Using Cell Phone Tracking to Predict State Revenue
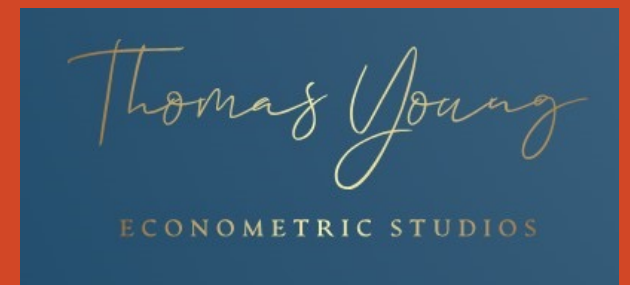
Thomas Young, Ph.D.
thomas.young@econometricstudios.com
(801) 647-4979
Bear White Investments
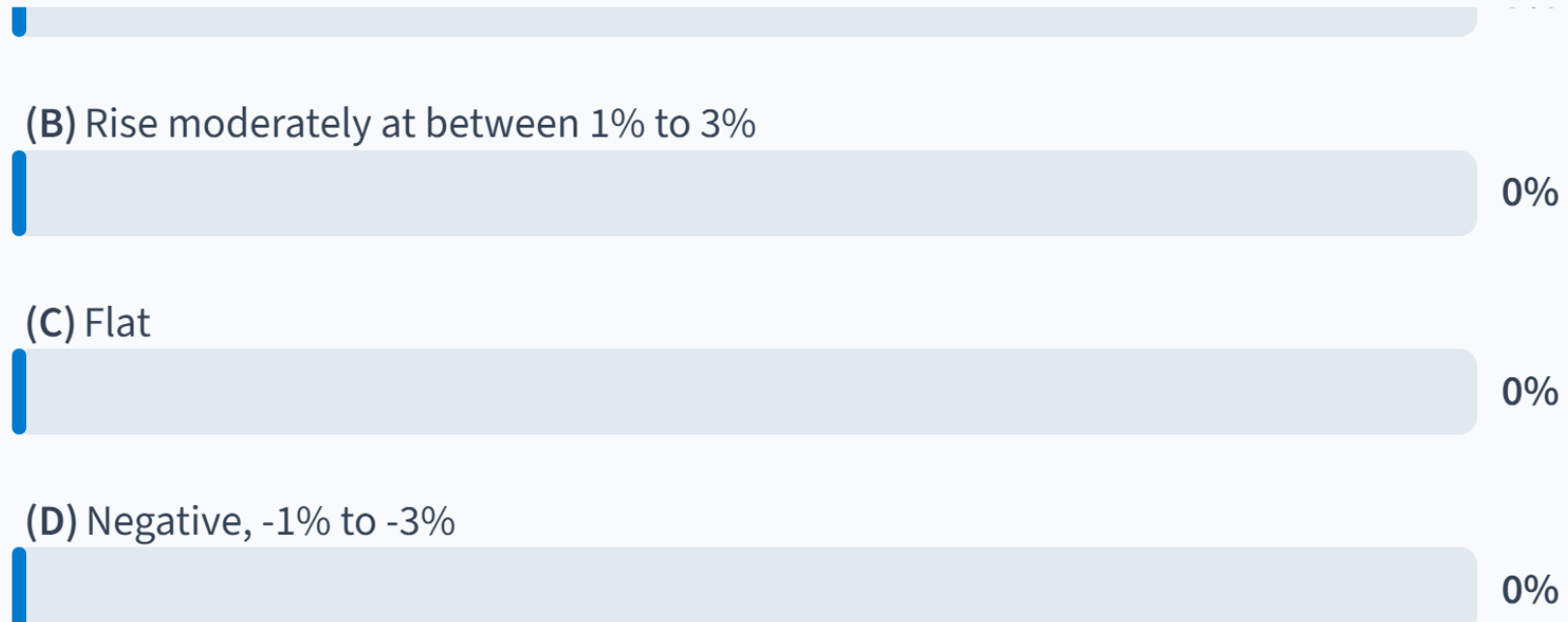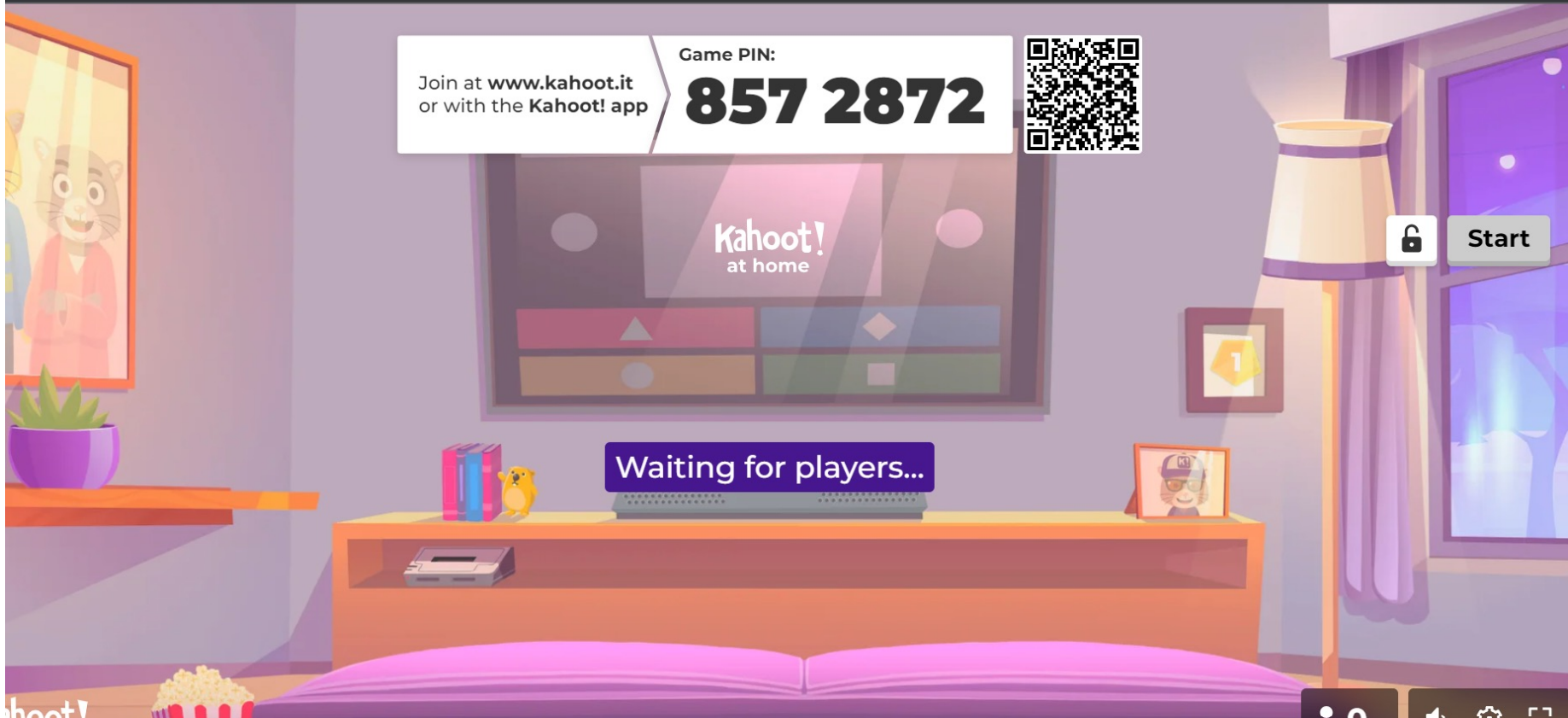Econometric Studios, LLC

