

## Client

Dr. Barry Nussbaum of the USEPA

## Background & Goals

- Over the past decade, toxic releases in the United States have been steadily decreasing
- The United States has also seen a major economic downturn
- Goal: Develop a statistical model using major economic measures as predictors for toxic chemical releases
- Get a good idea of how the economy is impacting toxic releases
- Focus on the furniture industry in North Carolina

## Making the Dataset

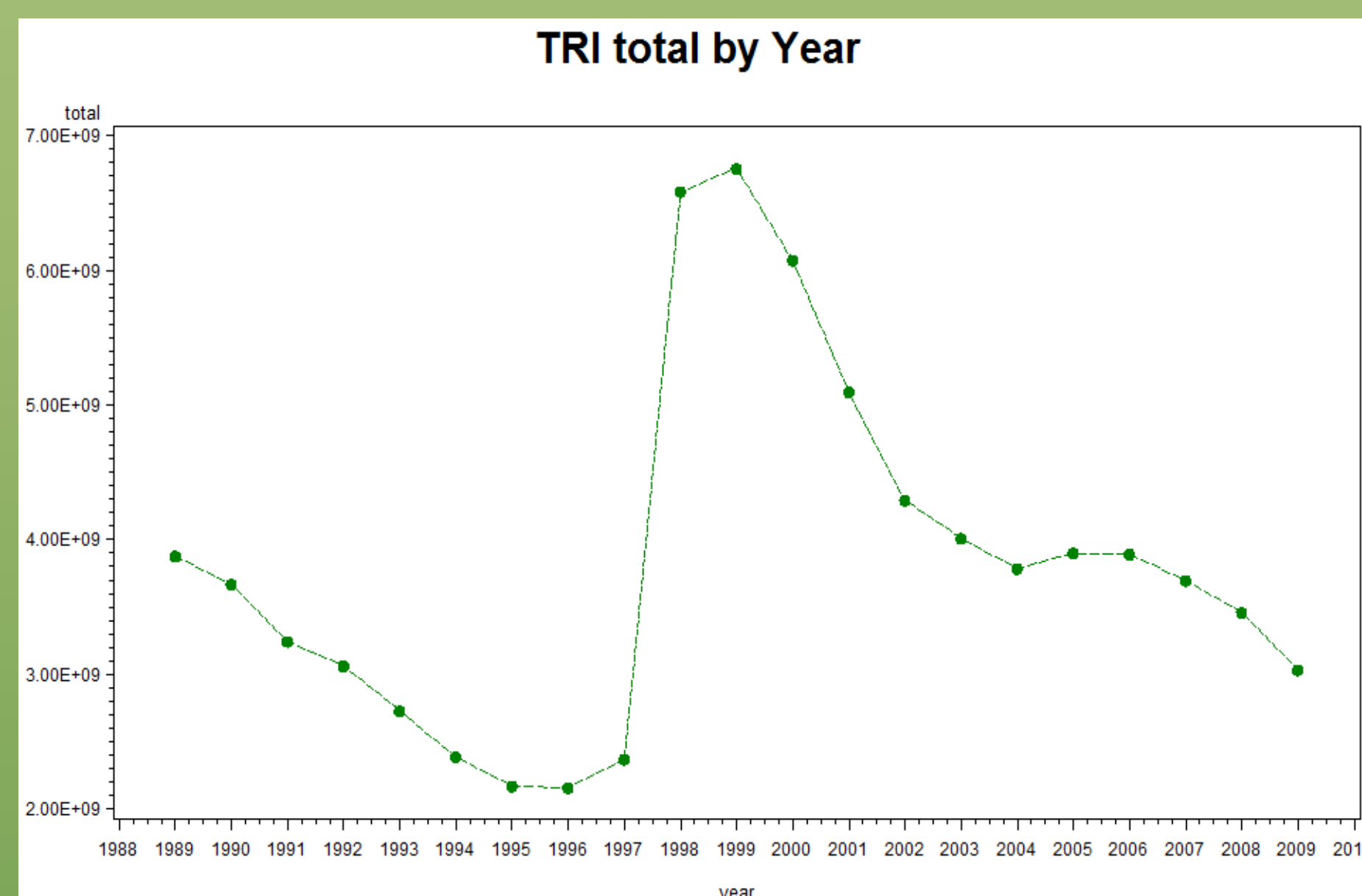
### Toxic Release Inventory Data

- Using the program 'TRI Explorer'
- TRI On-site and Off-site Reported Disposed of or Otherwise Released (in pounds), for All industries, for All chemicals in U.S.
- TRI data from 1989 to 2009

