Transportation, Inflation, and the Supply Chain

Regional Economic Models, Inc.

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what does REMI say?sm

Overview

Inflation is an Economic Problem #1

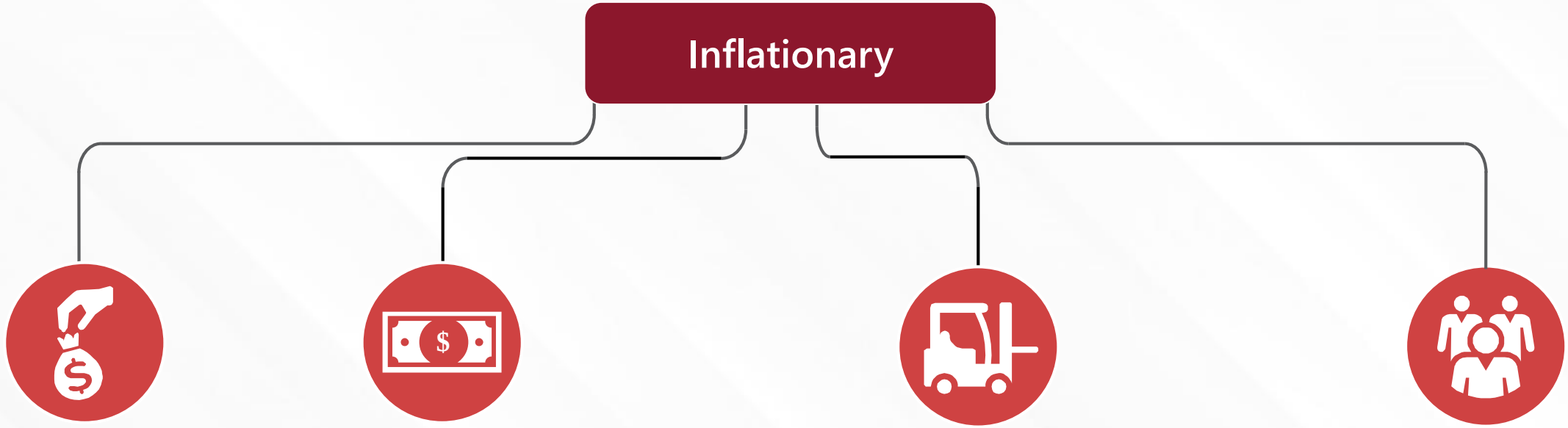
We show how supply shocks impact inflation

Transportation investments lower inflation by reducing supply chain bottle neck

Federal Reserve Policy caught in a trap (stagflation)

Need to focus on fundamentals (reduce friction in transportation)

Inflationary Factors



Monetary

Quantitative Easing, Near-Zero Fed Funds rate (FRED M1)

