# Economic analysis

Matt Bhagat-Conway

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

# Planning and economic development

- Economic development is often a justification for planning activities
  - Employment, retail sales, tax base increases
- Economies are complex, linked, and have many feedback loops, so analyzing them can be challenging

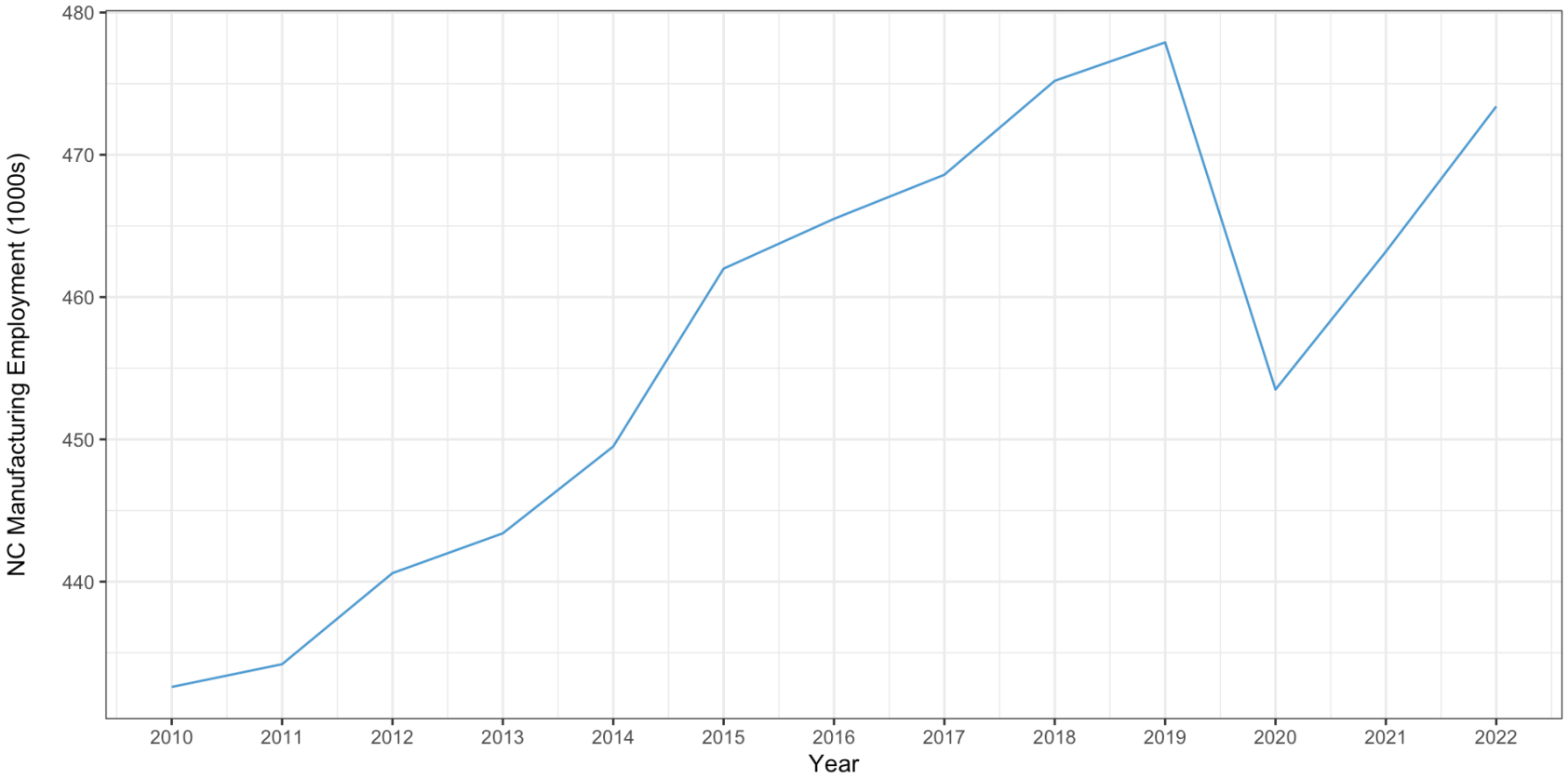
# Shift-share analysis

- Regional employment growth by industry can be divided into three components
  - National share: growth attibutable to the overall level of growth across all industries nationally
  - Industry mix: excess growth or decline in a particular industry nationally
  - Regional shift: excess growth or decline in a particular industry in this region