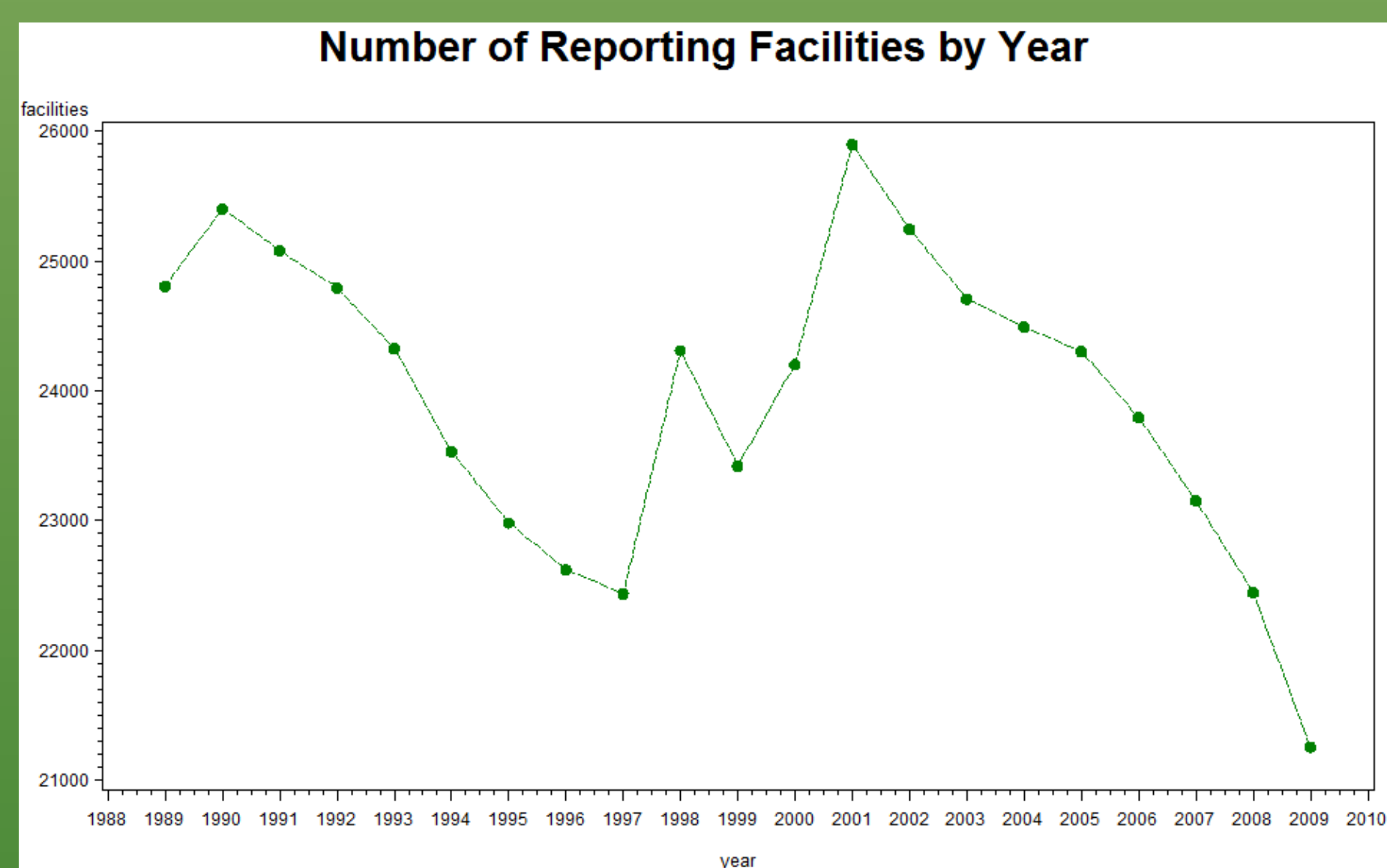
### Economic Data

- GDP (gross domestic product in thousands of dollars)
- CPI (consumer product index)
- Exchange Rate (Trade Weighted Exchange Index=how the US dollar compares to the value of other major currencies)
- Unemployment Rate
- Number of Reported Facilities

