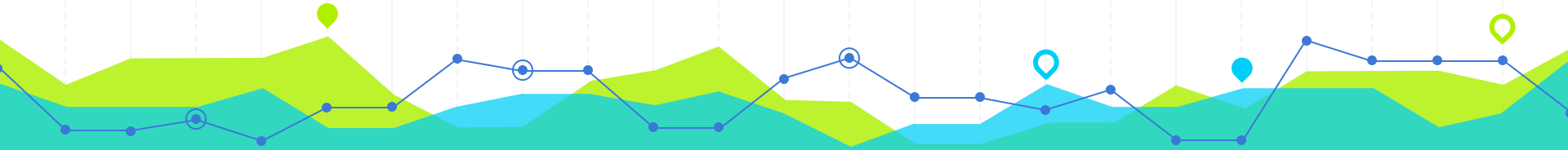


Restaurants, Reviews, & Recessions



A Study Into Recessionary
Behavior

Lester Pi

Research Question

Can restaurant goers' behavior be analyzed and modeled during a U.S. recession?

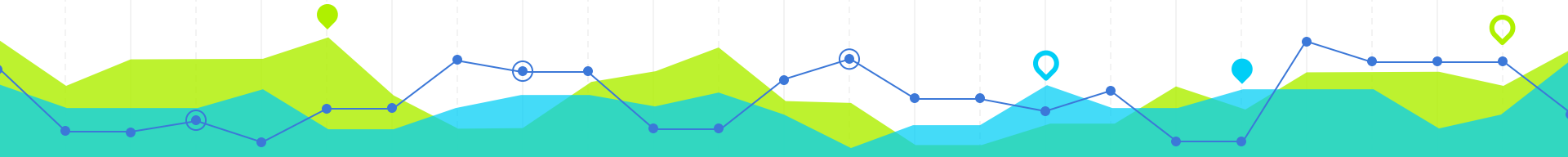


The Solution?



The Data

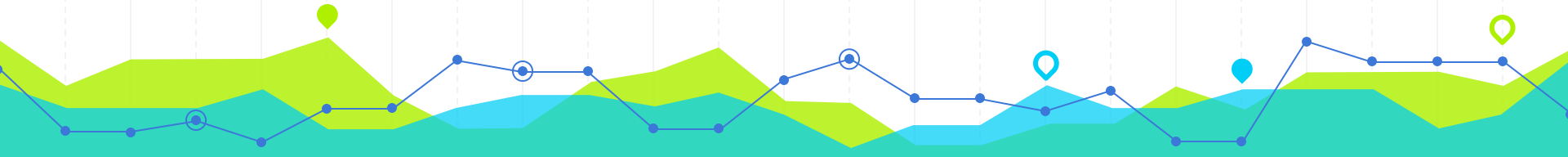
- ◉ Yelp
- ◉ FRED
- ◉ Yahoo Finance
- ◉ BEA



Yelp Challenge 9 Data

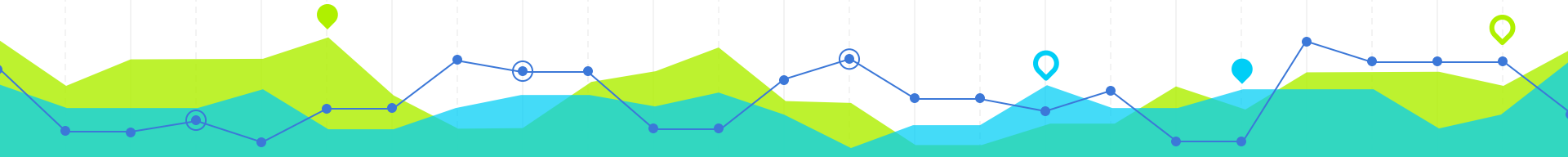
- Business
- Review
- User
- Check In
- Tip