Will wage growth jump back up in 2024 to 5% or turn negative to -1%?

(B) Rise moderately at between 1% to 3%

0%

(C) Flat

0%

(D) Negative, -1% to -3%

0%

Just as Background: Can Visits to Car Dealers Predict Relative Performance of Automotive Manufacturers?

Using SafeGraph and Bloomberg Data to Inspect the Relationship Between Visits

to Car Dealers and Performance of Automotive Manufacturers' Stock Prices

Thomas Young

ECONOMETRIC STUDIOS

Data Processing

- Combined the monthly data by looping through each set.

- SafeGraph dataset comprised 2,345,670 firm-month rows and 40 variables, capturing visits to new and used car dealers.

- Next step was to extract out the days, day of the week, month, and year from the reported columns.

- After reshaping to capture daily visits and cleansing, the raw data comprised 47,990,280 firm-day observations from January 2019 through June 2021 across 81 variables.

- These were then combined with daily stock price performance of four companies: GM (General Motors), F (Ford), TM (Toyota Motors), and HMC (Honda Motor Company).

- After combination, the data was ready for analysis:

  Can visits to car dealers predict relative performance of stock prices?

Thomas Young
ECONOMETRIC STUDIOS
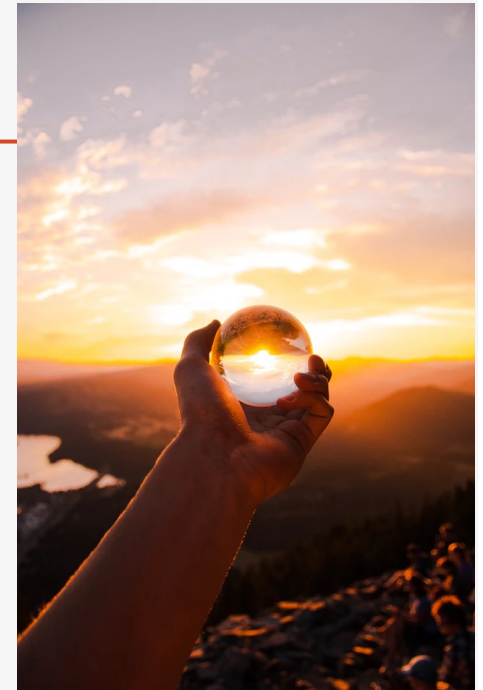
Raw Visits

Visit Counts to New and Used Car Dealers
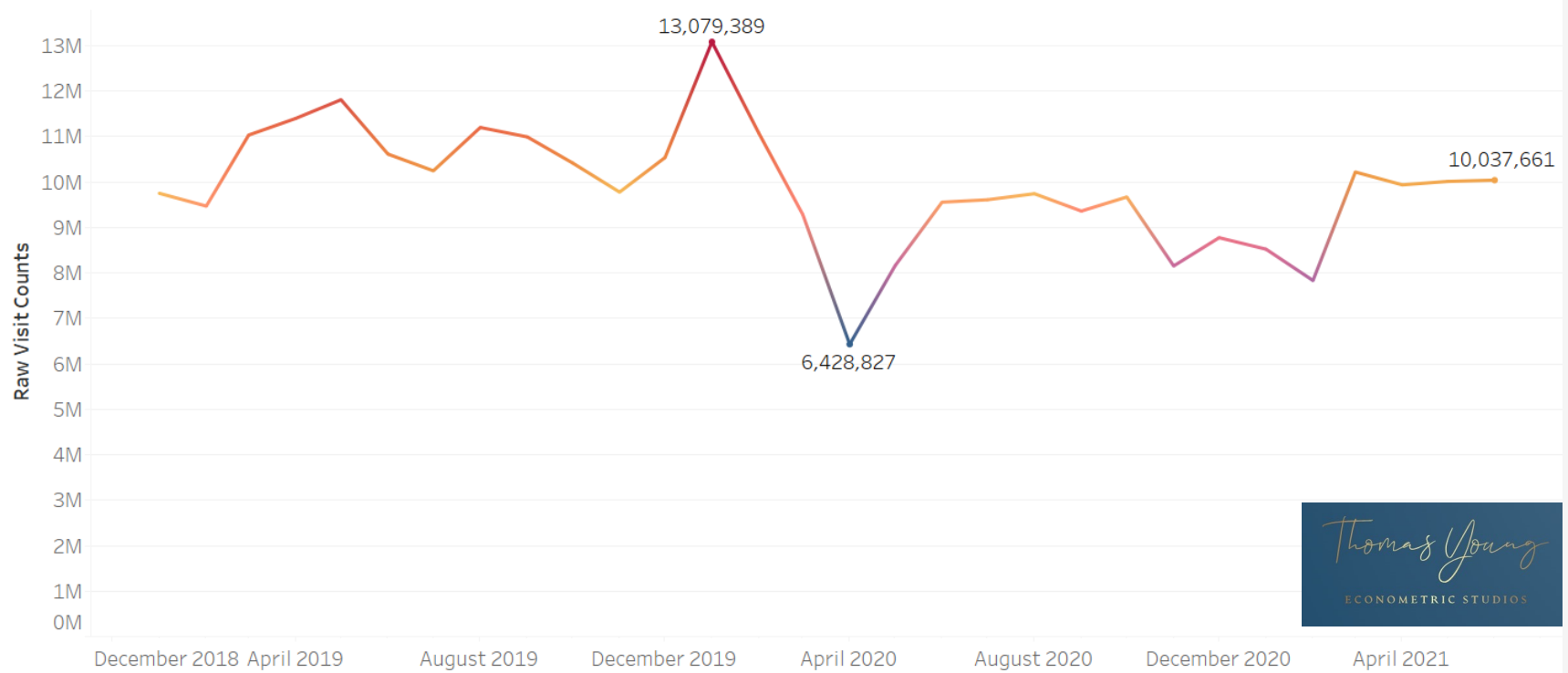
Source: SafeGraph
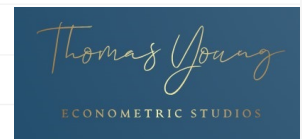
Raw Visits