## Trends Over Years



There is major increase in 1998 due to the addition of the Mining Industry.



There was an increase in the number of reporting facilities in 1998, but number of facilities reporting did not peak until 2001. However, 2001 showed a decrease in toxic releases.

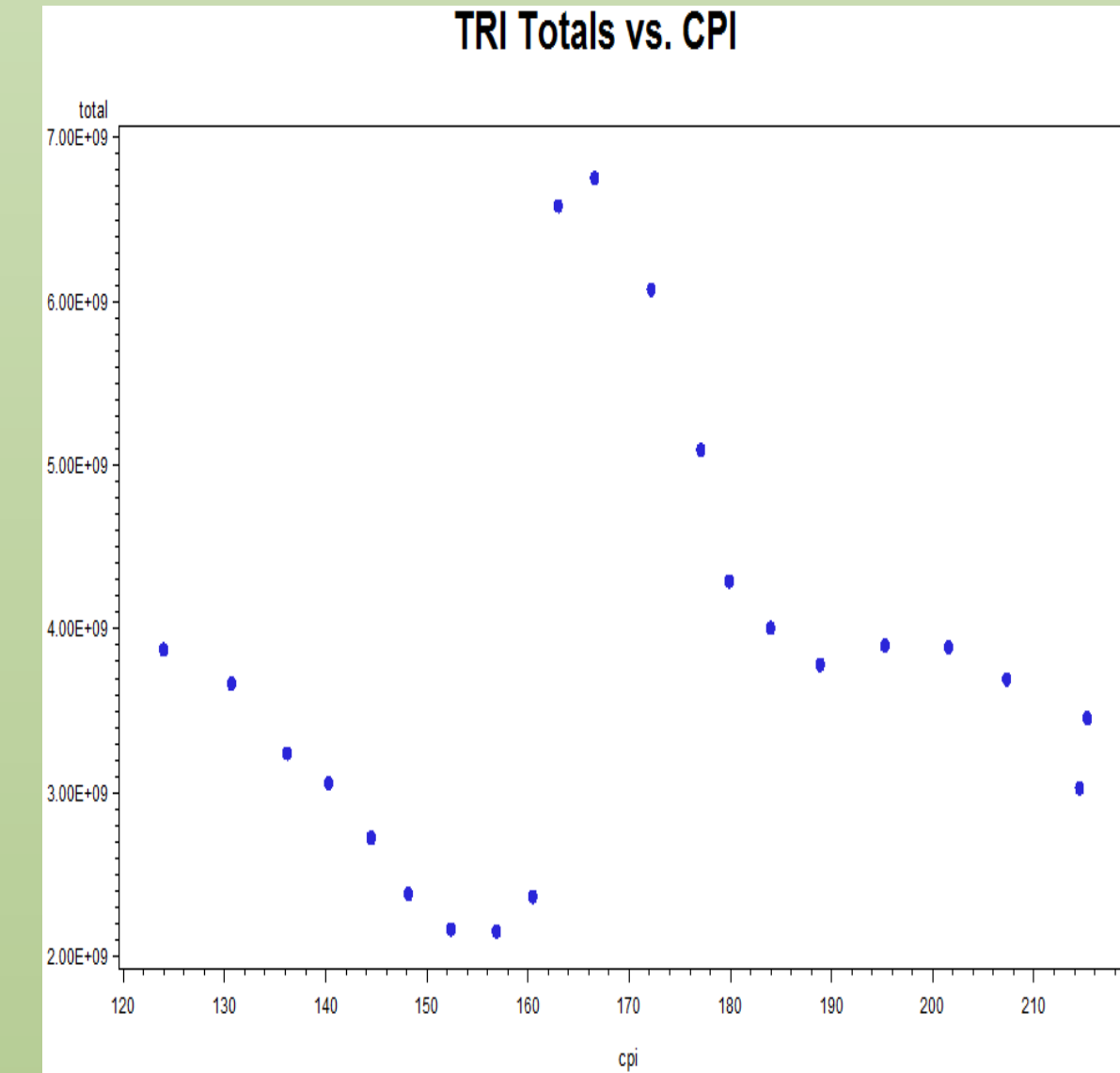
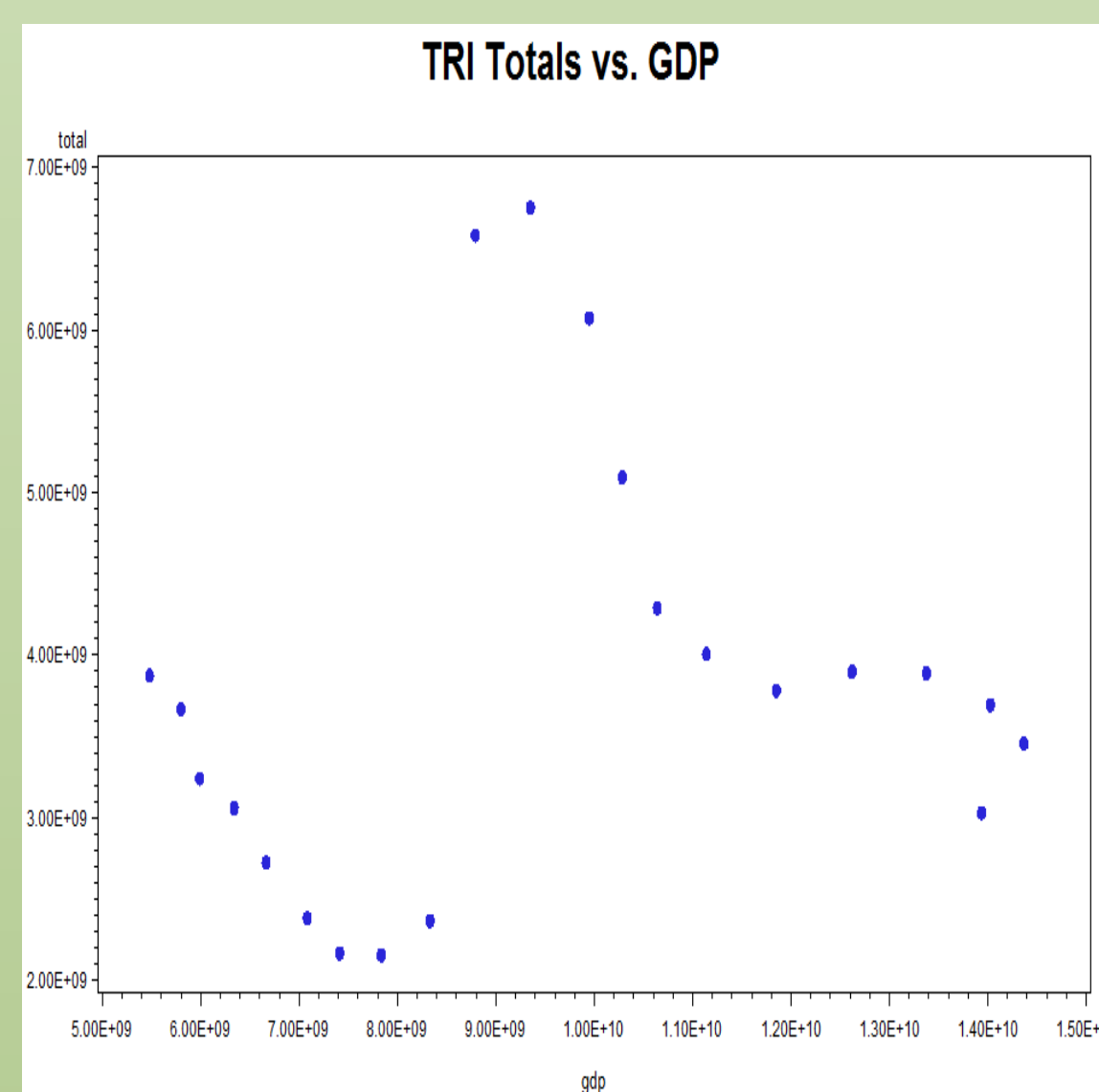
## Regression Analysis Models