Fiscal Policy

CARES Act, American Rescue Plan

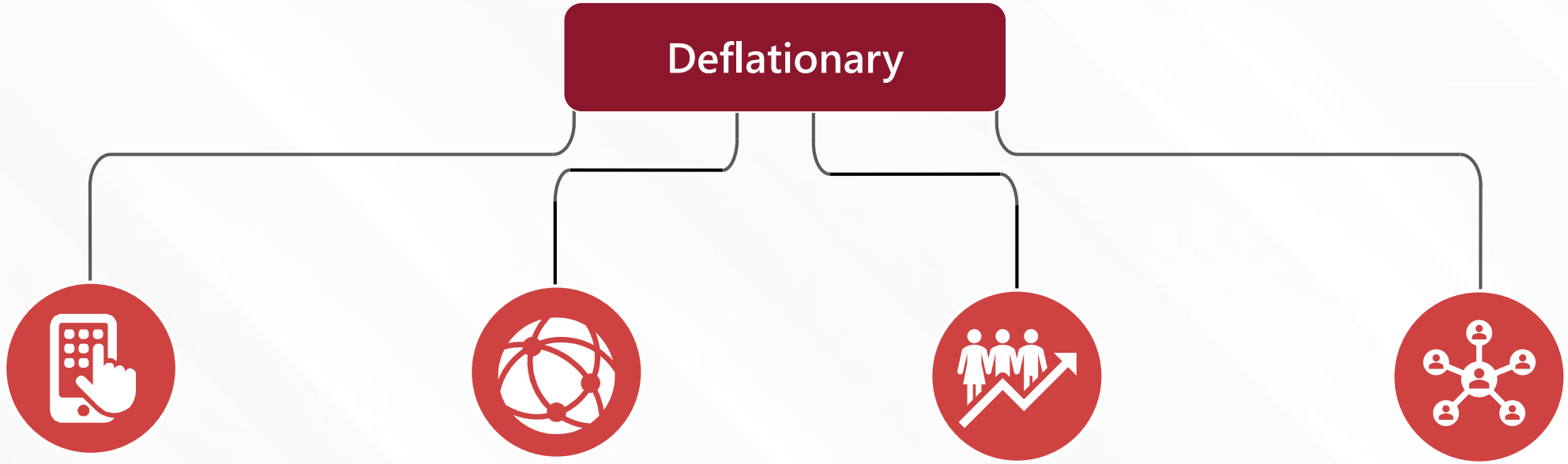
Supply-chain Disruptions

- Closure of factories in 2020
- Demand for manufactures grew faster
- Particularly imports, with U.S. fiscal deficit financed in part by U.S. trade deficit
- Shocks to specific components causing motor vehicle plant closures
- Led to price increases

Labor shortages

- The Great Resignation and Early Retirement
- Lower Labor Force Participation
- Lower Immigration
- Re-training workers

Deflationary Factors



Technology

Adoption of technology (for example, self-checkout)

Globalization

Ongoing globalization (imports from low-cost countries)

Aging

Aging of the Population (risk-averse, reduced spending)

Remote

Adoption of remote/hybrid allows shift to low cost location

Topic Overview

Inflation

- Focus on Inflation Impacts on Middle- and Lower-Income People
- Motor vehicle prices; housing and rents

Transportation

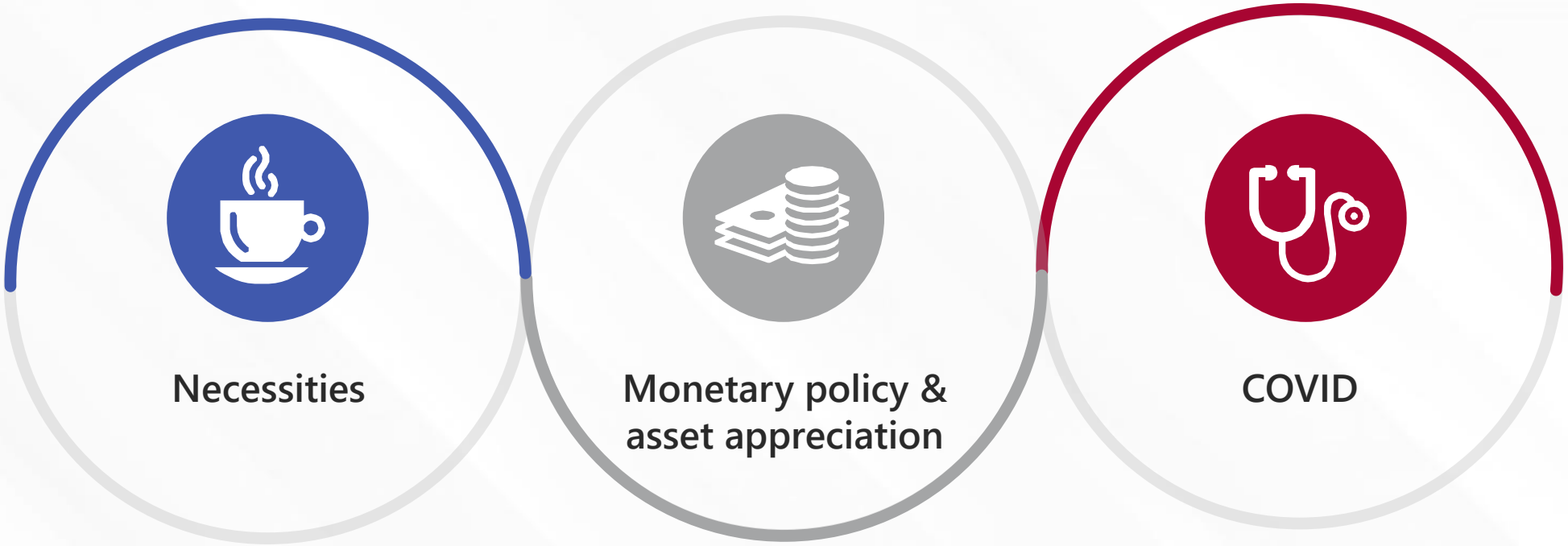
- Infrastructure investments support the efficient flow of goods and services
- Transportation is central to the supply chain