Geographic Coverage of Visit Counts to New and Used Car Dealers

Raw Visit Counts
- 1
- 50,000
- 100,000
- 151,253

© 2021 Mapbox © OpenStreetMap

Source: SafeGraph
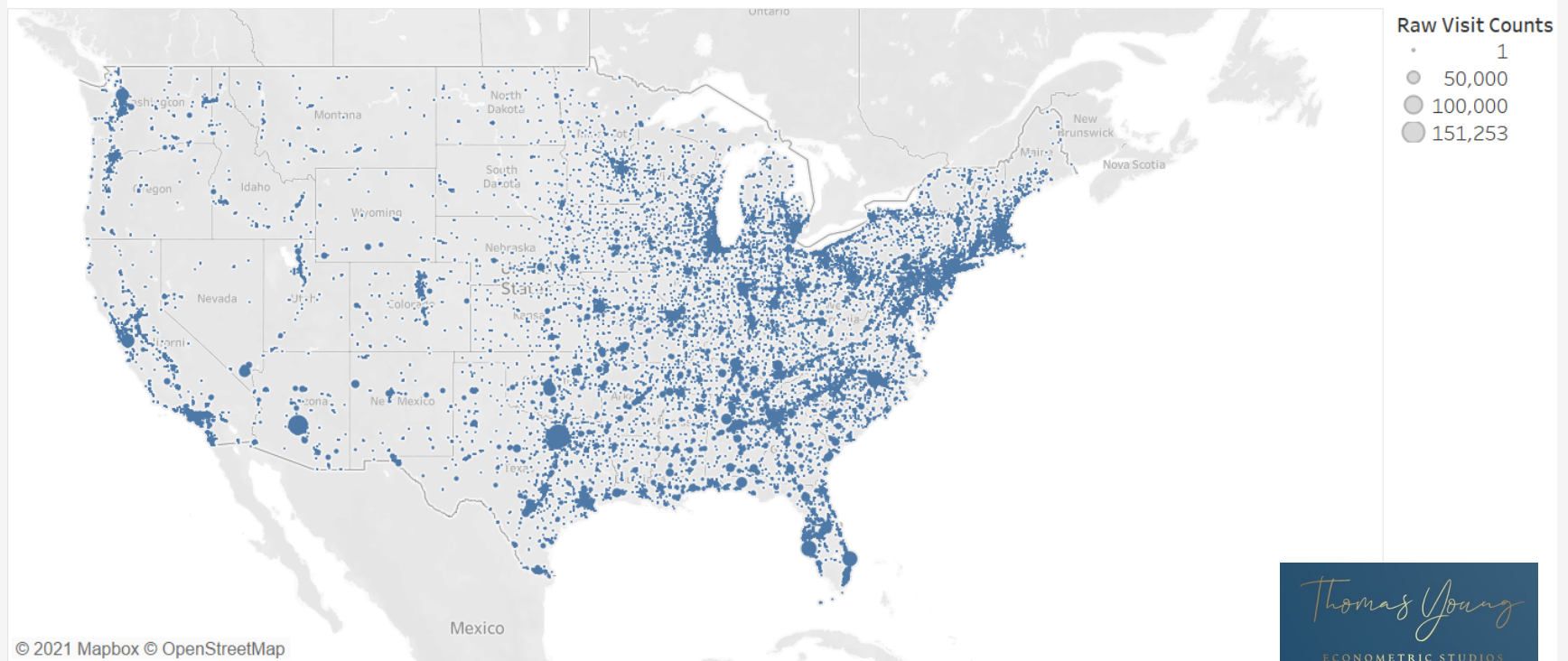
Selected Stock Prices of Car Manufacturers
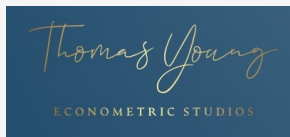
Measure Names
F   GM   HMC   TM