- Used stepwise regression
- Total Emissions=  $B_0 + B_1 * GDP + B_2 * CPI + B_3 * Exchange Rate$
- F-Value: 7.31
- Adjusted R-Square= .49

# Analyzing the Release of Toxic Chemicals Over Time: Is It Economy or Environment?

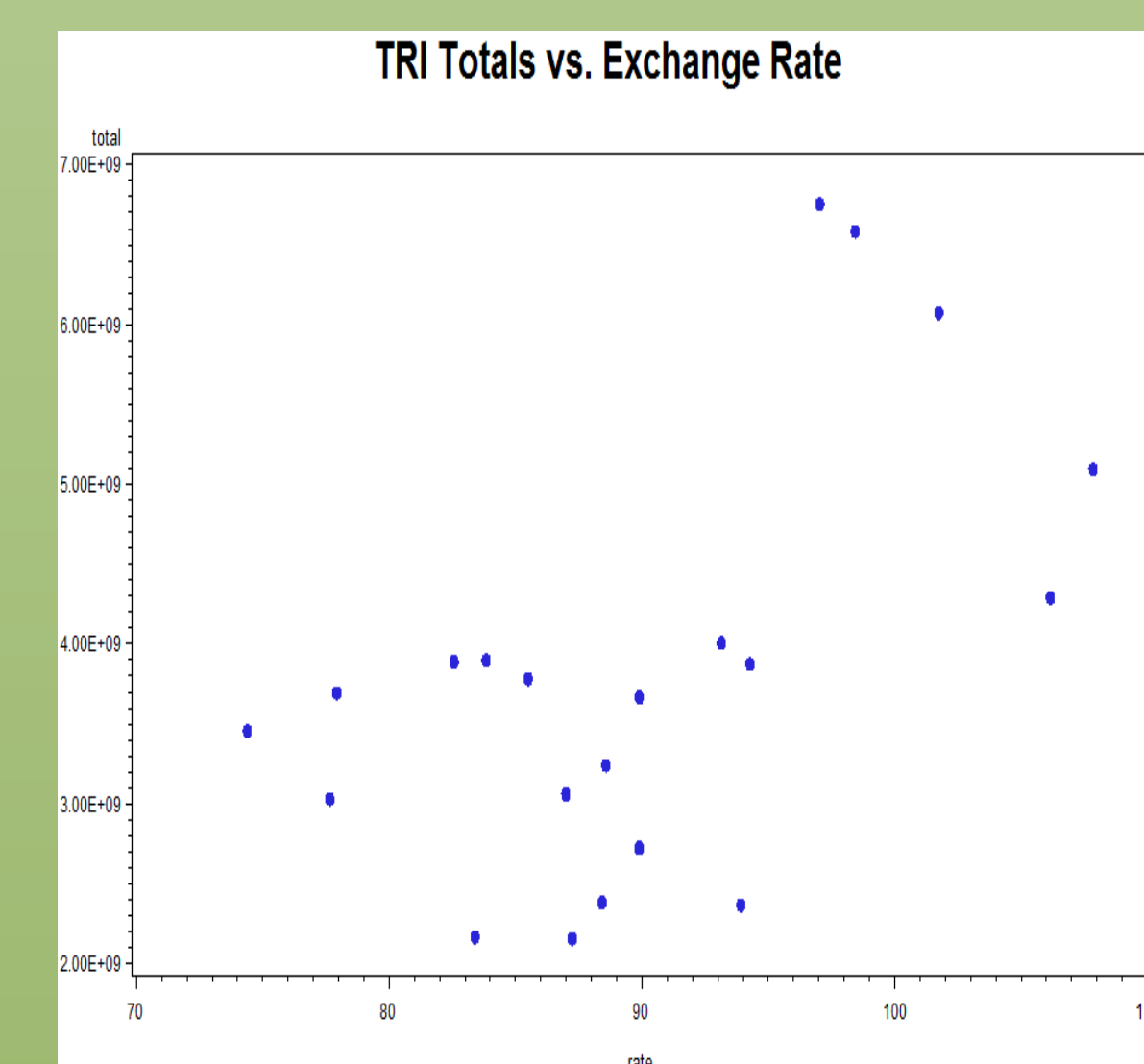
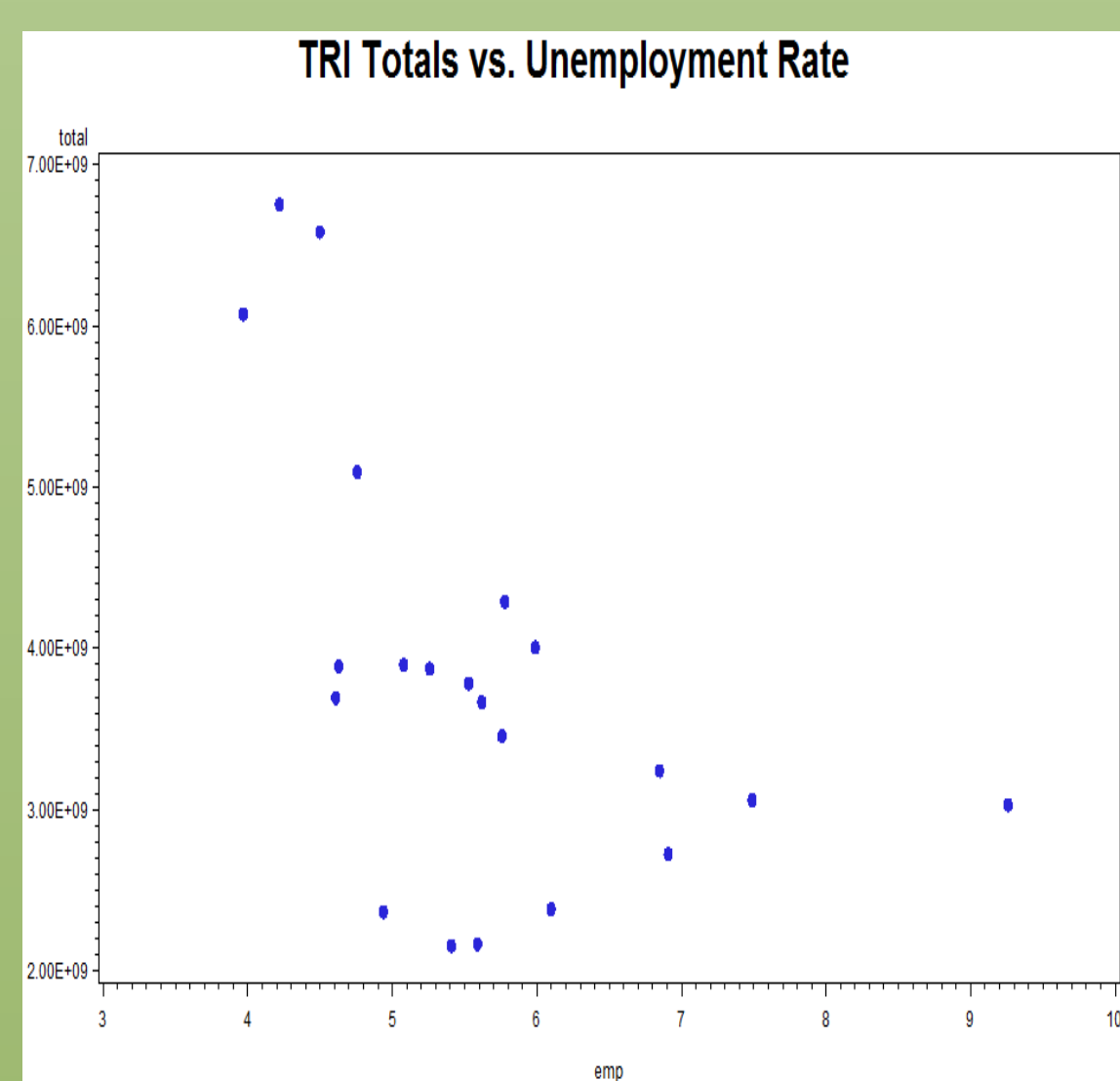
Amanda English, Bomin Kim, James Wrenn, Scott James