# A shift-share analysis

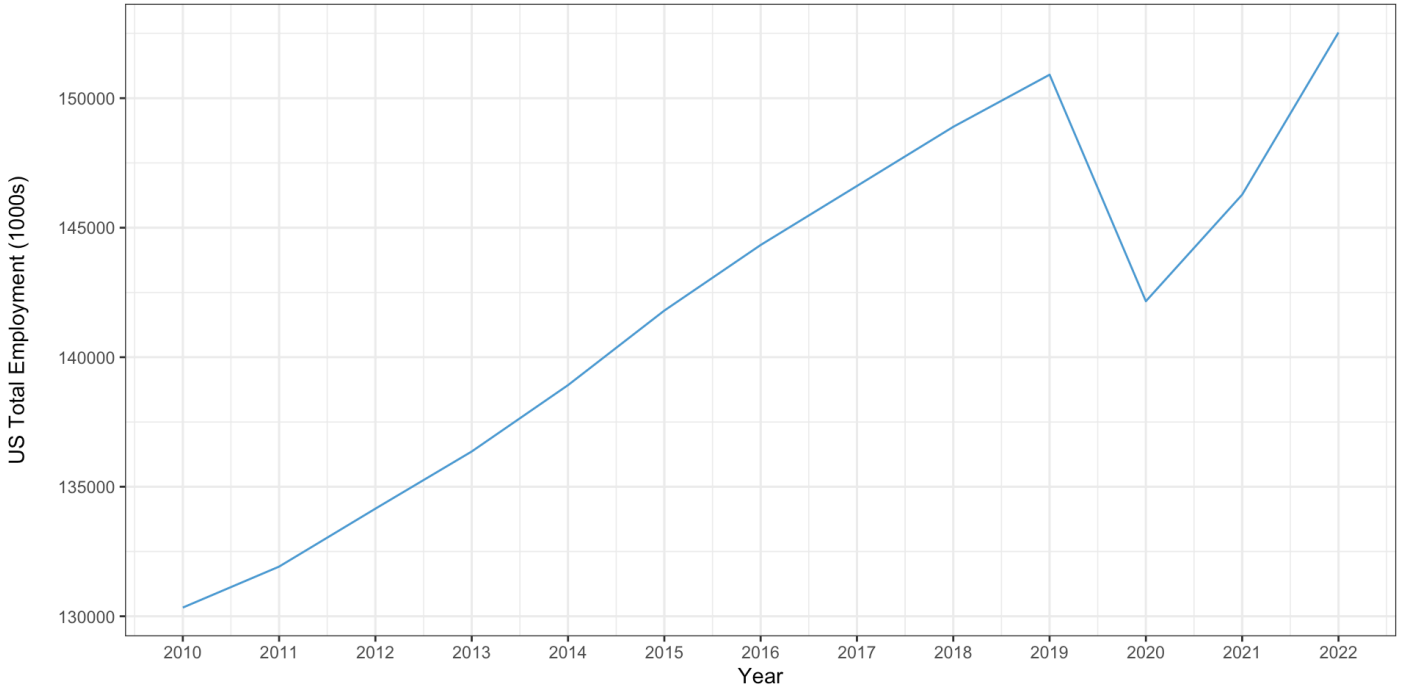
- Let’s analyze the growth of the manufacturing industry in North Carolina since 2010
- All the data we’re using here comes from FRED

# NC Manufacturing employment since 2010




- In 2010, total NC manufacturing employment was 433,000
- In 2022, it was 474,000
- The growth was 41,000 jobs or 9.5%