→ More information on this dataset here: https://www.yelp.com/dataset_challenge



The Process

1. Exploration
2. Data work
3. Find connections
4. Model



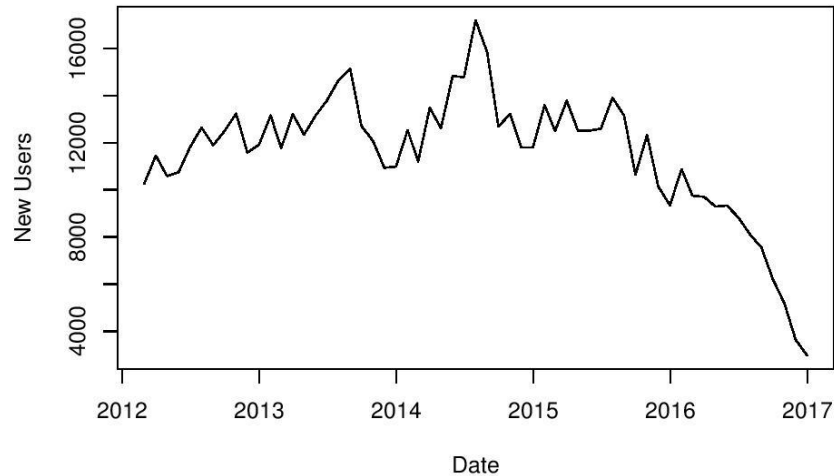
Challenges and Issues Addressed

- ❖ Yelp Data spans globally
 - Subset only U.S. businesses and examine The Great Recession in the U.S.
- ❖ Low number of observations on heads and tails
 - Set date range to handle statistical significance and heteroskedasticity
- ❖ Only a Yelp-decided subset of their data
 - Potential bias, but can only hope it is a representative sample of population
- ❖ Endogeneity
 - Attempt to confirm or reject cases of endogeneity
- ❖ And many more

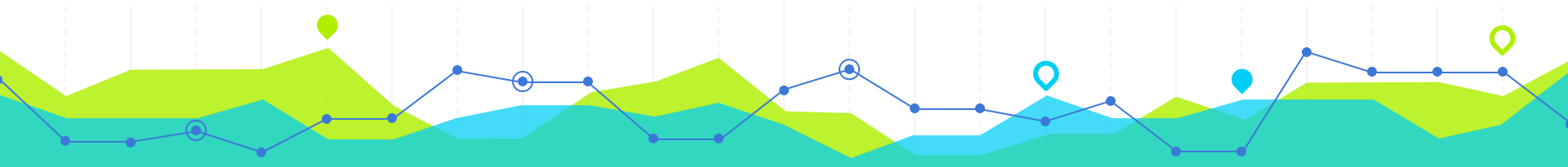
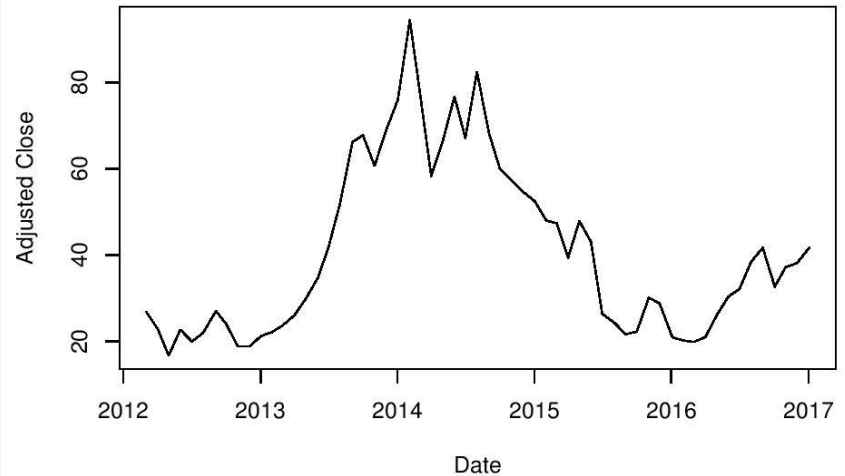


Does Yelp's Company Performance Matter?