## TRI Total vs. Economic Variables



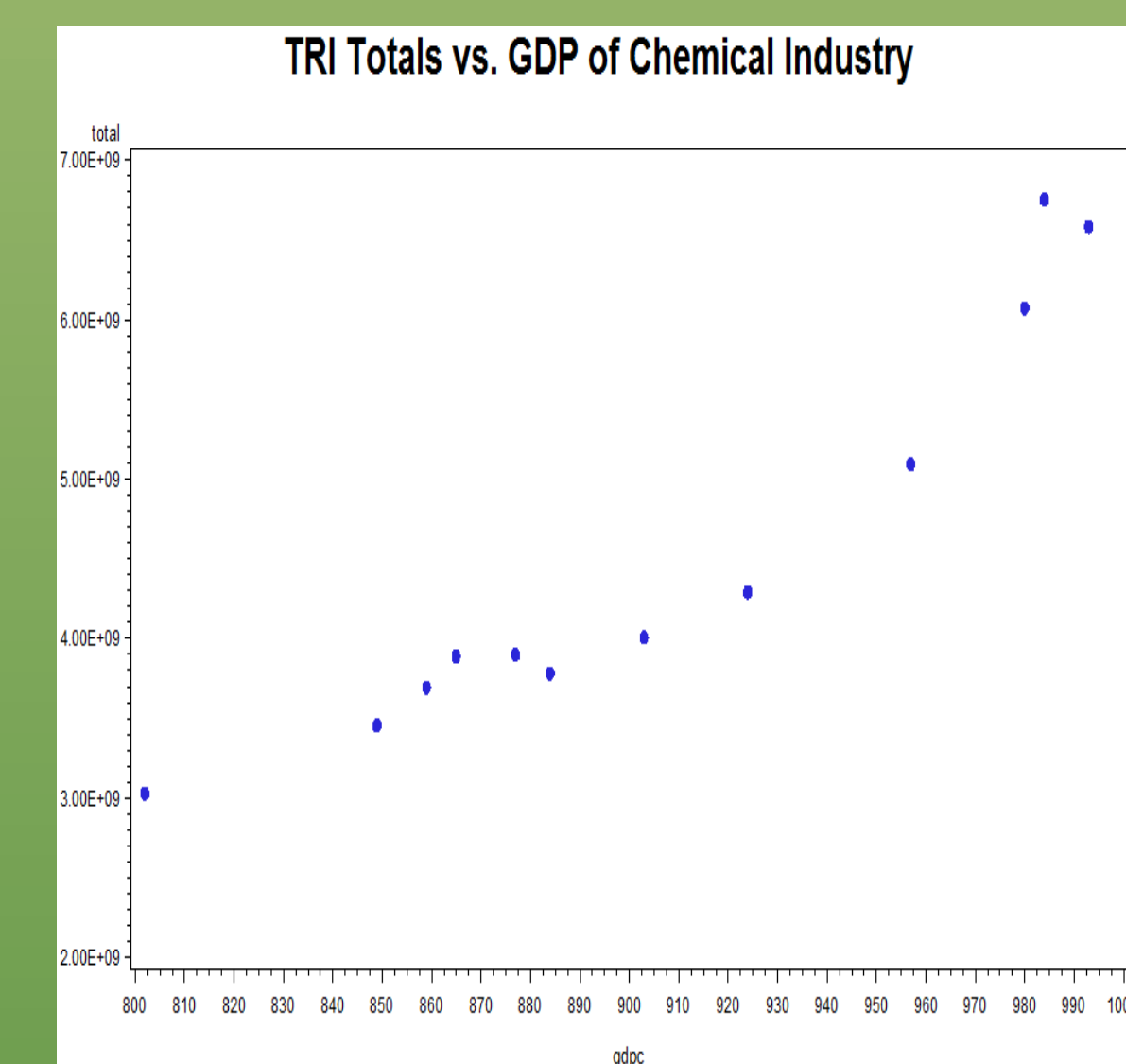
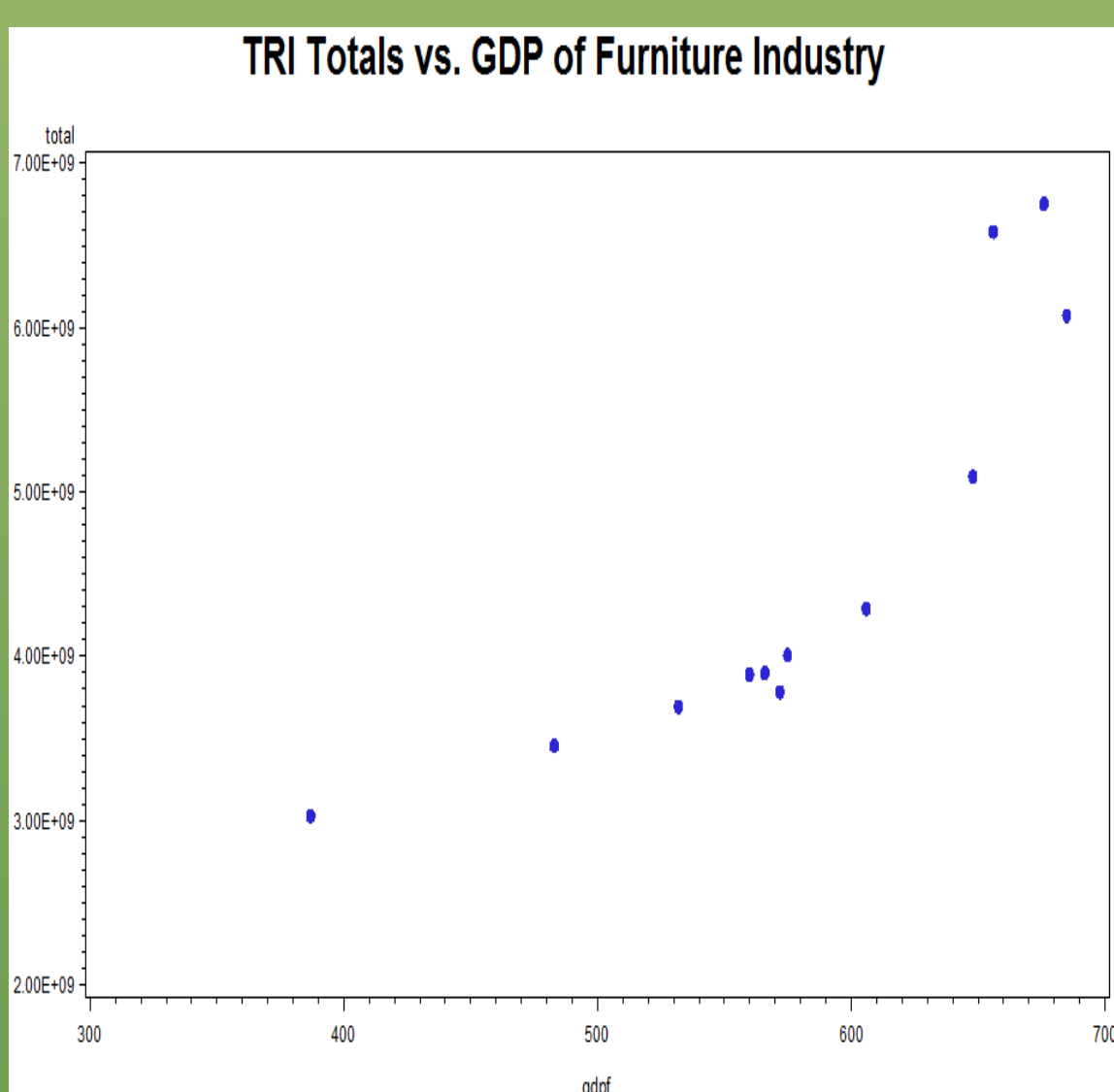
Look familiar?

GDP is highly correlated with year and not very significant in our model.  
CPI also appears to be highly correlated with year.



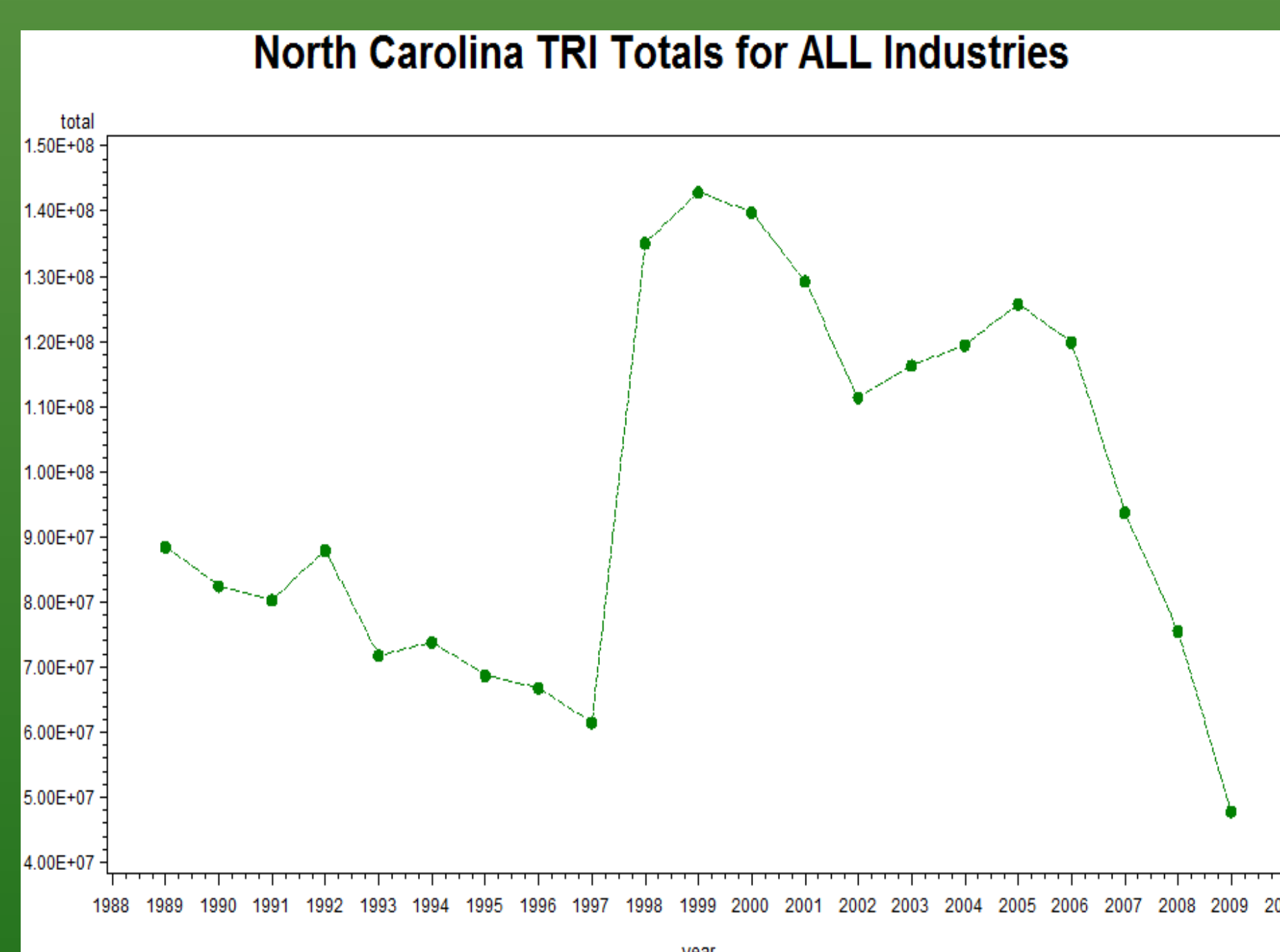
TRI total and unemployment rate appears to be slight correlation, but no clear pattern.