Simulations

- Reduced commodity access
- Oil supply shock

Inflation Impacts by Wage / Income Group

Inflation is particularly difficult for middle and lower-income people.



Necessities

Lower-income groups spend a higher proportion of income on necessities (gasoline, housing, food)

Monetary policy & asset appreciation

Higher-wealth individuals have disproportionally benefitted from monetary policy and asset appreciation

COVID

COVID disruption to many middle and lower-income workers; CARES and other benefits running out

Scenario: Reduced Commodity Access

- Community Access Index
  - Transportation and logistics cost for commodity shipments
- Multiregional US model: 9 major metro areas & rest of U.S.
- 10% Disruptions in 2022, 3% in 2023
- Results for consumer price by quintile and employment

Scenario: Reduced Commodity Access (supply chain bottlenecks), Manufacturing, 8 Metros + Rest of U.S.

Policy Variable Inputs

Active	Edit	Group
☐	✎ ✖	New Search Results - Commodity Access Index
☑	✎ ✖	New Search Results - Commodity Access Index

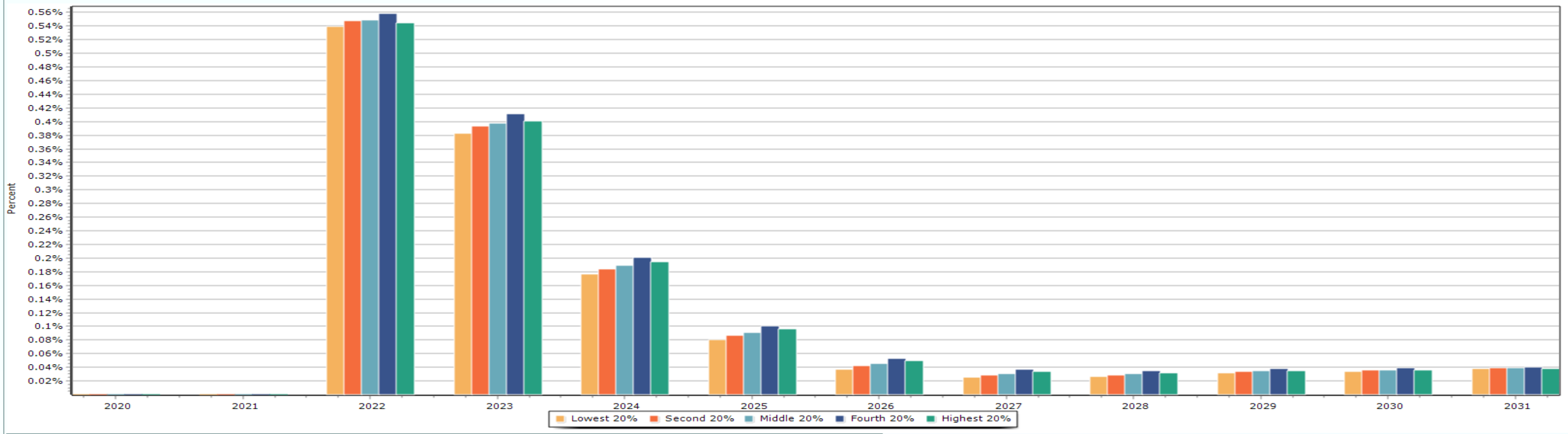
Active	View	Category	Detail	Region	Units	2020	2021	2022	2023	2024	2025	2026	2027
☑	🔍	Commodity Access Index	Wood product manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Nonmetallic mineral product manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Primary metal manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Fabricated metal product manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Machinery manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Computer and electronic product manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Electrical equipment, appliance, and component manufacturin	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Motor vehicles, bodies and trailers, and parts manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Other transportation equipment manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Furniture and related product manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0
☑	🔍	Commodity Access Index	Miscellaneous manufacturing	Regions (9)	Percent	0	0	-10	-3	0	0	0	0