New User Accounts by Month

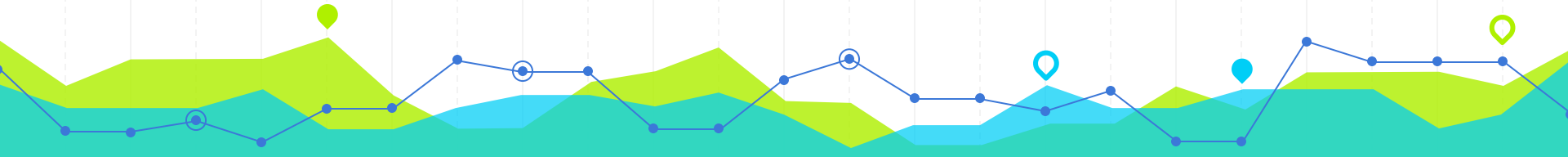


Yelp Stock



Nope

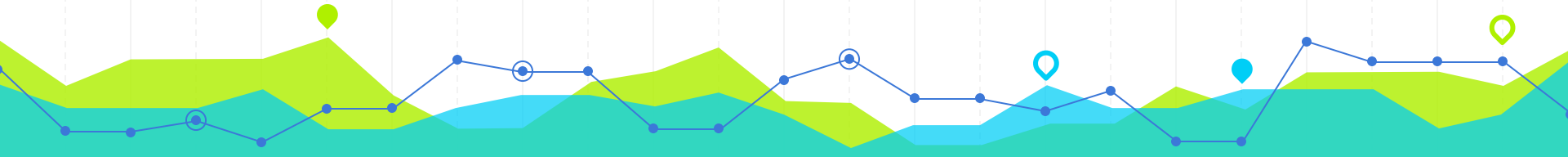
Granger Causality Test shows that Yelp stock growth does not granger cause the growth of new yelp users (p-value: .6265).



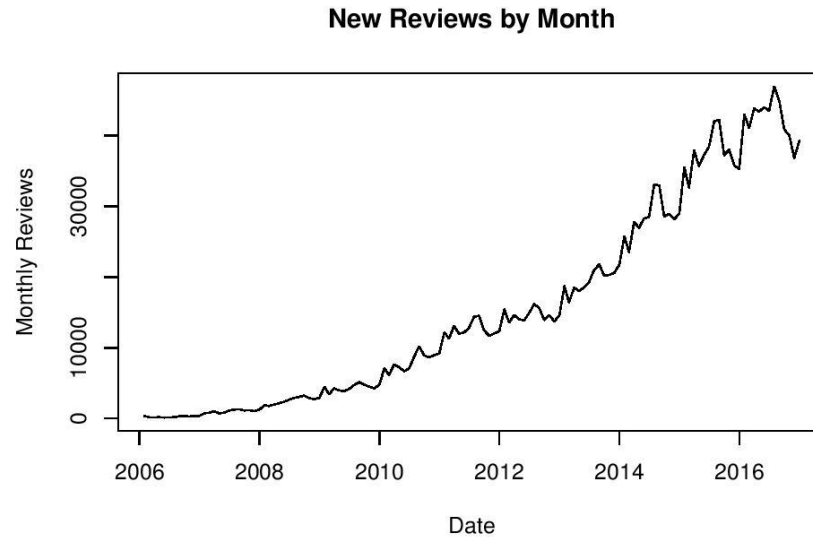
Quantifying With Users and Reviews

However, new users basically represents new reviews.

Let's just use reviews because they tell us more.