TRI total and exchange rate shows a slightly positive correlation if anything.



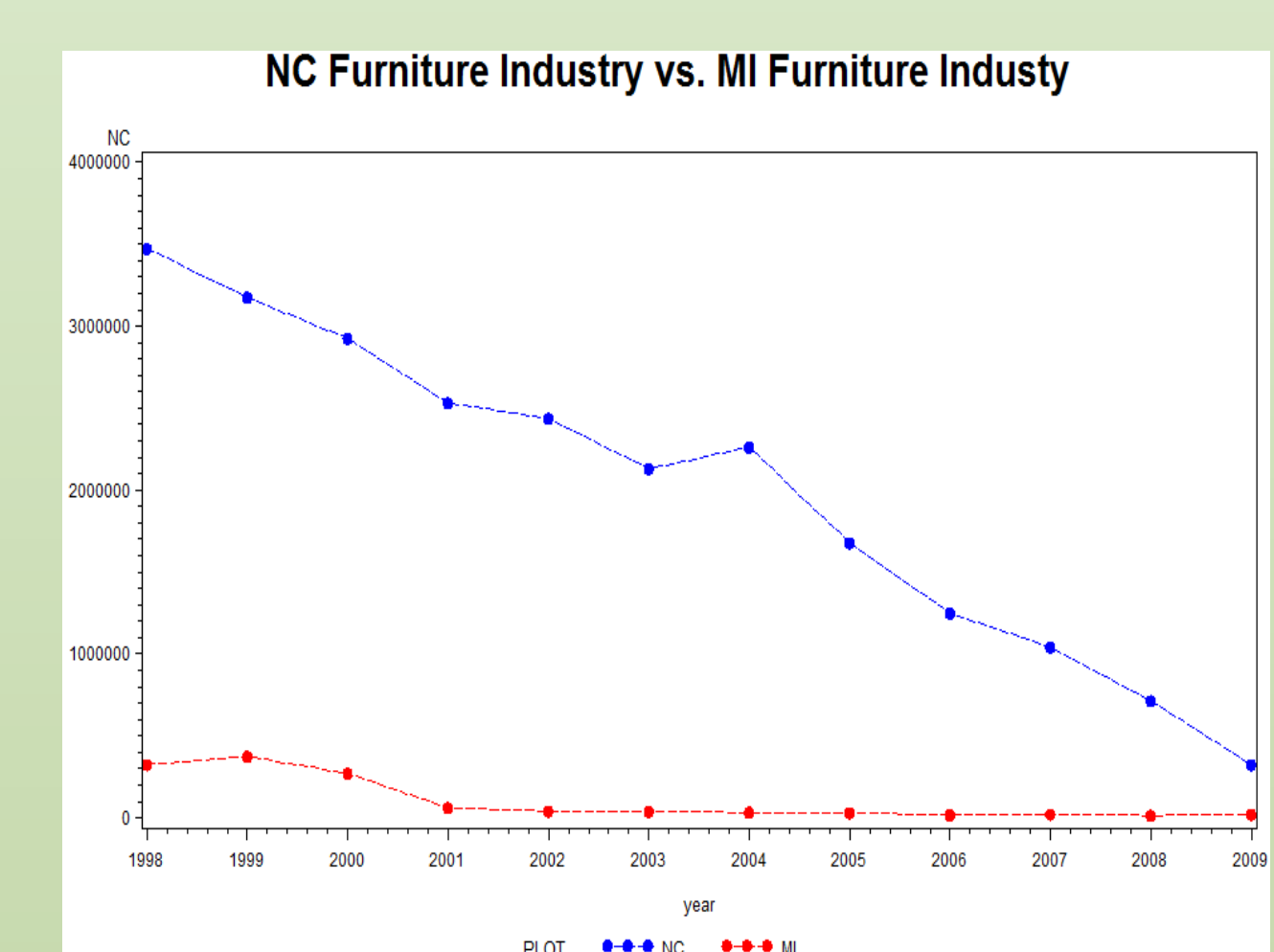
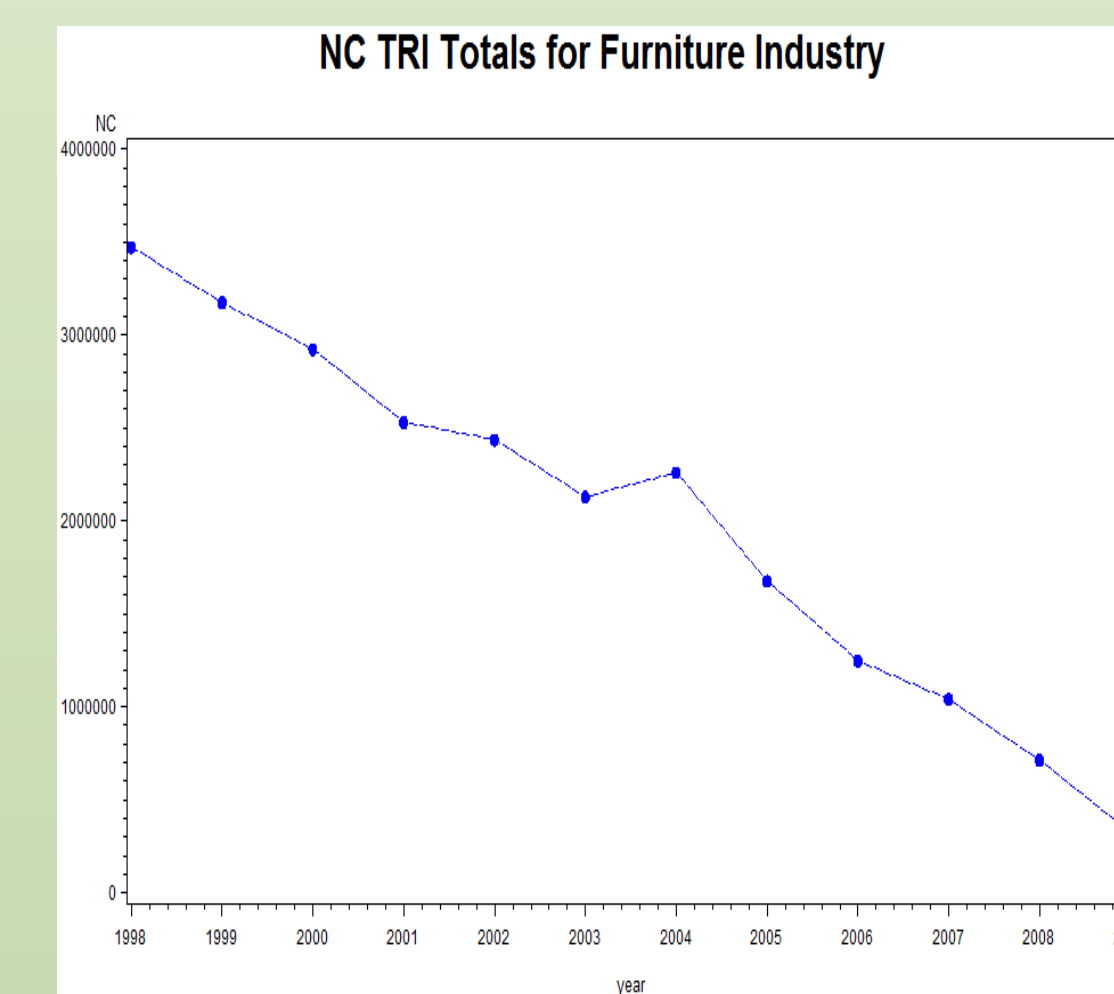
Not only does this reveal a strong positive correlation, but there also appears to be a fairly clear pattern! There appears to be a strong positive relationship between GDP-furniture industry and GDP-Chemical Producing Industries versus the total amount of chemical releases.