Scenario: Reduced Commodity Access Index; Consumer Price by Quintile

By Income Quintile | By Income Range

Consumption Price by Income Quintile

Region	Category	Comparison Type	Forecast	Comparison Forecast
All Regions	Consumption Price Distribution	% Change	Regional Simulation 1	Standard Regional Control



Detail	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Lowest 20%	Percent	0.000%	0.000%	+0.539%	+0.383%	+0.176%	+0.080%	+0.038%	+0.025%	+0.026%	+0.032%	+0.034%	+0.038%
Second 20%	Percent	0.000%	0.000%	+0.548%	+0.393%	+0.185%	+0.087%	+0.042%	+0.029%	+0.029%	+0.034%	+0.036%	+0.039%
Middle 20%	Percent	0.000%	0.000%	+0.549%	+0.398%	+0.189%	+0.090%	+0.045%	+0.031%	+0.030%	+0.035%	+0.036%	+0.039%
Fourth 20%	Percent	0.000%	0.000%	+0.558%	+0.411%	+0.201%	+0.101%	+0.053%	+0.037%	+0.035%	+0.038%	+0.039%	+0.041%
Highest 20%	Percent	0.000%	0.000%	+0.544%	+0.401%	+0.195%	+0.096%	+0.050%	+0.034%	+0.032%	+0.035%	+0.036%	+0.038%

Scenario: Employment Change as a Result of Lower Commodity Access

Economic Summary

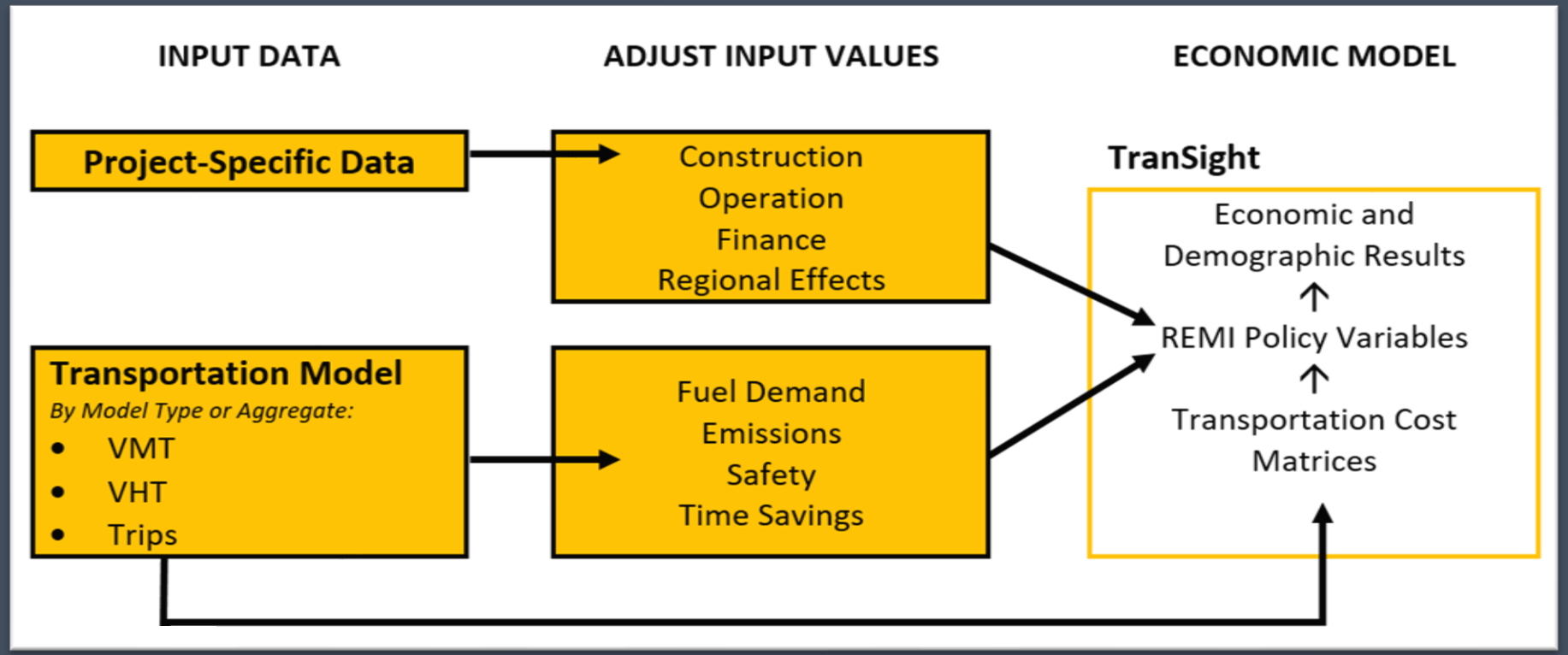
Category	Comparison Type	Forecast	Comparison Forecast
Total Employment	% Change	Regional Simulation 1	Standard Regional Control

