

# **REMI PI+ STRUCTURE OF THE MODEL**

Presented by Regional Economic Models, Inc.

# What is PI+?



**PI+** is the leading off-the-shelf solution for conducting dynamic macroeconomic impact analysis of public policy. PI+ allows users to understand the deep linkages and relationship between a policy and its economic foundation.

PI+ is uniquely customizable to your region's economy:

6,000+ policy variables

**Detailed industrial sector data** 

Accommodates region's economic and demographic projections

# **About REMI**



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

**Input-Output** Close analysis of inter-industry relationships

#### **Econometrics**

Advanced statistical analyses underpinning the model

**General Equilibrium** 

Estimate of long-run stability of the economy allows for analysis of policy decisions

#### **Economic Geography**

Effects of geographic concentration of labor and

industry

**Business** 

Roundtable<sup>\*\*</sup>



Sandia National

aboratories

California Environmental Protection Agency

**Integrated REMI** 

economic modelling

approach



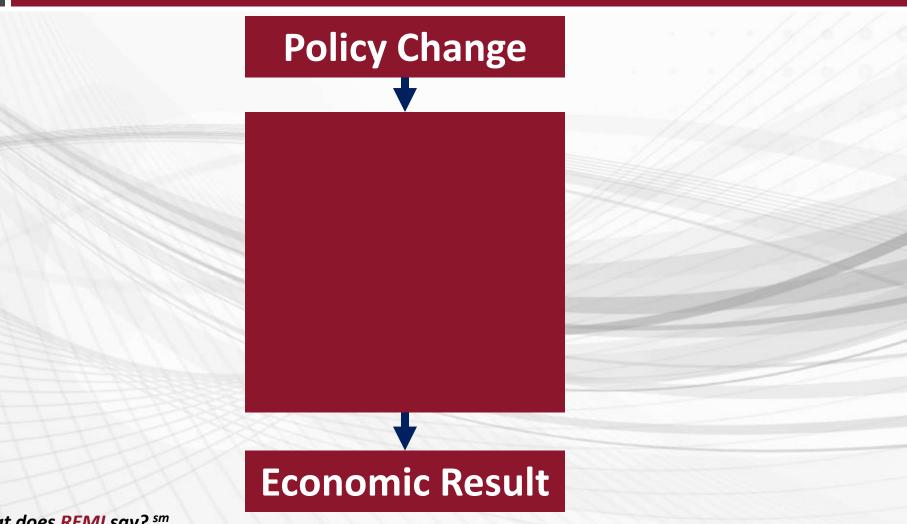
**US Army Corps** of Engineers<sub>®</sub>















