

# Macroeconomic Modeling

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PTAC

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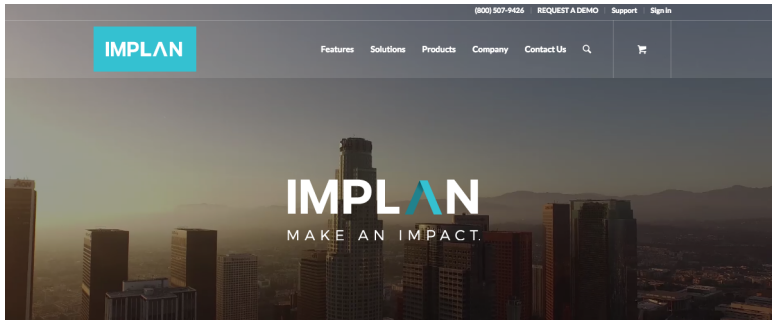
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- As a function of market incentives as well as taxes and subsidies

# The source of data: IMPLAN





# IMPLAN Data-15 Agricultural sectors

Industry Code	Description	Employment	Output	Employee Compensation	Proprietor Income	Other Property Type Income	Tax on Production and Imports
1	Oilseed farming	5.3	\$2,233,767	\$14,205	\$618,972	\$182,455	\$1,477
2	Grain farming	85.3	\$17,428,144	\$372,123	\$1,321,565	\$2,047,645	\$45,429
3	Vegetable and melon farming	23.2	\$2,838,348	\$568,963	\$1,026,021	\$623,616	(\$4,628)
4	Fruit farming	634.4	\$31,788,380	\$9,008,087	\$10,657,824	\$5,842,251	(\$108,202)
5	Tree nut farming	0.9	\$77,627	\$25,517	\$21,600	\$16,037	(\$263)
6	Greenhouse, nursery, and fl...	447.7	\$38,907,619	\$13,163,711	\$9,561,628	\$4,588,951	(\$68,633)
10	All other crop farming	4,534.4	\$154,130,722	\$42,427,078	\$29,319,557	\$16,914,555	(\$411,209)
11	Beef cattle ranching and far...	1,118.4	\$93,570,000	\$2,404,099	\$15,676,780	\$10,381,357	(\$3,788,179)
12	Dairy cattle and milk produc...	2,530.9	\$676,005,005	\$42,311,279	\$140,384,552	\$65,767,632	\$10,093,094
13	Poultry and egg production	105.7	\$44,462,376	\$3,448,658	\$4,832,829	\$1,836,456	\$207,142
14	Animal production, except c...	197.3	\$13,249,627	\$1,418,388	\$4,872,167	\$1,135,541	\$245,185
15	Forestry, forest products, an...	47.7	\$3,031,430	\$219,101	\$923,053	(\$34,253)	\$58,129
16	Commercial logging	1,940.4	\$110,292,633	\$9,581,410	\$34,954,811	(\$984,164)	\$1,979,409
18	Commercial hunting and tra...	91.7	\$2,788,779	\$0	\$572,421	\$0	\$311,337
19	Support activities for agricult...	1,474.0	\$58,137,283	\$17,848,267	\$10,327,865	\$9,893,364	\$729,662

# 359 Non-agricultural sectors

Industry Code	Description	Employment	Output	Labor Income	Total Value Added	Output Per Worker	Labor Income Per Worker
0	Total	428,286.8	\$61,429,761,680	\$20,273,012,861	\$30,596,413,610	\$0	\$0
1	Agriculture	13,237.3	\$1,248,941,741	\$407,882,530	\$535,383,723	\$94,350	\$30,813
2	Mining	1,425.4	\$369,092,781	\$46,834,414	\$241,121,501	\$258,940	\$32,857
3	Construction	30,041.3	\$4,354,450,684	\$1,311,833,612	\$1,428,984,510	\$144,949	\$43,668
4	Manufacturing	34,771.2	\$13,541,968,834	\$2,208,965,006	\$2,706,275,769	\$389,459	\$63,529
5	TIPU	16,703.5	\$4,996,434,215	\$1,059,226,082	\$2,062,054,475	\$299,124	\$63,413
6	Trade	54,695.4	\$5,845,345,749	\$2,191,767,244	\$3,659,147,949	\$106,871	\$40,072
7	Service	220,940.8	\$26,339,550,254	\$9,262,229,739	\$15,462,150,540	\$119,215	\$41,922
8	Government	56,471.9	\$4,733,977,423	\$3,784,274,234	\$4,501,295,145	\$83,829	\$67,012