Region	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
New York City Area	Percent	0.000%	0.000%	-0.840%	-0.959%	-0.795%	-0.600%	-0.411%	-0.258%	-0.143%	-0.069%	-0.017%	+0.012%
Fulton County, GA (Atlanta)	Percent	0.000%	0.000%	-0.915%	-1.080%	-0.928%	-0.729%	-0.528%	-0.357%	-0.224%	-0.132%	-0.065%	-0.025%
Cook, IL (Chicago)	Percent	0.000%	0.000%	-0.726%	-0.868%	-0.745%	-0.574%	-0.400%	-0.253%	-0.142%	-0.068%	-0.016%	+0.013%
Harris County, TX (Houston)	Percent	0.000%	0.000%	-0.976%	-1.296%	-1.201%	-0.971%	-0.704%	-0.460%	-0.263%	-0.123%	-0.024%	+0.033%
King County, WA (Seattle)	Percent	0.000%	0.000%	-0.907%	-1.103%	-0.959%	-0.748%	-0.529%	-0.340%	-0.194%	-0.097%	-0.029%	+0.008%
San Francisco County, CA	Percent	0.000%	0.000%	-0.772%	-0.909%	-0.782%	-0.609%	-0.433%	-0.283%	-0.169%	-0.092%	-0.037%	-0.006%
Los Angeles County, CA	Percent	0.000%	0.000%	-0.788%	-0.872%	-0.719%	-0.544%	-0.379%	-0.245%	-0.147%	-0.083%	-0.036%	-0.011%
Miami-Dade County, FL	Percent	0.000%	0.000%	-1.015%	-1.189%	-1.008%	-0.774%	-0.544%	-0.351%	-0.205%	-0.108%	-0.040%	-0.002%
Rest of U.S.	Percent	0.000%	0.000%	-0.829%	-1.037%	-0.925%	-0.733%	-0.529%	-0.350%	-0.211%	-0.116%	-0.048%	-0.008%

What is the Role of Transportation Infrastructure?

- Economic growth fundamentals: How many people work, output per worker (productivity)
- Inventory and fiscal policy is interesting, but the root causes are what matters
- Transportation is a root cause of labor productivity
  - Do we gave an efficient supply chain?
- Transportation investments should be viewed In terms of improving the productivity of the supply chain

Model Structure



TranSight

Model Methodology

REMI's 35-year history of rigorous academic research and software development has led to the development of the industry standard in macroeconomic research methodology:

General Equilibrium

Input-Output

Econometrics

Economic Geography

Integrated REMI economic modelling approach

Our clients include:

- AECOM
- Michigan Department of Transportation
- Cambridge Systematics, Inc.
- Illinois Department of Transportation
- Atlanta Regional Commission (ARC)
- Southern California Association of Governments (SCAG)
- New York State Department of Transportation
- United States Army Corps of Engineers Great Lakes District
- Houston-Galveston Area Council (H-GAC)

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Static vs. Dynamic Analysis

Static Analysis	Dynamic Analysis
• Construction spending • O&M spending	• Construction spending • O&M spending • Travel time savings • Emissions savings • Safety improvements • Population changes • Fuel expenditures • Non-fuel VOCs • Network speed improvements • Access to labor • Access to intermediate inputs

FHWA: TranSight is among the "best equipped to estimate *productivity* impacts"*

*https://ops.fhwa.dot.gov/publications/fhwahop15034/ch5.htm

TranSight

Key Advantages of TranSight

Proven Accuracy

Validated by REMI's peer-reviewed model equations, TranSight can answer *"what if…?"* questions about your economy by producing various forecasts and impact analyses of transportation investments.