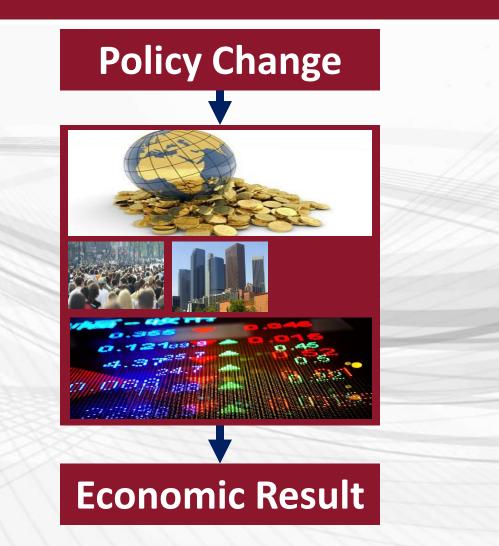




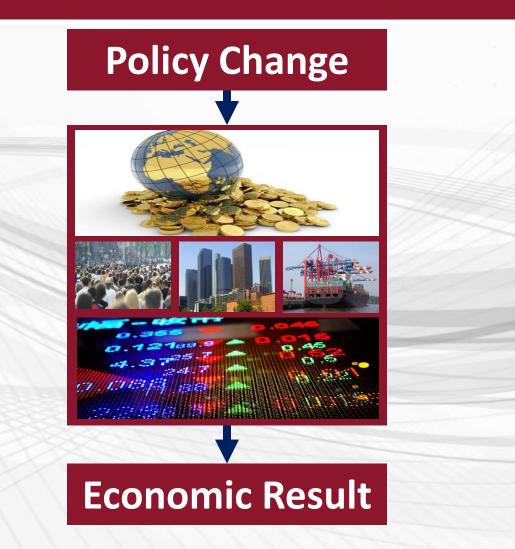












# **Two motivating examples**



# Hiring at Boston University

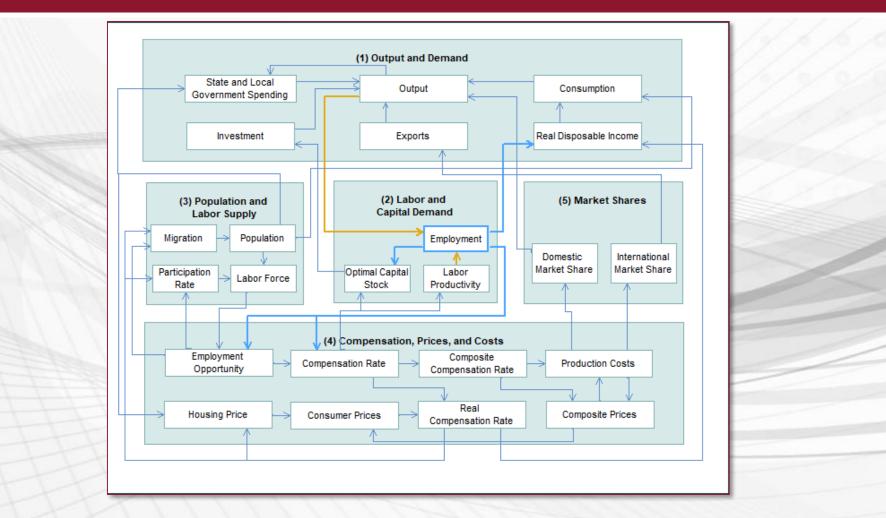
 Higher chemical manufacturing costs



#### □ Hiring in several sectors

Ŀ	2 🖉 B	BU Exp	pansion											
	Active	View	Category	Detail	Region	Units	201	201	201	2019	2020	2021	2022	2023
Þ	$\checkmark$	٩	Employment	Industry (Exogenous Production): Professional, scientific, and technical services	Suffolk County	Units	0	0	0	200	200	200	200	200
		٩	Employment	Industry (Exogenous Production): Repair and maintenance	Suffolk County	Units	0	0	0	400	400	400	400	400
	$\checkmark$	٩	Employment	Industry (Exogenous Production): Management of companies and enterprises	Suffolk County	Units	0	0	0	100	100	100	100	100
<				11										







# Optimal capital stock increases Investment Increases

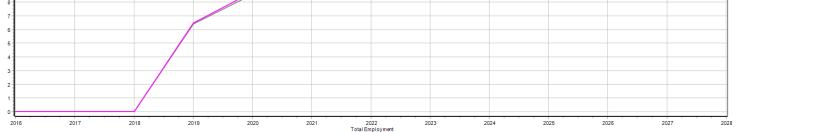
#### 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 Category Units Nonresidential Investment Millions of Chained (2009) Dolk 0.00% 0.00% 0.00% +20.13% +30.08% +36.47% +40.16% +42.18% +42.76% +42.52% +42.04% +41.14% +40.01% Regional Nonresidential Actual Capital Sty Millions of Fixed (2018) Dollars 0.00% 0.00% +0.61% +1.52% +2.63% +3.85% +5.13% +6.41% +7.67% +8.89% +10.05% +11.15% Regional Nonresidential Optimal Capital S Millions of Fixed (2018) Dollars 0.00% 0.00% +11.36% +12.11% +13.91% +15.23% +16.35% +17.27% +18.01% +18.66% +19.21% +19.70% Nonresidential Investment Determinants - Suffolk Count Nonresidential Investment



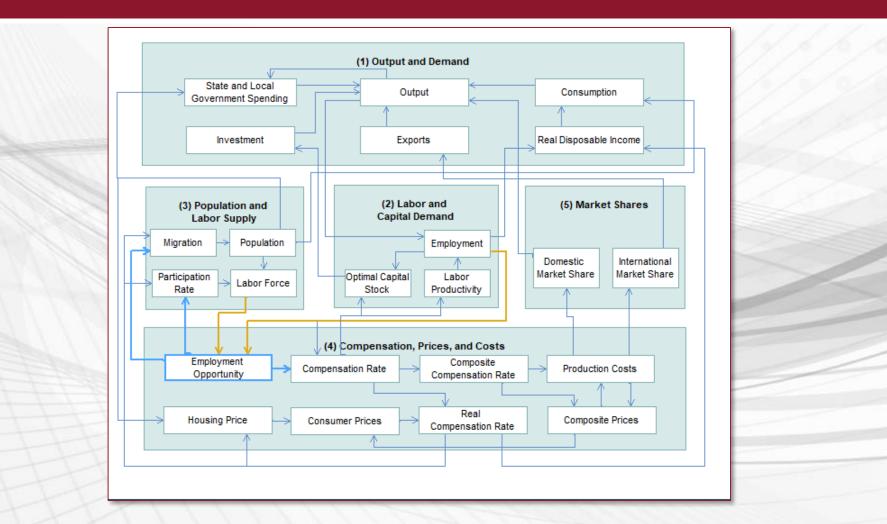
#### Domestic demand (industries) increases