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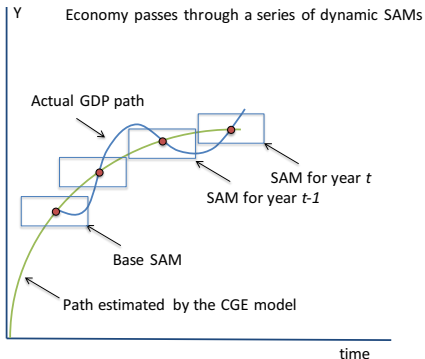
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# SAM based Computable General Equilibrium Models

- Social Accounting Matrix SAM as data base
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- Wide variety of assumptions on how out of equilibrium adjustment takes place
- **Limited appeal to dynamic optimization as in DSGE**

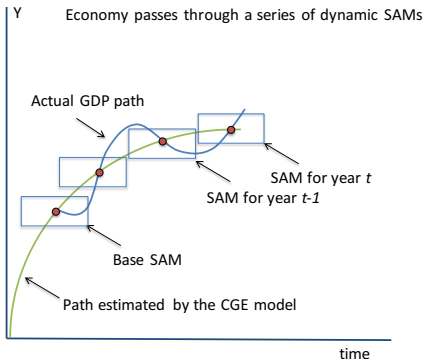
# Dynamic CGEs

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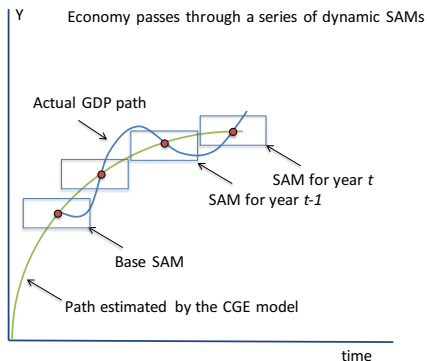
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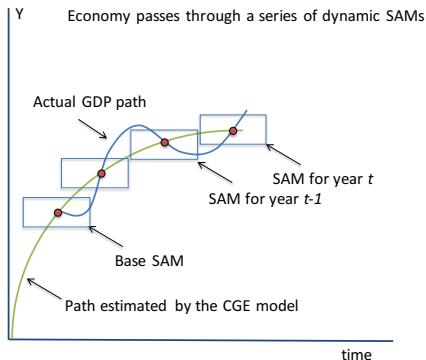
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- **Must account for tech change and productivity growth**



# Model in Excel and GAMS

0 1.86266766

producer prices

Activities	Activities			Firms			C	I	G	ED	EF	Total
	Agp	Fst	Dev	Ag	Fst	Dev						
Ag				832.3	19.7	2.4						854
Fst				0.0	150.4	0.0						150
Dev				0.0	0.0	36414.7						36415
Ag	131.1	2.0	444.3				72	5	4	344	28	1030
Fst	61.9	41.5	123.6				30	0	2	31	10	280
Dev	309.1	33.7	16568.1				16191	5132	4432	15634	1823	60342
VA	352.2	73.1	19258.7									19684
wages	76.9	17.8	11613.5									11708
dividends	261.7	52.3	6105.3									6419
transfers							515	3199	3053	138		6904
savings							4458		1631	3950	2076	12115
Indirect taxes							1406					1406
Taxes	13.6	3.0	1539.9				2380	3779	5252			12967
payroll tax	9.4	2.2	1423.5									1435
corporate taxes	4.2	0.8	116.4									121
Imp-D				147	53	19897						20096
Imp-P				51	57	3829						3937
Total	854	150	36415	1030	280	60142	25032	12115	14373	20096	3937	0