Intuitive Software

TranSight is a desktop application with extensive user service and support functions. These are combined with unlimited assistance and professional training provided by REMI's expert staff members.

Analysis of Key Variables

TranSight offers a comprehensive suite of variables to provide the most thorough and robust understanding possible of the macroeconomy.

✓ **Employment** ✓ **GDP** ✓ **Income** ✓ **Output** ✓ **Demographics**

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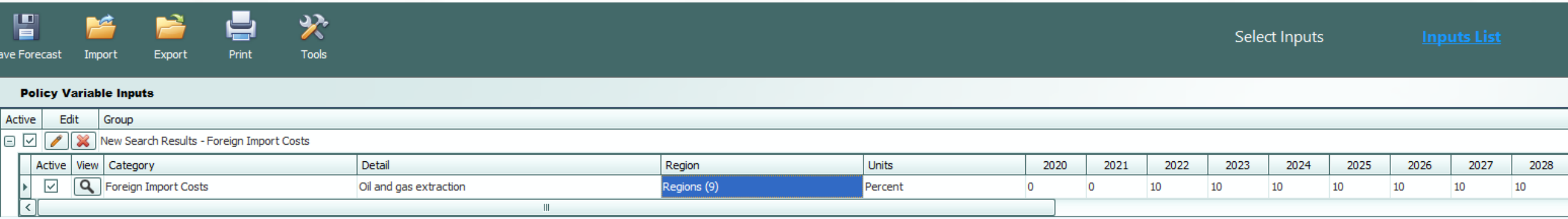
Scenario: Oil Supply Shock

- Increased in world price of oil and gas price by 10%
- Employment effect: 9 major metro's and part of U.S.
- Inflation impacts by wage quintile

Scenario: 10% increase in world oil and gas price
Policy Variable Input: 8 Major Metro Areas + Rest of U.S.



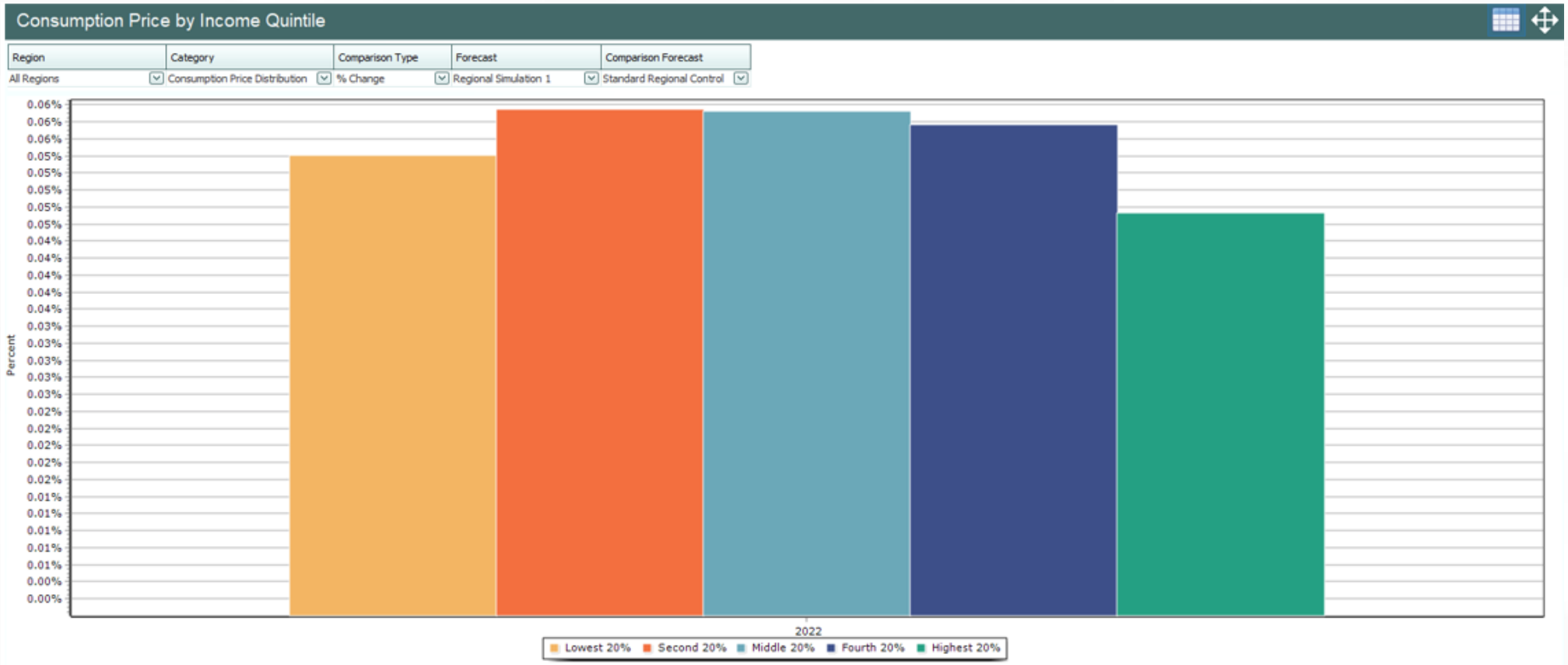
Scenario: 10% increase in world oil and gas price
Employment by Region