New Reviews by Month



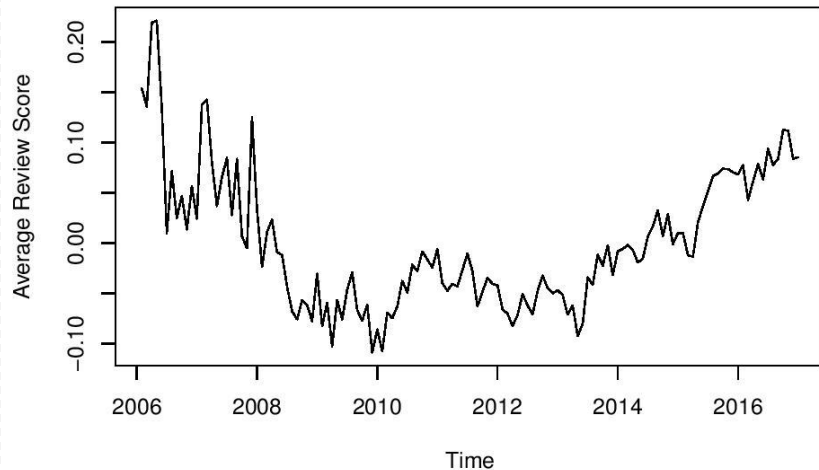
Average Review Scores by Month

Growth rates do not make
Sense for ratings

Use review score levels

Sharp drop, slow recovery

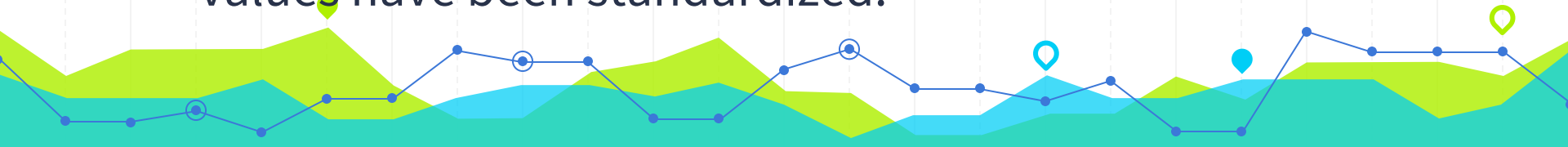
Detrended & Seasonally Adjusted Review Scores by Month



Examining Behavior

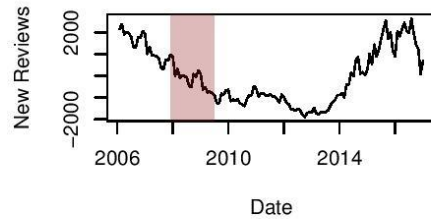
To examine behavior, the different dynamics of price levels need consideration. Yelp has a category for “price” of a business represented by dollar signs (\$).

We will be using detrended and seasonally adjusted data, except for review scores since the range of values have been standardized.

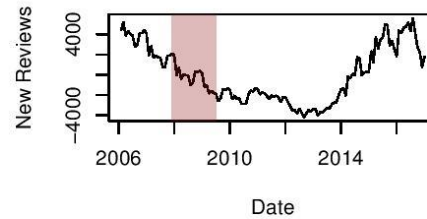


Split by Dollar Signs

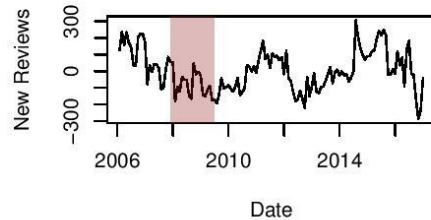
Adjusted Reviews, \$



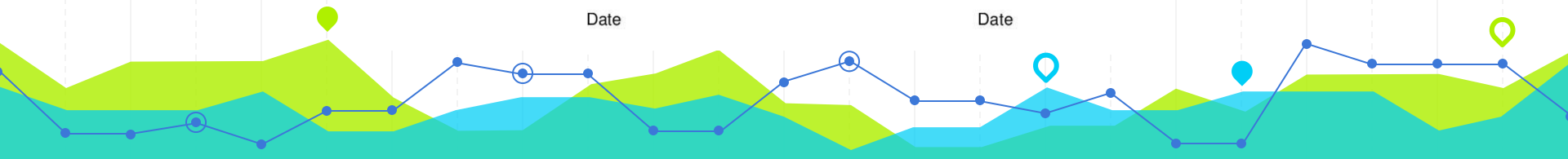
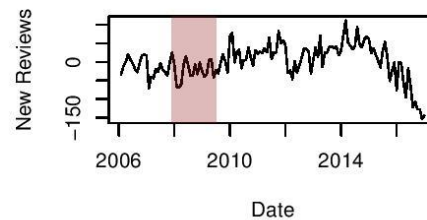
Adjusted Reviews, \$\$