Firm parameters			M4 parameters			Phosphorus			SE	
Tax rates			direct tax rate	t_h	0.10	\$/m clarity	16.80			
payroll taxes	0.12	0.12	0.12			m clarity/phos	-23.44	4.78	P coef.	
corporate	0.016	0.016	0.019	Frisch:	1.50	Initial P	48.71	0.37		
GOS	275.3	55.3	7645.2	LES intercepts:	theta_1	24.04				
capital share (beta)	0.781643748	0.756142771	0.39697397		theta_2	3.50	Land use			
wage rate (w)	1	1	1		theta_3	5396.9	Ag	Developed	Forest	Total P
mark-up (tau)	0.45	0.55	0.21	marginal prop	m_1	0.0044	18.73	4.16	77.11	1
indirect tax rate (tauD)	-0.0471	0.1806	0.0869	to consume	m_2	0.0006	2.43	9.978	0.16	0.9935998
labor coefficient (l)	0.09	0.12	0.32		m_3	0.9949				
prime costs (cst)	0.688777532	0.65	0.83		s_h	0.1968				
depreciation (dep)	0.035	0.035	0.035		tr_I	0.6227				

# Dual role for investment

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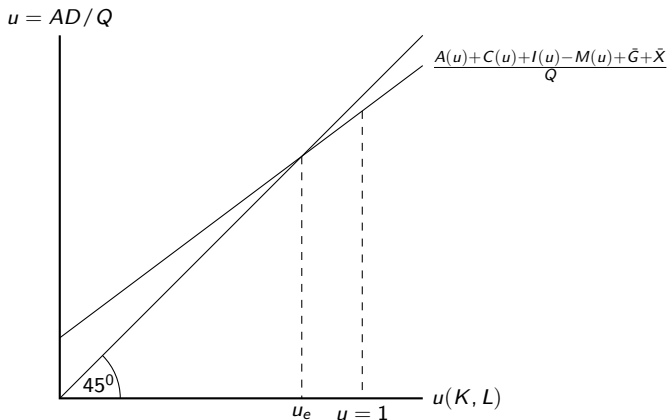
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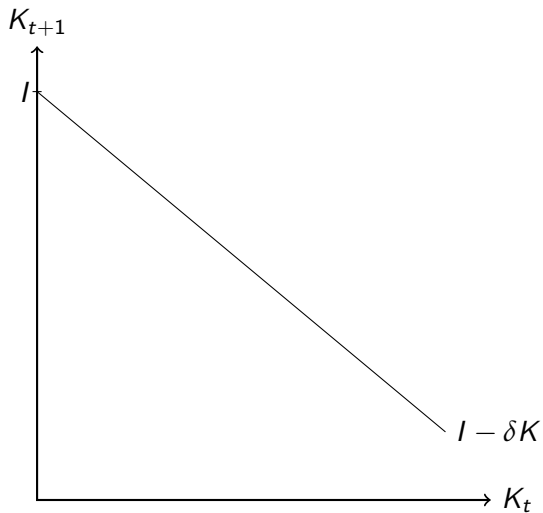
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- This is the basic approach