#### Output Increases

Category	Units	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Fotal Employment	Individuals (Jobs)	0.00%	0.00%	0.00%	+7.50%	+9.94%	+12.12%	+13.73%	+15.00%	+16.01%	+16.81%	+17.49%	+18.08%	+18.62%	
Private Non-Farm Employment	Individuals (Jobs)	0.00%	0.00%	0.00%	+8.92%	+11.37%		+15.17%	+16.42%	+17.39%		+18.80%		+19.86%	
Residence Adjusted Employment	Individuals	0.00%	0.00%	0.00%	+12.12%	+13.30%		+17.46%	+19.09%	+20.53%	+21.80%	+23.00%		+25.19%	
Population	Individuals	0.00%	0.00%	0.00%	+2.79%	+5.03%	+7.23%	+9.29%	+11.20%	+12.96%		+16.08%	+17.49%	+18.81%	
abor Force	Individuals	0.00%	0.00%	0.00%	+4.91%	+7.74%		+12.72%	+14.87%	+16.79%		+20.10%	+21.54%	+22.85%	
Bross Domestic Product	Millions of Fixed (2018) Dollars	0.00%	0.00%	0.00%	+6.40%	+8.57%		+11.88%	+12.99%	+13.87%		+15.16%		+16.17%	
utput	Millions of Fixed (2018) Dollars	0.00%	0.00%	0.00%	+6.49%	+8.75%		+12.19%	+13.34%	+14.26%	+14.99%	+15.61%	+16.15%	+16.64%	
/alue Added	Millions of Fixed (2018) Dollars	0.00%	0.00%	0.00%	+6.45%	+8.62%		+11.94%	+13.04%	+13.92%		+15.22%	+15.74%	+16.21%	
Personal Income	Millions of Fixed (2018) Dollars	0.00%	0.00%	0.00%	+20.01%	+20.51%	+22.72%	+24.55%	+26.30%	+27.92%	+29.38%	+30.78%	+32.14%	+33.43%	
14															Population     Labor Force     V — Gross Domestic     V — Output
12															Value Added
9															