Adjusted Reviews, \$\$\$



Adjusted Reviews, \$\$\$\$



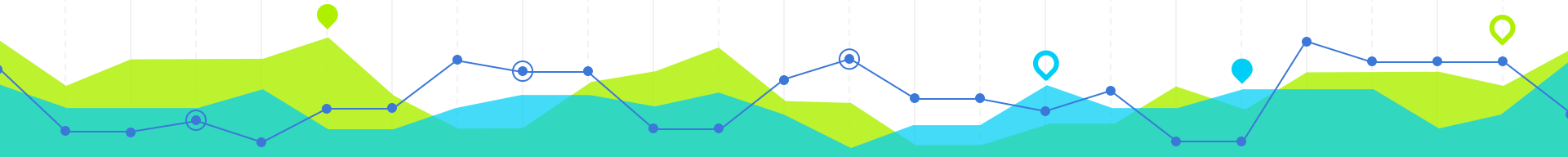
A Picture is not Always Worth 1,000 Words

Visually, it looks that (\$) and (\$\$) have a decline in the number of reviews, but the statistics tell a different story when regressing reviews on recession.

Recession	(\$)	(\$\$)	(\$\$\$)	(\$\$\$\$)
coefficient:	-236.11	-495.52	-100.01	-28.960
p-value:	0.460	0.470	0.00075 ***	0.0128 *

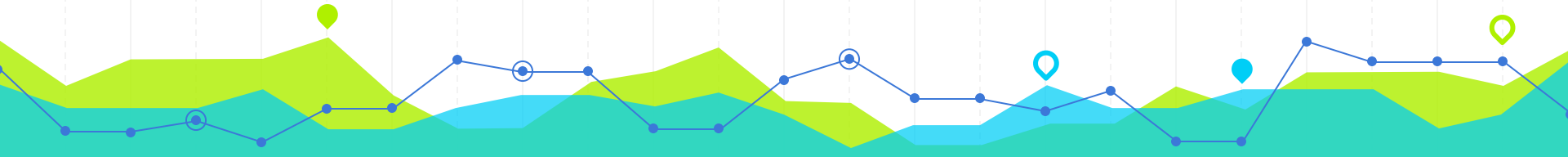
Do People Become Stingier?

It looks as if people are reviewing (\$\$\$) and (\$\$\$\$) restaurants less during a recession while (\$) and (\$\$) restaurants are unaffected. This helps add to the argument that people's behavior change during a recession.



We Can Always Do Better

How about controlling for the number new reviews among all restaurants? Lets add in the detrended and seasonally adjusted data.



A Better Regression

		(\$)	(\$\$)	(\$\$\$)	(\$\$\$\$)
Recession	coefficient:	33.324607	84.734117	-85.505163	-3.239e+01
	p-value:	0.192	0.00349 **	0.000406 ***	0.00328 **
New Reviews (adjusted)	coefficient:	0.311485	0.670808	0.016770	-3.962e-03
	p-value:	<2e-16 ***	< 2e-16 ***	1.25e-13 ***	3.78e-05 ***



Where Do People Eat?

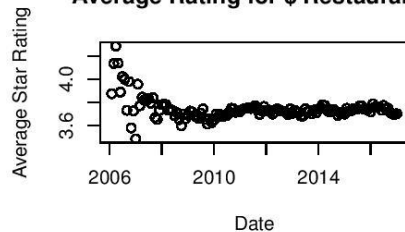
These are very interesting results. During The Great Recession, (\$\$\$) and (\$\$\$\$) see less reviews while (\$\$) see a boost in reviews that they otherwise would not have seen.

It seems like people are opting more for (\$\$) when eating out rather than (\$\$\$) and (\$\$\$\$).

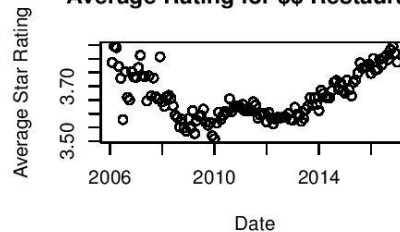


Split Scores by Dollar Signs

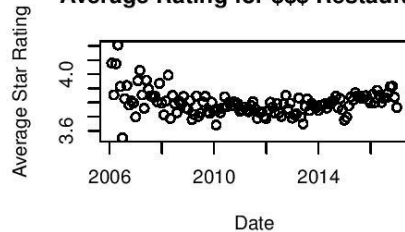
Average Rating for \$ Restaurants



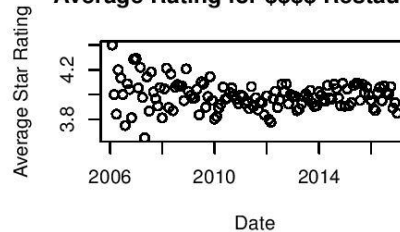
Average Rating for \$\$ Restaurants



Average Rating for \$\$\$ Restaurants



Average Rating for \$\$\$\$ Restaurants



Which Scores Go Down?