# Breaking it down: national share



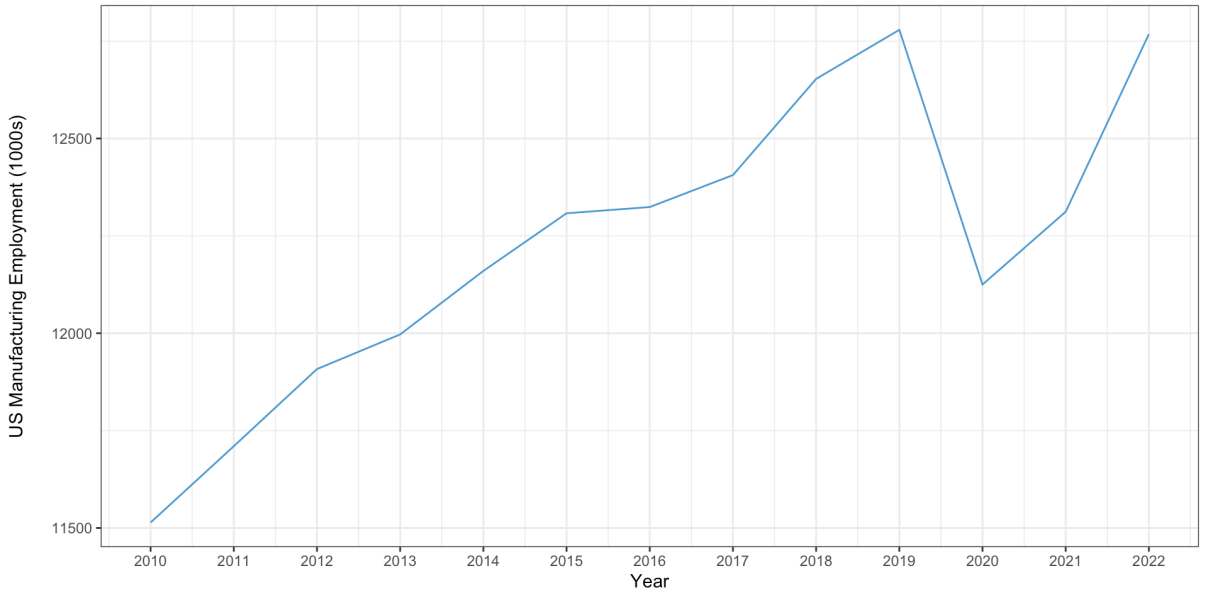
# The industry mix

- Also known as “competitive share”
- Manufacturing has been declining in the US overall for some time
- The industry mix accounts for differences between the industry’s national growth rate and the national growth rate overall
- It is calculated as the national industry growth rate minus the national all-jobs growth rate, multiplied by the original employment, i.e.

$$(G_{ind} - G_{all}) \times e_{ind,t=1}$$

where $G_{ind}$ is the national growth rate of employment in this industry, $G_{all}$ is the growth rate of national employment overall, and $e_{ind,t=1}$ is employment in this industry at the start of the period

# Calculating the industry mix



# The influence of national trends

- If NC had followed national trends for manufacturing growth, it would have added 73,610 + -25,980 = 47,630 manufacturing jobs
- It actually added 41,000
- The rest is due to regional trends