Selected Stock Prices of Car Manufacturers
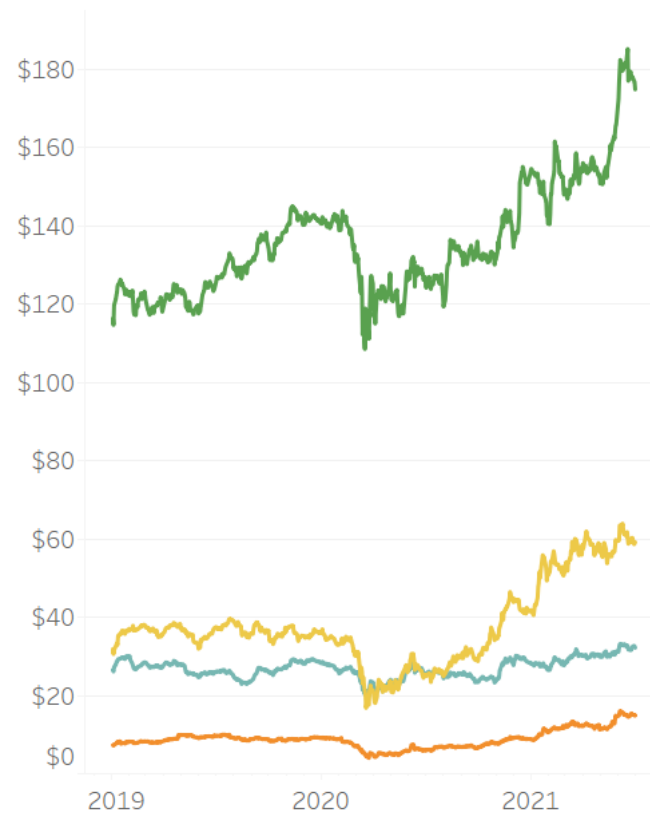
% Change in Stock Prices from January 3, 20129
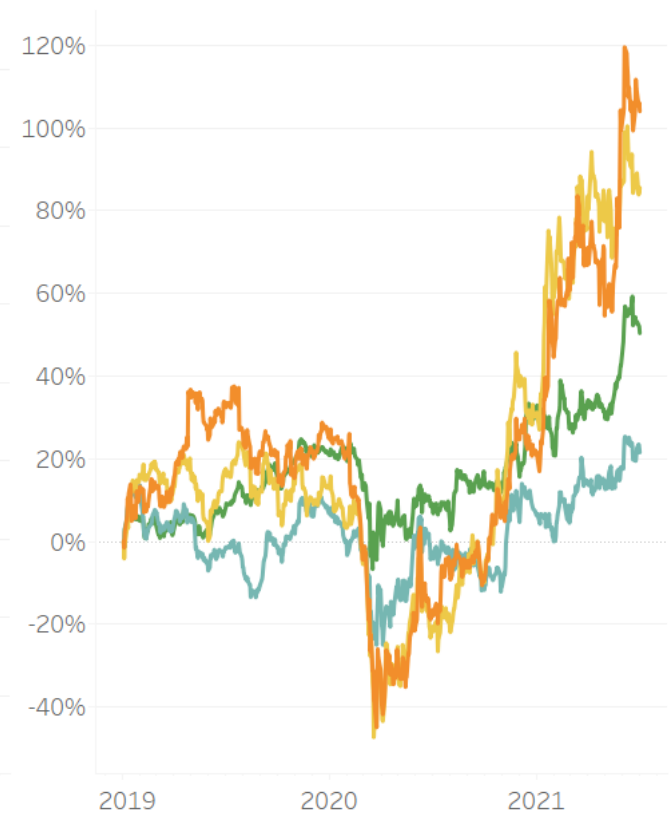
Raw Visit Counts for the Four Researched Companies