### Rising demand in labor market

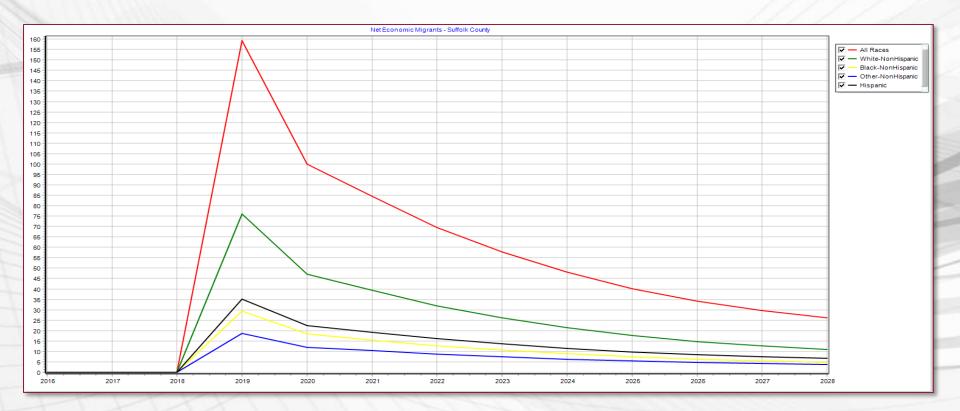
#### Compensation Rises

tegory	Units	2016	2017	2018	2019 🔻	2020	2021	2022	2023	2024	2025	2026	2027	2028	
inagement of Companies and Enterpris	Billions of Current Dollars	0.00%	0.00%	0.00%	+1.15%	+1.14%	+1.14%	+1.13%	+1.12%	+1.12%	+1.11%	+1.10%	+1.09%	+1.08%	
her Services, except Public Administra		0.00%	0.00%	0.00%	+1.00%	+0.99%	+0.98%	+0.98%	+0.97%	+0.96%	+0.95%	+0.95%	+0.94%	+0.93%	
fessional, Scientific, and Technical Sei	Billions of Current Dollars	0.00%	0.00%	0.00%	+0.26%	+0.27%	+0.27%	+0.27%	+0.27%	+0.27%	+0.27%	+0.26%	+0.26%	+0.26%	
nstruction	Billions of Current Dollars	0.00%	0.00%	0.00%	+0.17%	+0.22%	+0.23%	+0.22%	+0.21%	+0.19%	+0.18%	+0.16%	+0.14%	+0.13%	
ing	Billions of Current Dollars	0.00%	0.00%	0.00%	+0.13%	+0.15%	+0.17%	+0.17%	+0.17%	+0.16%	+0.15%	+0.14%	+0.14%	+0.13%	
ail Trade	Billions of Current Dollars	0.00%	0.00%	0.00%	+0.11%	+0.11%	+0.11%	+0.12%	+0.12%	+0.12%	+0.12%	+0.12%	+0.12%	+0.12%	
ministrative and Waste Management S		0.00%	0.00%	0.00%	+0.09%	+0.10%	+0.10%	+0.10%	+0.10%	+0.10%	+0.10%	+0.10%	+0.10%	+0.10%	
olesale Trade	Billions of Current Dollars	0.00%	0.00%	0.00%	+0.09%	+0.09%	+0.10%	+0.10%	+0.11%	+0.11%	+0.10%	+0.10%	+0.10%	+0.10%	
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#### □ A large influx of economic migrants





# Higher local population drives consumption upwards



# **Two motivating examples**



Hiring at Boston
 University

 Higher chemical manufacturing costs



#### □ 5% increase in production cost from regulation

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Pro	oduction Co	osts												
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	Category	Detail	Region	Units	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
←	× Production Cost	Chemical manufacturing	Midland	Percent	0	5	5	5	5	5	5	5	5	5

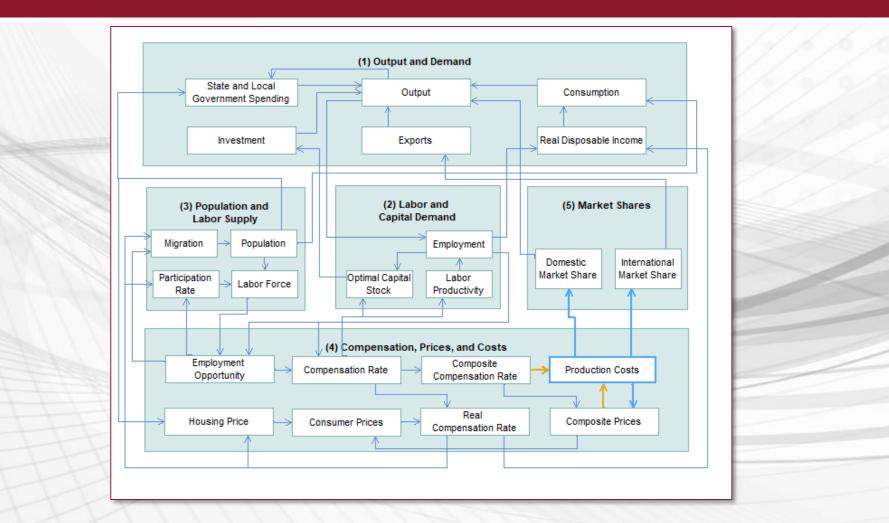


#### □ Increase in production costs

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<ul> <li>Instant los de la constructione d</li></ul>						Units		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	201
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<ul> <li></li></ul>			Inte	rmediate Demand I	Employment	Thousands (Jobs)		0.00%	-2.06%	-3.69%	-4.99%	-6.05%	-6.93%	-7.66%	-8.25%		-9.19%	-9.49%	-9.75%	-9.98%	-10.19%	-10.35%	-10.48%	-10.60%	-10.71%	-10.84%	-10.94%	-11
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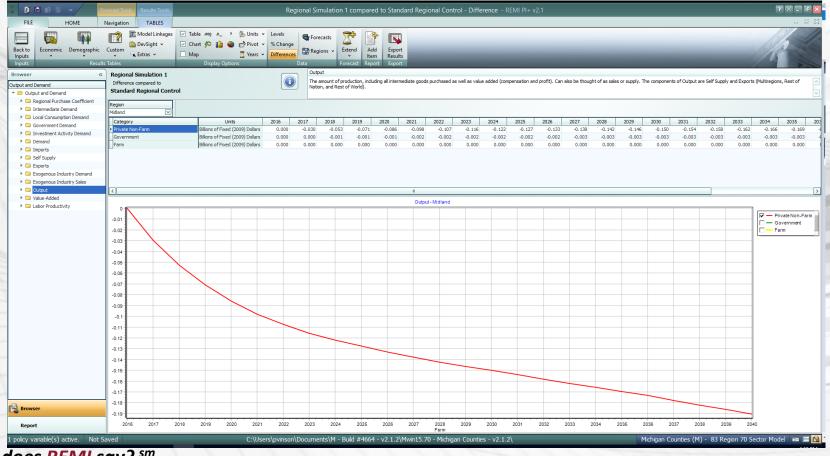
# **Model Linkages**