Now, let's regress the review scores on the recession. Remember that review scores are on a scale of 1 to 5.

Recession	(\$)	(\$\$)	(\$\$\$)	(\$\$\$\$)
coefficient:	-0.044273	-0.076331	-0.020898	0.03506
p-value:	0.0653 .	0.000172 ***	0.333	0.203

Why Do We See This?

The (\$) and (\$\$) restaurants see a slight dip in review scores during The Great Recession. Why is this?

It could be people who would have otherwise dined at a (\$\$\$) or (\$\$\$\$) are switching to the lower priced restaurants and do not have their expectations met.

Or... Maybe people just want more bang for their buck? Is there a way we can see this?



Sentiment Analysis

By analyzing the text in reviews, we can see their related sentiments. Since The Great Recession occurred a few years after the start of Yelp, this sentiment analysis will only consider two time periods:

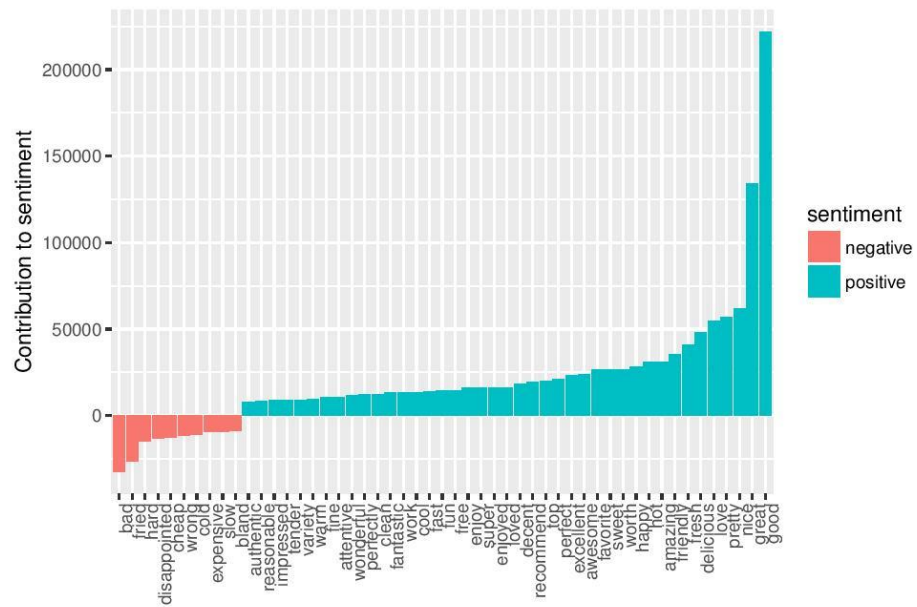
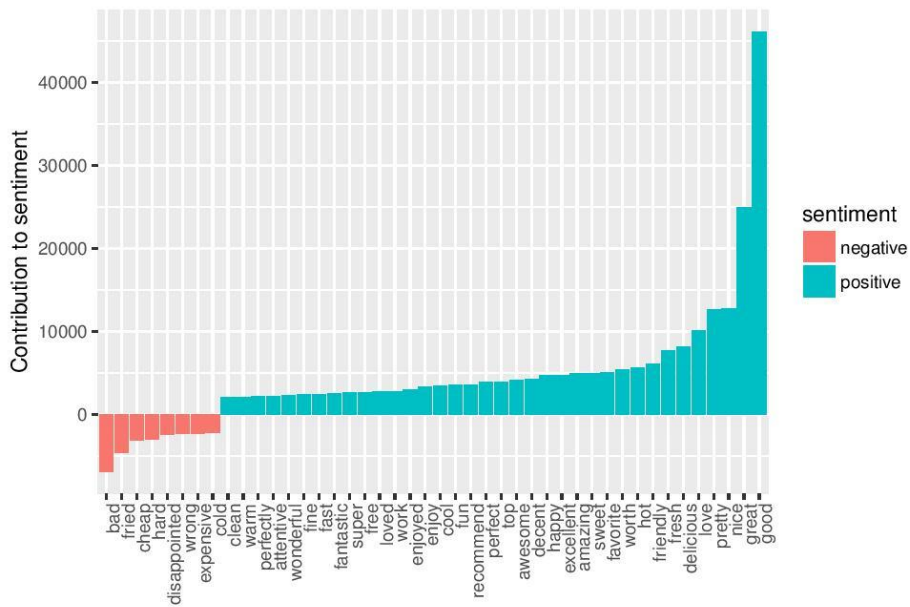
1. Start of December 2007 - Start of June 2009
2. Start of June 2009 - Start of December 2011