Economic Summary

Category	Comparison Type	Forecast	Comparison Forecast
Total Employment	Differences	Regional Simulation 1	Standard Regional Control

Region	Units	2020	2021	2022	2023	2024	2025	2026	2027
New York City Area	Thousands (Jobs)	0.000	0.000	-0.631	-0.582	-0.470	-0.317	-0.160	-0.021
Fulton County, GA (Atlanta)	Thousands (Jobs)	0.000	0.000	-0.134	-0.133	-0.124	-0.108	-0.089	-0.071
Cook, IL (Chicago)	Thousands (Jobs)	0.000	0.000	-0.779	-0.833	-0.832	-0.774	-0.693	-0.609
Harris County, TX (Houston)	Thousands (Jobs)	0.000	0.000	+9.329	+11.646	+12.810	+12.935	+12.536	+11.877
King County, WA (Seattle)	Thousands (Jobs)	0.000	0.000	-0.441	-0.435	-0.382	-0.296	-0.203	-0.117
San Francisco County, CA	Thousands (Jobs)	0.000	0.000	-0.079	-0.074	-0.064	-0.045	-0.025	-0.008
Los Angeles County, CA	Thousands (Jobs)	0.000	0.000	-1.646	-1.550	-1.491	-1.336	-1.153	-0.974
Miami-Dade County, FL	Thousands (Jobs)	0.000	0.000	-0.491	-0.499	-0.478	-0.425	-0.360	-0.298
Rest of U.S.	Thousands (Jobs)	0.000	0.000	-5.120	-7.539	-8.972	-9.640	-9.860	-9.787

Scenario: 10% increase in world oil and gas price
Consumer Price by Compensation Quintile



Detail	Units	2022
Lowest 20%	Percent	+0.054%
Second 20%	Percent	+0.059%
Middle 20%	Percent	+0.059%
Fourth 20%	Percent	+0.058%
Highest 20%	Percent	+0.047%

Conclusion

- Adverse Supply Shocks and Supply Chain Disruptions Continue
- This Exacerbates Economic Problem #1: Inflation
- The Fed Challenge: Reducing Inflation by Increasing Interest Rates to Lower Demand;
  - But—if a supply shock is the problem, risk of recession (STAGFLATION)
- Transportation improvements (ports, highways, rail) gets at the ROOT cause
- The REMI TranSight model enables users to quantify these effects
- Economic analysis using TranSight results in successful transportation outcomes

Thank you for attending!

For more information, please contact
info@remi.com