#### □ Output falls





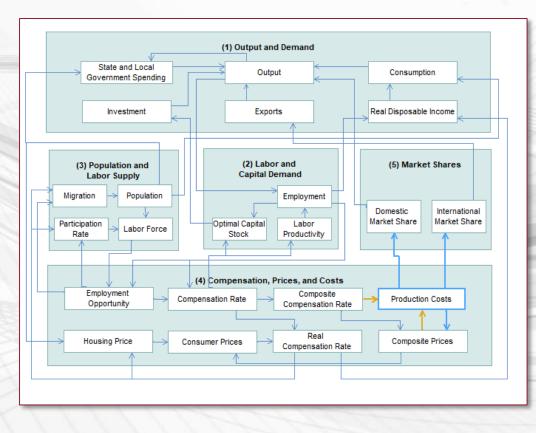
#### □ Driven by lower self-supply <u>and</u> falling exports

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# **Model Linkages**

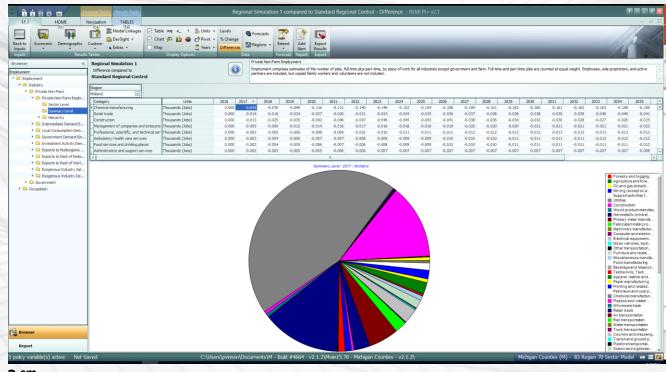


#### Employment declines





- Job impacts by industry
- Big impact on chem manufacturing jobs, but also construction & retail
  - Less income means less demand





□ Statewide job impacts as trade network is affected

Employment affects compensation, then income, then consumption demand

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r « st nployment	Regional Simulation 1 Difference compared to Standard Regional Control		C	Empi		rises estimates e not included.	s of the numbe	er of jobs, full-tim	e plus part-time	by place of work	Full-time and	d part-time job	are counted	l at equal weig	ght. Employer	es, sole propri	ietors, and ac	tive partners	are included,	but unpaid far	mily workers
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<ul> <li>Private Non-Farm</li> <li>Private Non-Farm Emplo</li> </ul>	Midland	Thousands (Jobs)	0.000	-0.099	-0.172	-0.227	-0.267		0.317 -0				-0.352	-0.356	-0.358	-0.354	-0.354	-0.356	-0.358	-0.354	-0.355
Intermediate Demand E	Oakland	Thousands (Jobs)	0.000	-0.032	-0.041	-0.047	-0.051			53 -0.054			-0.054	-0.055	-0.056	-0.056	-0.057	-0.058	-0.058	-0.059	-0.060
<ul> <li>Local Consumption Dem</li> </ul>	Wayne	Thousands (Jobs)	0.000	-0.022	-0.028	-0.032	-0.034		0.036 -0.				-0.037	-0.037	-0.038	-0.038	-0.039	-0.039	-0.040	-0.040	-0.041
Government Demand Em	Saginaw	Thousands (Jobs)	0.000	-0.016	-0.027	-0.035	-0.041			47 -0.047			-0.045	-0.044	-0.044	-0.042	-0.042	-0.041	-0.041	-0.040	-0.040
<ul> <li>Government Demand Em</li> <li>Investment Activity Dem</li> </ul>	Kent	Thousands (Jobs)	0.000	-0.014	-0.019	-0.023	-0.025		0.027 -0.				-0.028	-0.028	-0.028	-0.028	-0.028	-0.029	-0.029	-0.029	-0.029
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- REMI's structure shows how economic events can shape factors across the economy
- REMI can help tell stories