## Looking at North Carolina



North Carolina's total TRI emissions follow roughly the same pattern as the nation's emissions. However, NC shows a sharper decrease in the past few years.

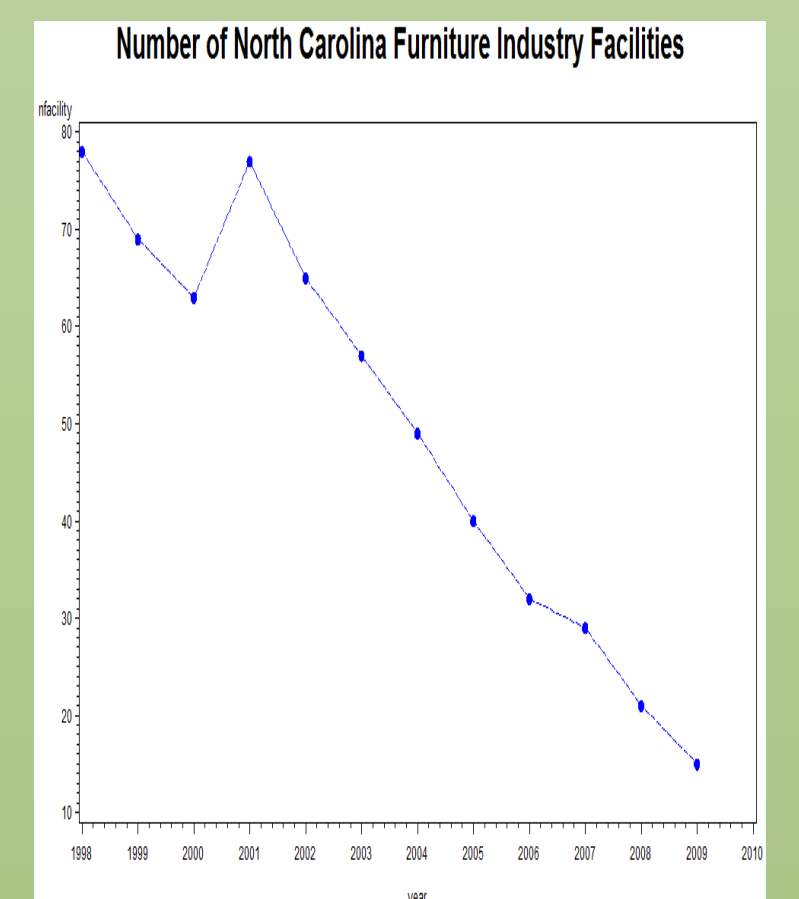
## North Carolina vs. Michigan Furniture Industry



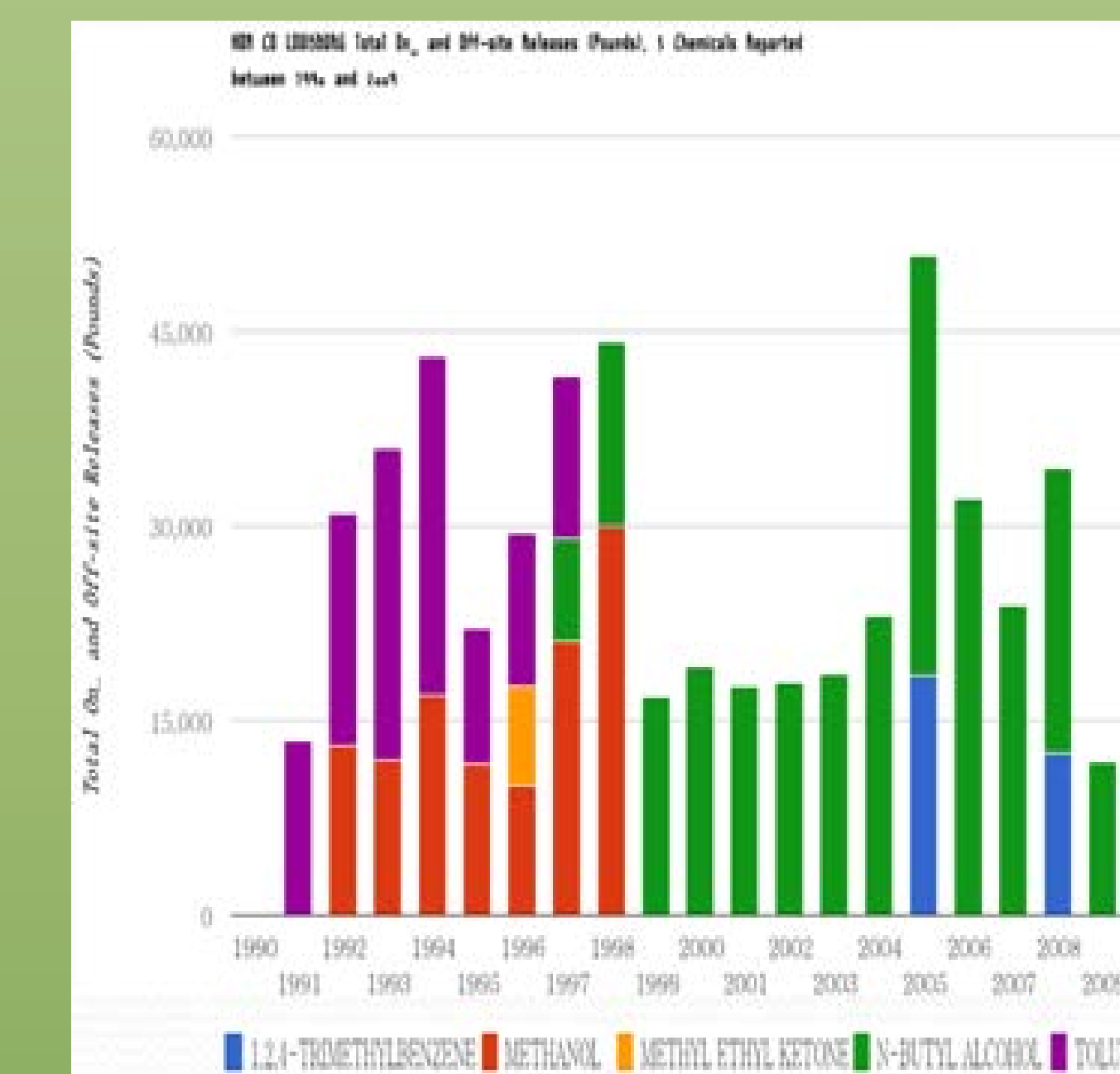
North Carolina's Furniture Industry has shown a steady, almost linear decrease in TRI emissions over the past ten years. Michigan's Furniture Industry also has shown decreasing pattern, but there exists steep decrease between 1999 to 2000.