# Equilibrium in the short run



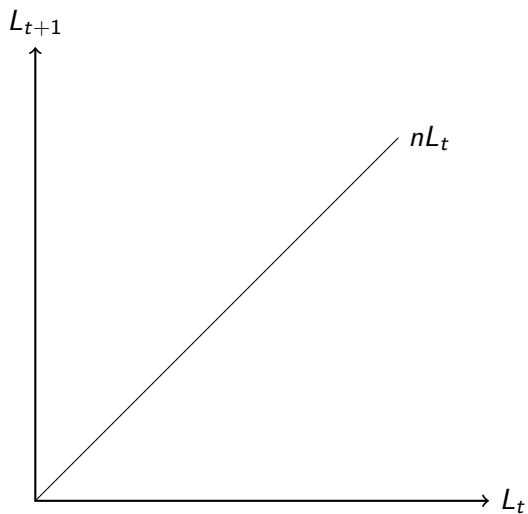
$A =$  intermediates,  $C =$  consumption,  $I =$  investment,  $M =$  imports,  $G =$  govt,  $X =$  exports,  $Q =$  capacity,  $AD =$  demand

# Change in capital



$K = \text{capitalstock}$

# Change in labor



$L = \text{labor}$

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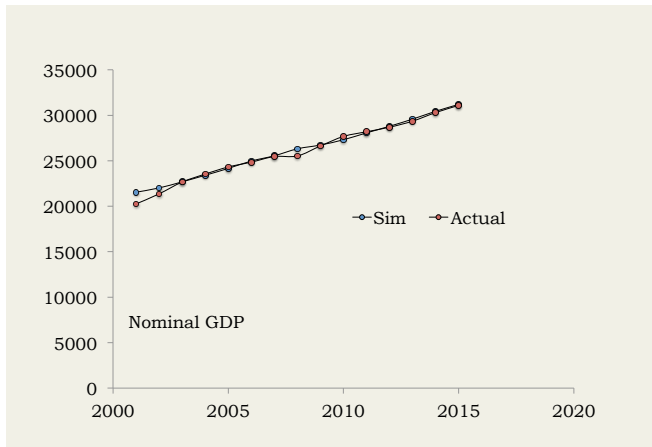
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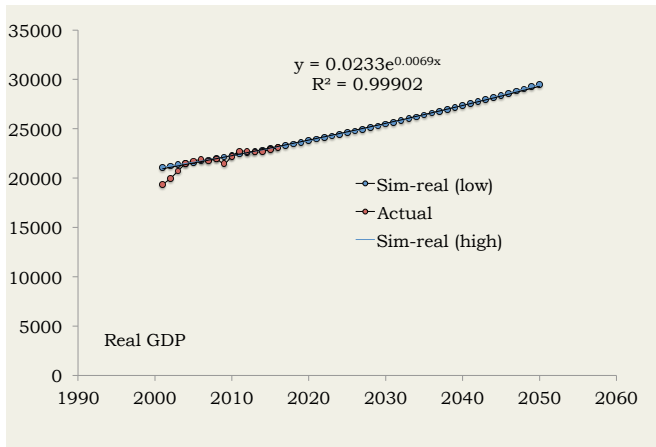
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- Until  $u$  is stationary