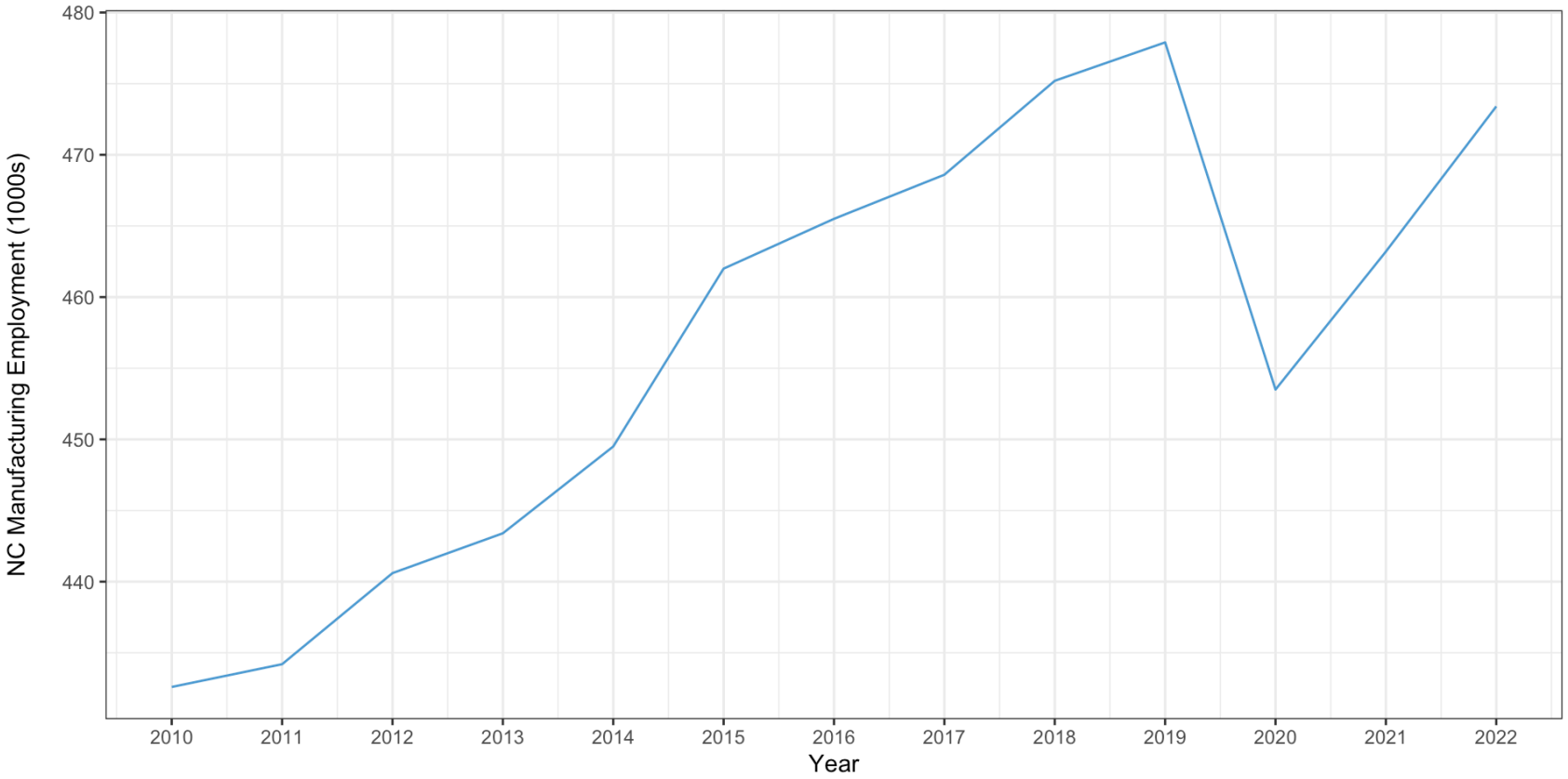
# Regional shift

- This measures the regional part of employment growth
- Is is calculated as the local growth rate of the industry minus the national growth rate, times the original employment in the industry

$$(g_{ind} - G_{ind}) \times e_{ind,t=1}$$

where $g_{ind}$ is the growth rate of the industry *in the region*.