Raw Visit Counts to the Four Companies

Brands (group)
- Ford/Lincoln
- GM
- Honda/Acura
- Toyota/Lexus
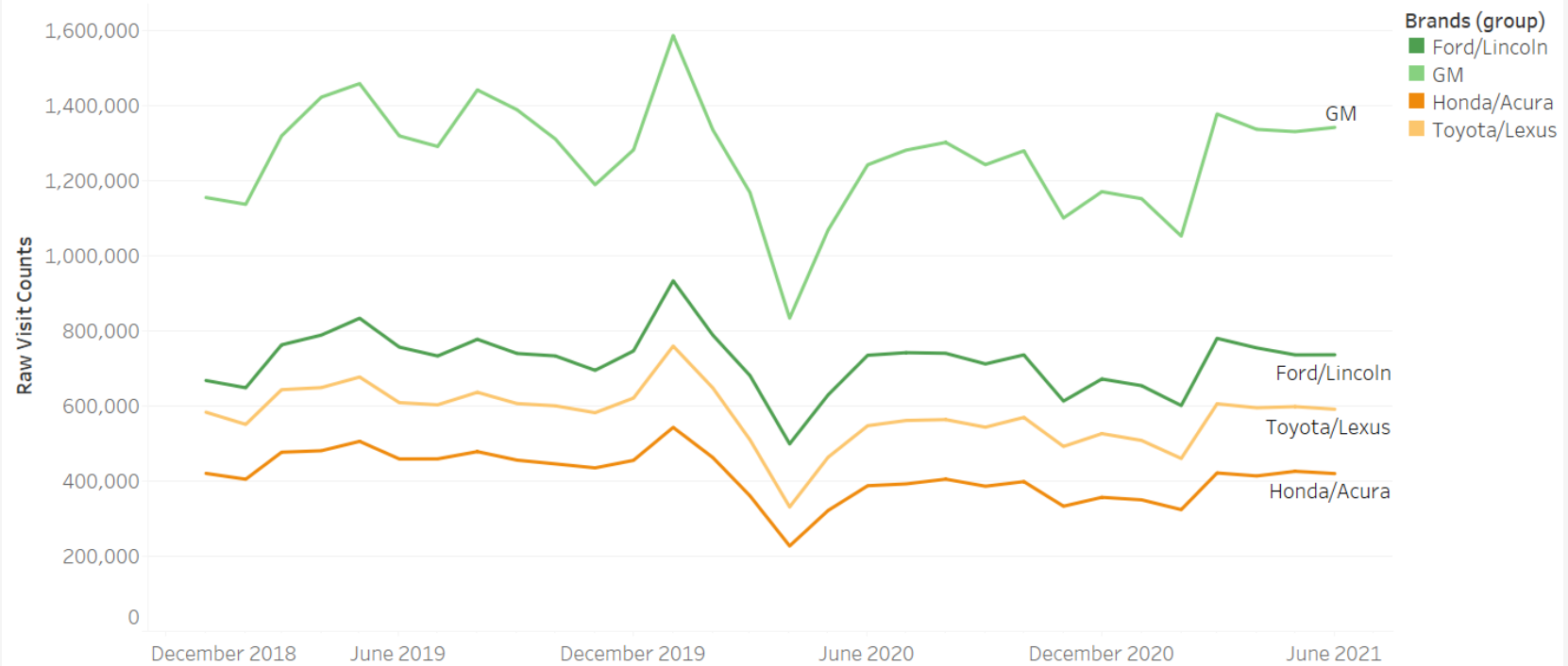
Source: SafeGraph
Grouping done by Thomas Young

Connecting Month-over-Month Visit Changes with Stock Price Changes

Raw Scatterplot of the Change in Stock Price with the Change in Visits

$$\Delta \text{ Stock price}_i = 0.14 \cdot \Delta \text{ Visits}_i + 0.016$$
$$R^2 = 0.06; p - value_{visits} = 0.01$$

Sources: Bloomberg, SafeGraph
Each dot represents the month-over-month change in each respective measure.