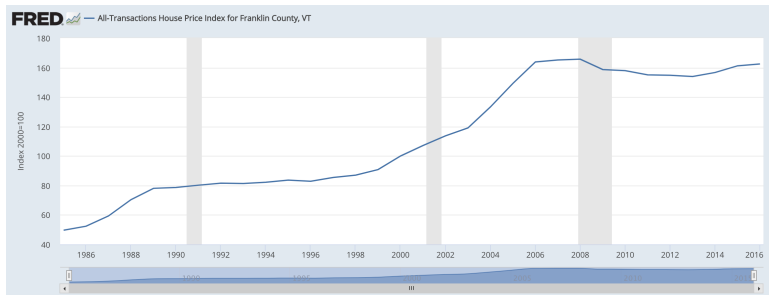
# Nominal GDP in Vermont



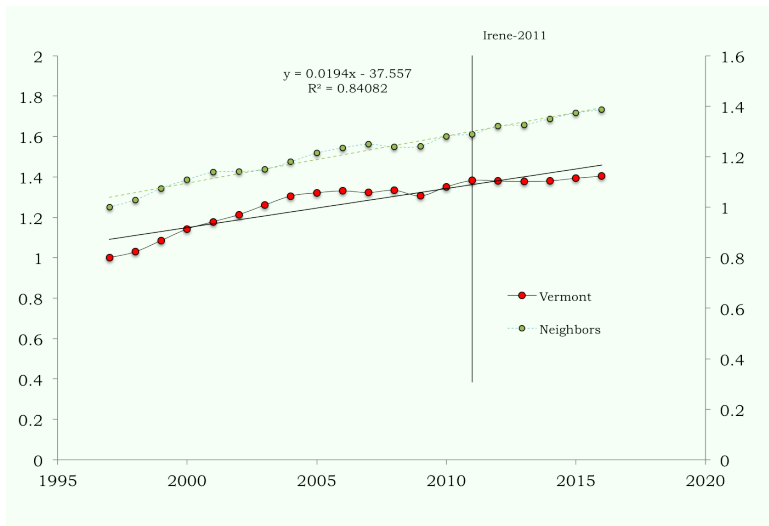
# Real GDP in Vermont



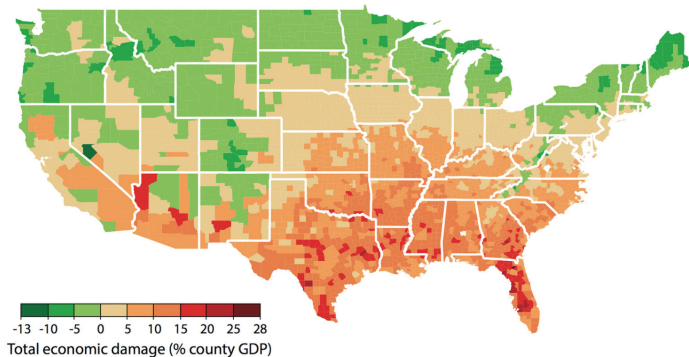
# House Prices in Franklin County



# Impact of Irene



# Economic impacts of Global Warming



Potential economic damages are shown at the county level in a scenario in which emissions of greenhouse gases continue at current rates. Green indicates areas that could see economic benefits. To see an interactive version of this map, [click here](#).

*Hsiang, Kopp, Jina, Rising, et al./Science*

# Scaling laws and Climate Change

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- Scaling laws are key to understanding the impact

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- Scales superlinearly

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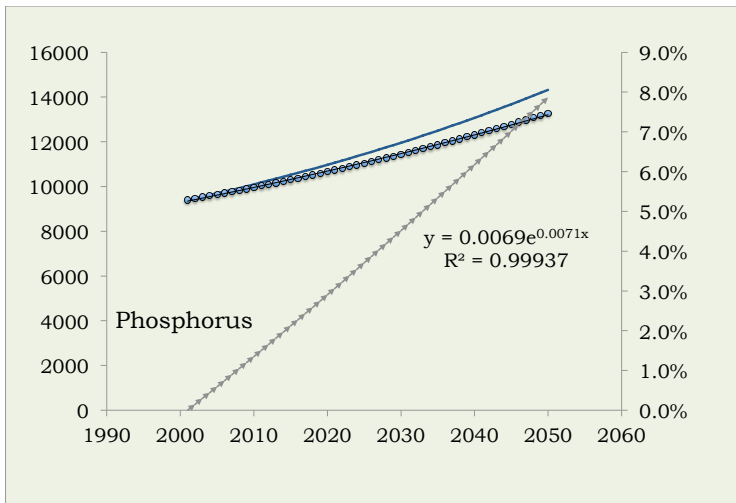
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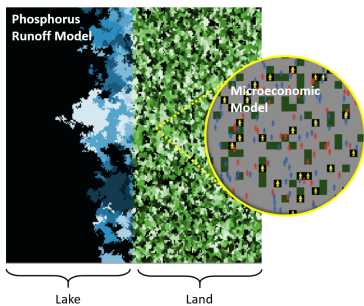
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# Phosphorus





Thank you!

*Questions, suggestions?*