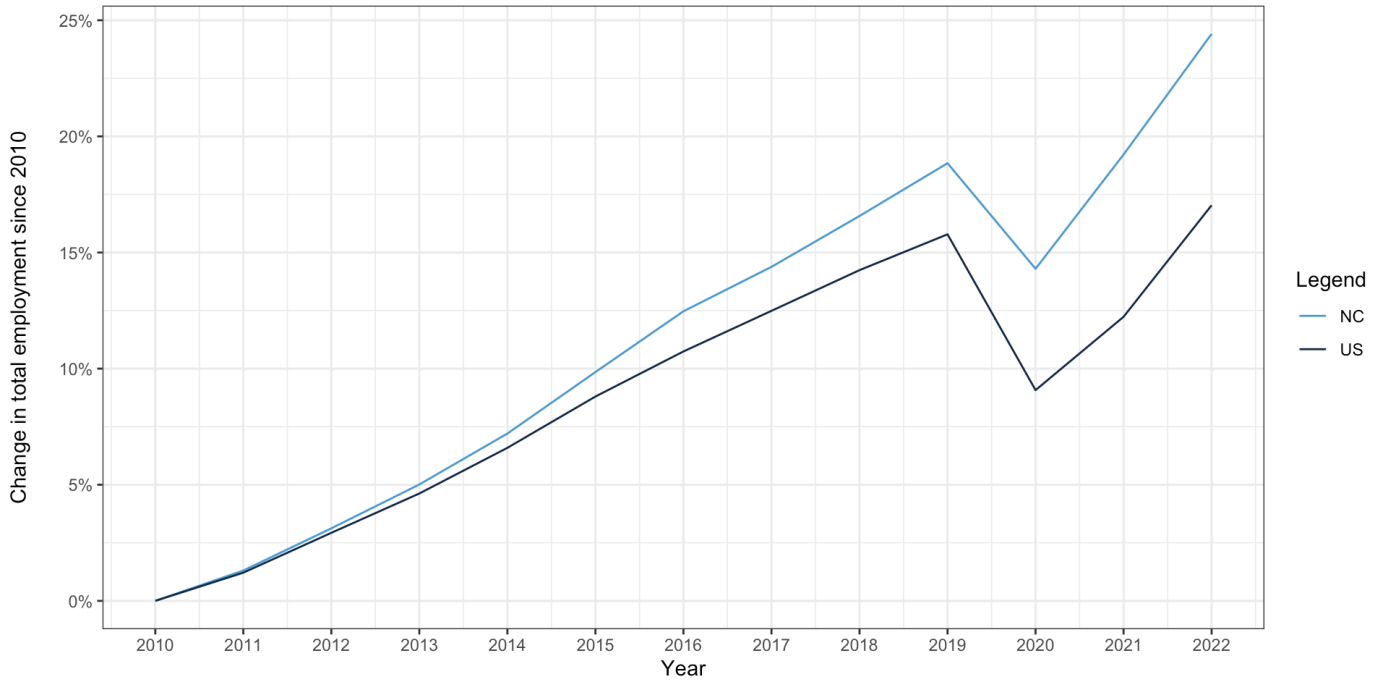
# Calculating regional shift



# Putting it all together: shift-share for NC manufacturing

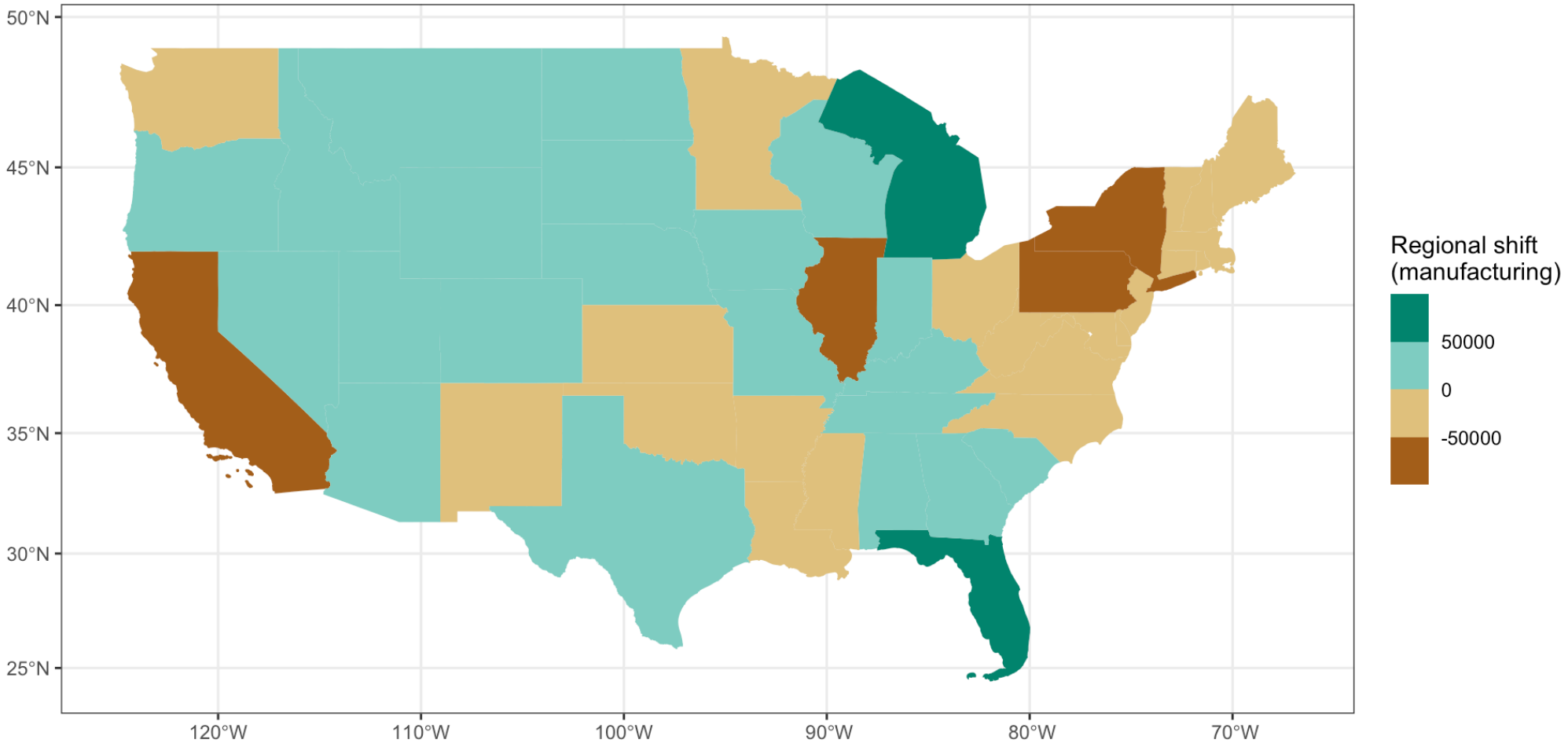
# Interpreting shift-share

# What if the region overall is growing faster than the national average?



# Where does manufacturing have a positive regional shift?

- I initially suspected NC would have a positive regional shift for manufacturing



# Economic base theory

# The role of basic and non-basic employment

- Clearly, we need both types of employment
- But basic employment plays a special role, as it increases overall wealth
- Investments to increase basic employment increase the economic well-being of a region

# The base multiplier

- An additional basic job will spur the creation of additional non-basic jobs
- The base multiplier is the ratio of non-basic to basic employment in a region
- It is assumed that an additional basic job will lead to this many total new jobs
- When you see analysis that says something like “this new investment will directly support 1000 jobs and indirectly support 800 more,” this is what they’re doing

# The location quotient

# Calculating the location quotient

# The location quotient in terms of jobs

# Problems with the location quotient

- It doesn't account for local conditions
- For instance, there are a lot more snowplow operators in Wisconsin than Florida
  - And this has nothing to do with export of snow removal services from Wisconsin to Florida

# Deriving base multipliers from location quotients

# Input-output models

- The other tool commonly used for economic impact analysis is an *input-output model*
- In the US, the IMPLAN software is ubiquitous, so you may also see this referred to as an IMPLAN model

# Input-output models: theory

- Every industry produces some level of output
- Three things can happen to those outputs
  - They can be purchased by consumers
  - They can be exported
  - They can be used as inputs to other industries
    - This is the key insight behind the input-output model