## NC Consistent Facilities

- Number of facilities: decrease from 78 to 15
  - Six facilities steadily reported from 1998 to 2009
- American Drew Plant  
Casegoods Plant  
Hon Co.  
Marsh Furniture Co.  
Stanley Furniture Co.  
Thomasville Furniture Industries INC.



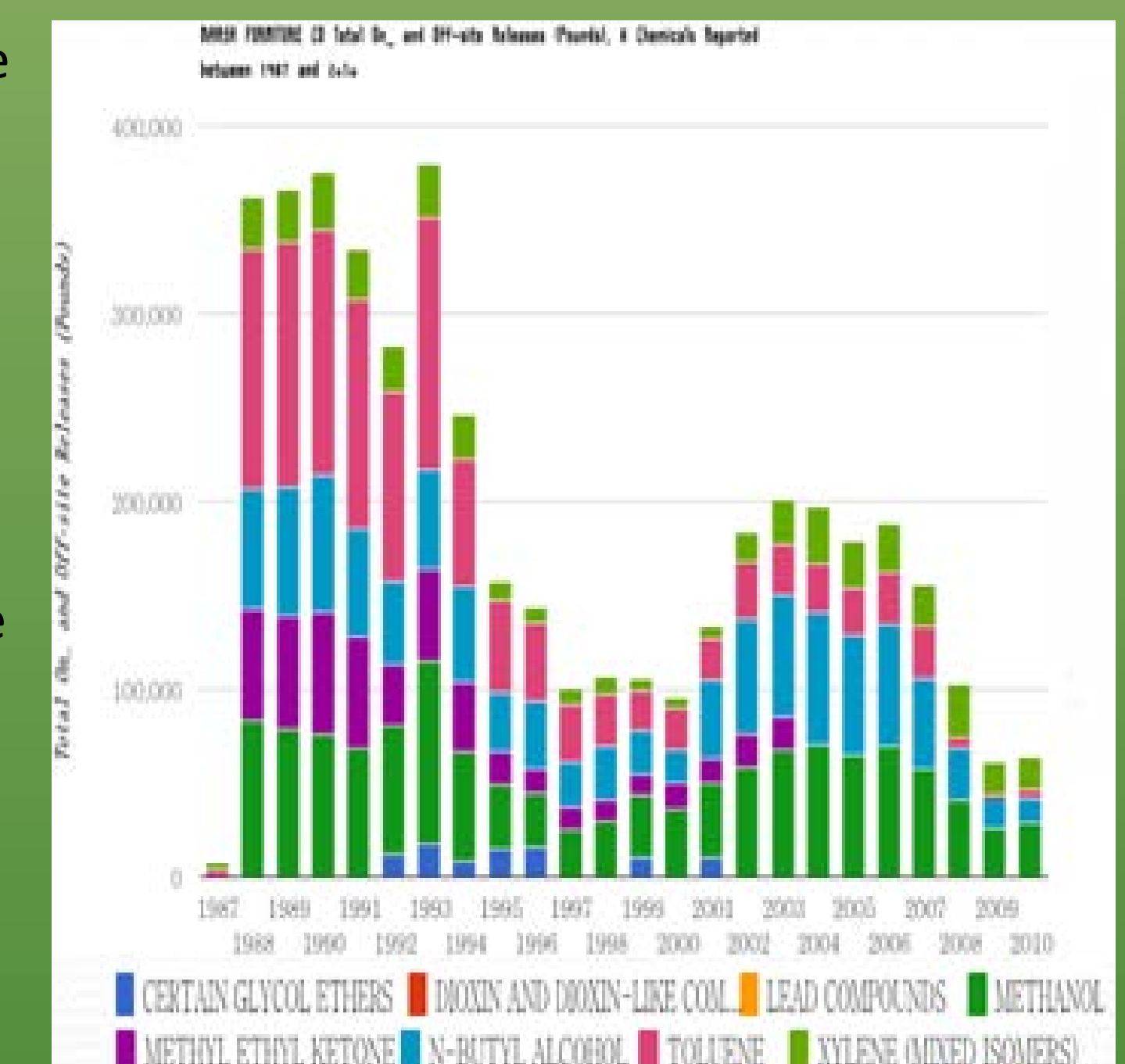
## Hon Co.



- Spoke with representative over phone
- He felt it is now economically better to produce in the U.S. as opposed to producing overseas (due to shipping)
- He said they are always looking for new processes that are better economically and environmentally
- Thier plant in China reportedly operates the exact same as the plant in the U.S.

## Marsh Furniture Co.

- Spoke with a representative over phone
- Emission changes are usually a result of environmental policy
- Firms that produce over 100 tons are almost all moving to China
- He felt more companies are still moving overseas for cheaper labor and looser environmental regulations



## Conclusions

The overall effectiveness of the model, along with our plots of individual economic variables reveal that the state of the economy appears to at least have some effect on TRI emissions. Furthermore, it seems very possible that emissions within our borders are decreasing because many firms are moving production overseas and are no longer producing in the United States. Close analysis of the North Carolina furniture industry seems to strongly suggest this as well. Further investigation is needed to better understand the impact environmental regulations are having on TRI emissions, but it is very likely that the economy is part of the reason emissions are going down.

## Acknowledgement

We would like to thank our mentor, Professor Bill Hunt, our TA Kristen Gullidge and our client, Dr. Barry Nussbaum of the USEPA for all of their support and help with the project.