Word Clouds: Which is From The Recession?



Again, Which is Which?



A Closer Look

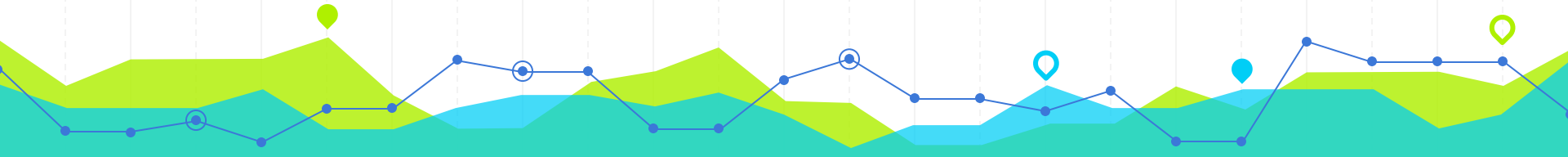
	Negative	Positive	% Negative	Cheap Rank	Expensive Rank
Recession	158714	346991	31.4%	3rd	7th
After	733329	1731938	29.75%	5th	8th

We can see there is a slightly stronger negative sentiment during the recession. Also, take a look at where the words “Cheap” and “Expensive” rank for negative words. Although “Cheap” is not always used in a negative way, it does indicate, along with “Expensive”, a stronger price sentiment.



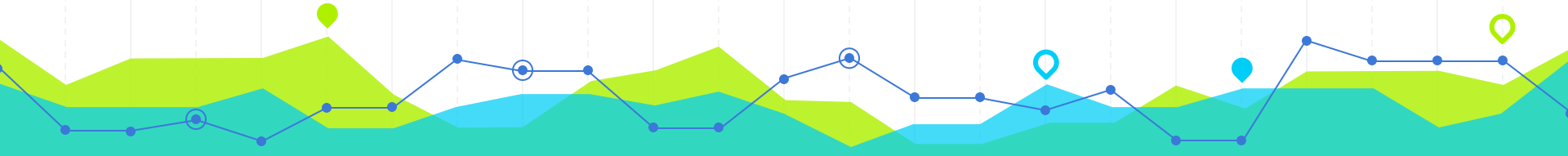
Coming Full Circle

Can we connect our Yelp data with restaurant expenditures? After finding a potential granger causality of restaurant expenditures granger causing the number of reviews, we can attempt to build some VAR models.



VAR Results

The VAR results are not as sound as our previous results. Although there is some significance spread throughout the different VAR models, I would not say it is strong enough to conclude a strong enough causality. This could be due to keeping the VAR in adjusted levels, where not all of the data was stationary. This was done because growth rates did not make sense in some cases.



Summary Pt. 1

- People's restaurant reviewing behavior does change during The Great Recession.
- Yelp company performance doesn't matter.
- The Recession lowers the number of (\$\$\$) and (\$\$\$\$) reviews, but increases (\$\$) reviews.
- There is no evidence of an effect on the number of (\$) reviews.



Summary Pt. 2

- Review scores in The Recession drop for cheaper restaurants, but stay constant for expensive ones.
- People care more about prices during The Recession.
- Comprehensive VAR models connecting previous findings with restaurant expenditures is pointing towards a full model, but not conclusive.

