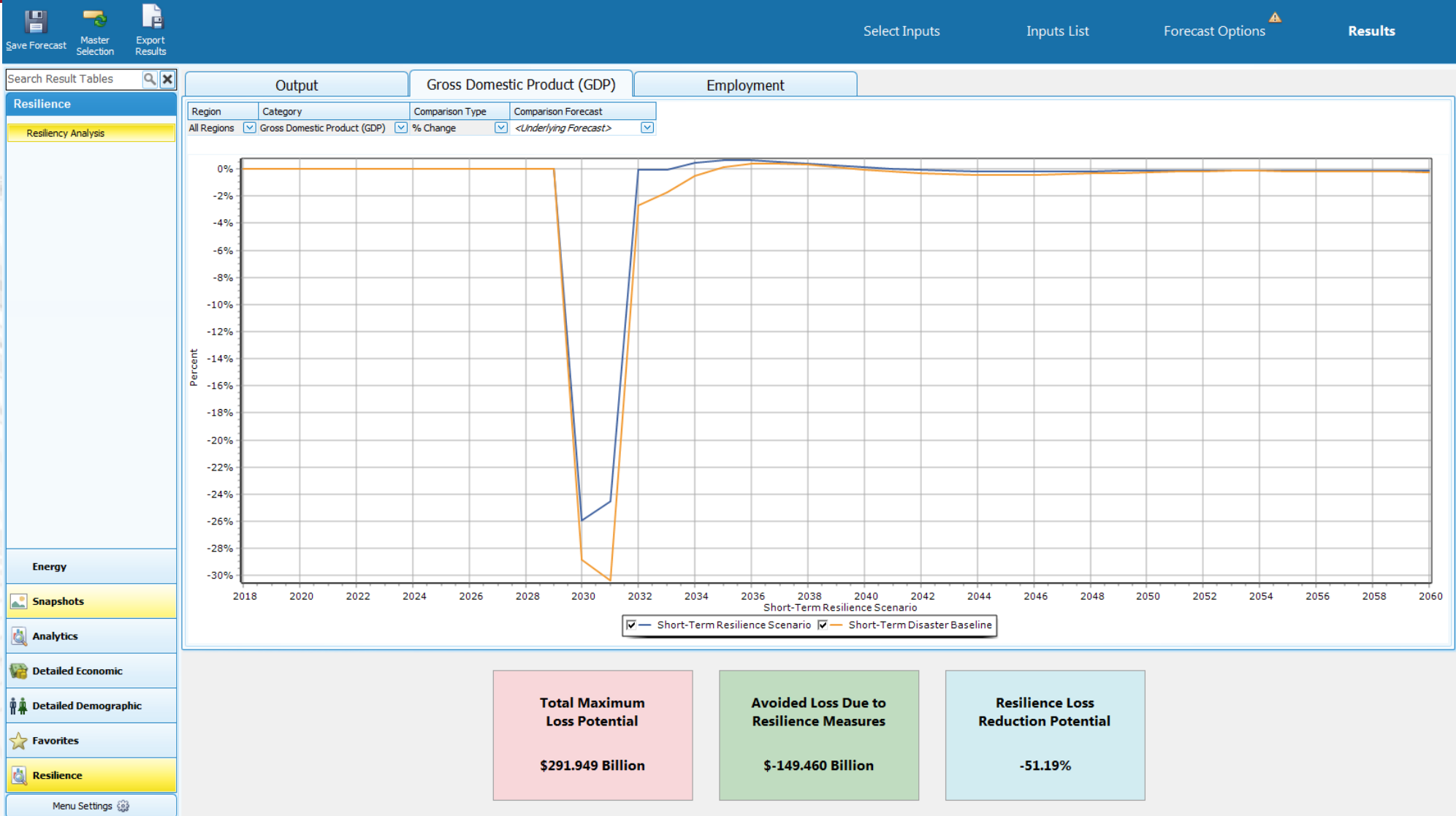
Resiliency Analysis measured in Output

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How to Analyze Resiliency with REMI Model
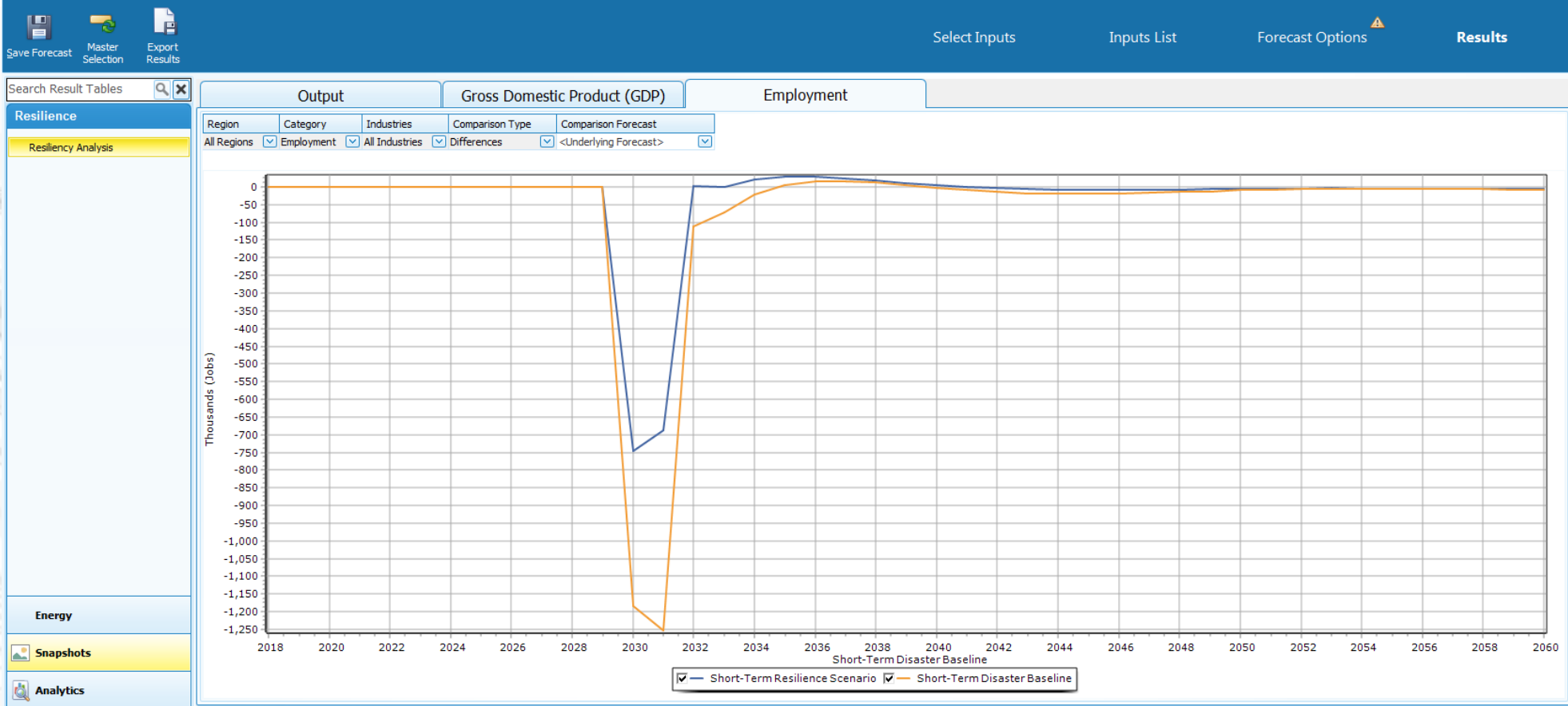
Resiliency Analysis measured in GDP

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How to Analyze Resiliency with REMI Model

Resiliency Analysis measured in Employment

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Other Resiliency Studies

□ ## REMI's been involved with:

- □ *A Storm to Remember: Hurricane Harvey and the Texas Economy, Glenn Hegar, Office of Texas Comptroller of Public Accounts, February 2018*

- □ *Dania Beach: Economic Impacts of Sea Level Rise and Coastal Storms, AECOM, Sutainable Economics Practice for the Broward County, Division of Environmental Planning and Community Resilience, November 2018*

- □ *Economic Analysis and Disaster Resiliency Study, The Central Florida Regional Planning Council for the Economic Development Administration, U.S Department of Commerce, 2009*

- □ *Hillsborough MPO Surface Transportation Resiliency Planning, Allison Yeh, AICP, LEED GA, March 2017*

- □ *Linking Different Forms of Resilience, Igor Linkov, OECD NAEC, April 2018*

- □ *REMI TranSight in the Tampa Bay Area: Project Analysis and Planning for Resiliency, Randy Deshazo, Tampa Bay Regional Planning Council, 2019 Annual Emerald Coast Transportation Symposium, February 2019*

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