# Input-output models

- The output of each industry is the sum of demands from consumers, exports, and demands from other industries
- So, for each industry, we have a function like this (using notation from *Miller and Blair (2009)*)

$$x_i = z_{i1} + z_{i2} + \cdots + z_{ij} + f_i$$

where

- $x_i$ is the output of industry $i$ (usually in dollars)
- $z_{ij}$ is the amount of industry $i$'s goods demanded by industry $j$, and
- $f_i$ is the *final demand* for the output of industry $i$ (consumer demand + exports)

# Input-output matrix

- We can put these functions into a matrix for every industry, showing all interindustry relationships

$$
\begin{aligned}
x_1 &= z_{11} + z_{12} + \cdots + z_{1n} + f_1 \\
x_2 &= z_{21} + z_{22} + \cdots + z_{2n} + f_2 \\
&\vdots \\
x_n &= z_{n1} + z_{n2} + \cdots + z_{nn} + f_n
\end{aligned}
$$

- The rows are the total outputs of each industry as a function of the demand from other industries and consumers
- What about the columns?

# Interpreting input-output matrices

- The columns are the *inputs* to each industry
- If we sum up a column of $z$ s, we get the total value of inputs to that sector to produce a given output
- Remember these are all in dollars
- Are the outputs of an industry equal to the inputs in dollar value?

# Payments

# The full input-output model

- We can add terms for these, and create the full input-output model

$$
\begin{array}{cccccc|c}
z_{11} & z_{12} & \cdots & z_{1n} & f_1 & & x_1 \\
z_{21} & z_{22} & \cdots & z_{2n} & f_2 & & x_2 \\
\vdots & \vdots & \ddots & \vdots & \vdots & & \vdots \\
z_{n1} & z_{n2} & \cdots & z_{nn} & f_n & & x_n \\
l_1 & l_2 & \cdots & l_n & & & \\
n_1 & n_2 & \cdots & n_n & & & \\
m_1 & m_2 & \cdots & m_n & & & \\
\hline
x_1 & x_2 & \cdots & x_n & & &
\end{array}
$$

where

- $l_i$ is the labor input to industry $i$
- $n_i$ is other payments (rent, profit, etc.)
- $m_i$ is imports

# Using the input-output model

- We can add terms for these, and create the full input-output model

$$
\begin{array}{cccccc|c}
z_{11} & z_{12} & \cdots & z_{1n} & f_1 & & x_1 \\
z_{21} & z_{22} & \cdots & z_{2n} & f_2 & & x_2 \\
\vdots & \vdots & \ddots & \vdots & \vdots & & \vdots \\
z_{n1} & z_{n2} & \cdots & z_{nn} & f_n & & x_n \\
l_1 & l_2 & \cdots & l_n & & & \\
n_1 & n_2 & \cdots & n_n & & & \\
m_1 & m_2 & \cdots & m_n & & & \\
\hline
x_1 & x_2 & \cdots & x_n & & &
\end{array}
$$

- Summing rows gives us total outputs
- Summing columns gives us total inputs
- The outputs of industry $i$ are equal to its inputs

# Applications of the input-output model

# Economic development and investment

> As North American cities vie for the chance to be chosen by Amazon as the home of its second headquarters, one Georgia city has stepped up to the plate. The city council of Stonecrest, Georgia voted 4 to 2 on Monday to change its name to Amazon, Georgia and give the company 345 acres of land if Amazon selects it as the HQ destination, according to local media.

Shannon Liao/The Verge

# Analyzing economic development and investment

# Pareto improvements

# References

Crompton, John L. 2006. “Economic Impact Studies: Instruments for Political Shenanigans?” *Journal of Travel Research* 45 (1): 67–82. https://doi.org/10.1177/0047287506288870.

Miller, Ronald E., and Peter D. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*. 2nd ed. Cambridge [England] ; New York: Cambridge University Press.

O’Flaherty, Brendan. 2005. *City Economics*. Cambridge, MA: Harvard University Press. https://doi.org/10.4159/9780674041615.