Thomas Young
ECONOMETRIC STUDIOS
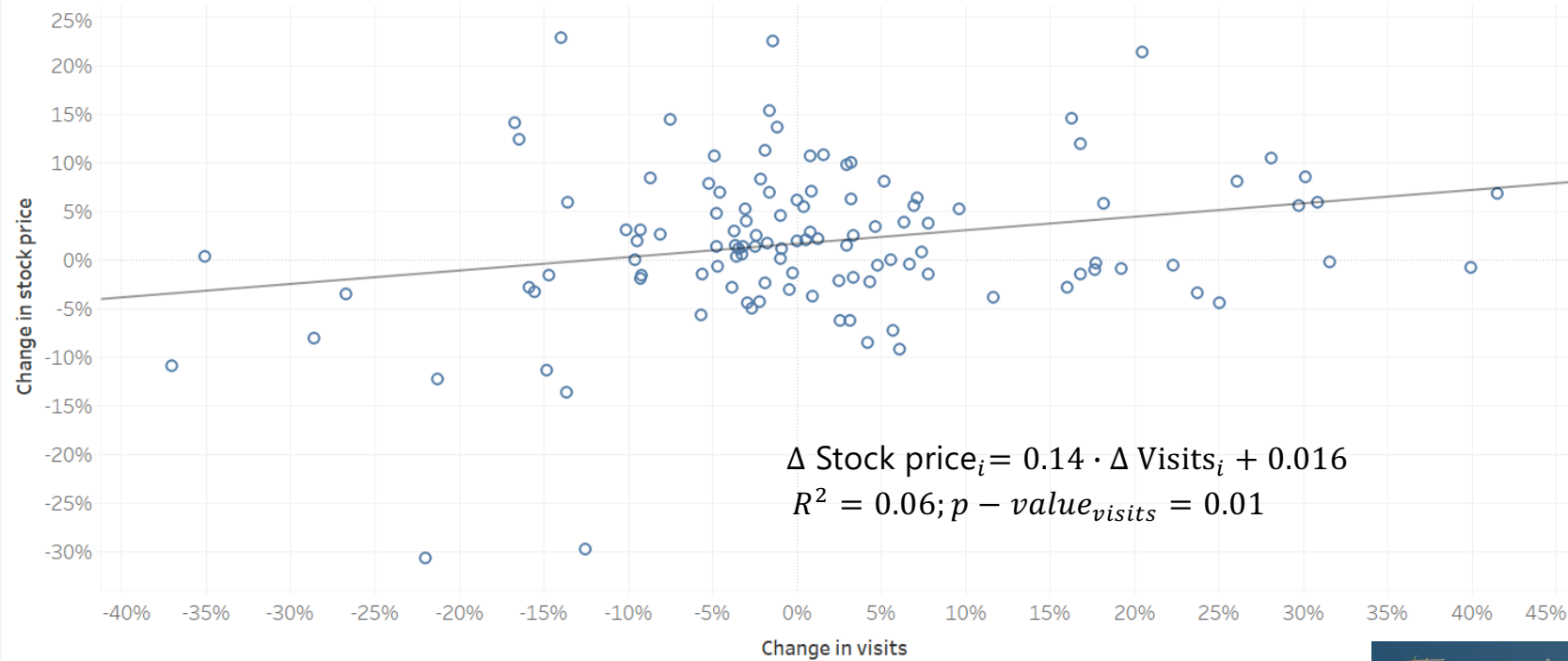
Connecting Month-over-Month Visit Changes with Stock Price Changes

Raw Scatterplot of the Change in Stock Price with the Change in Visits - by Company
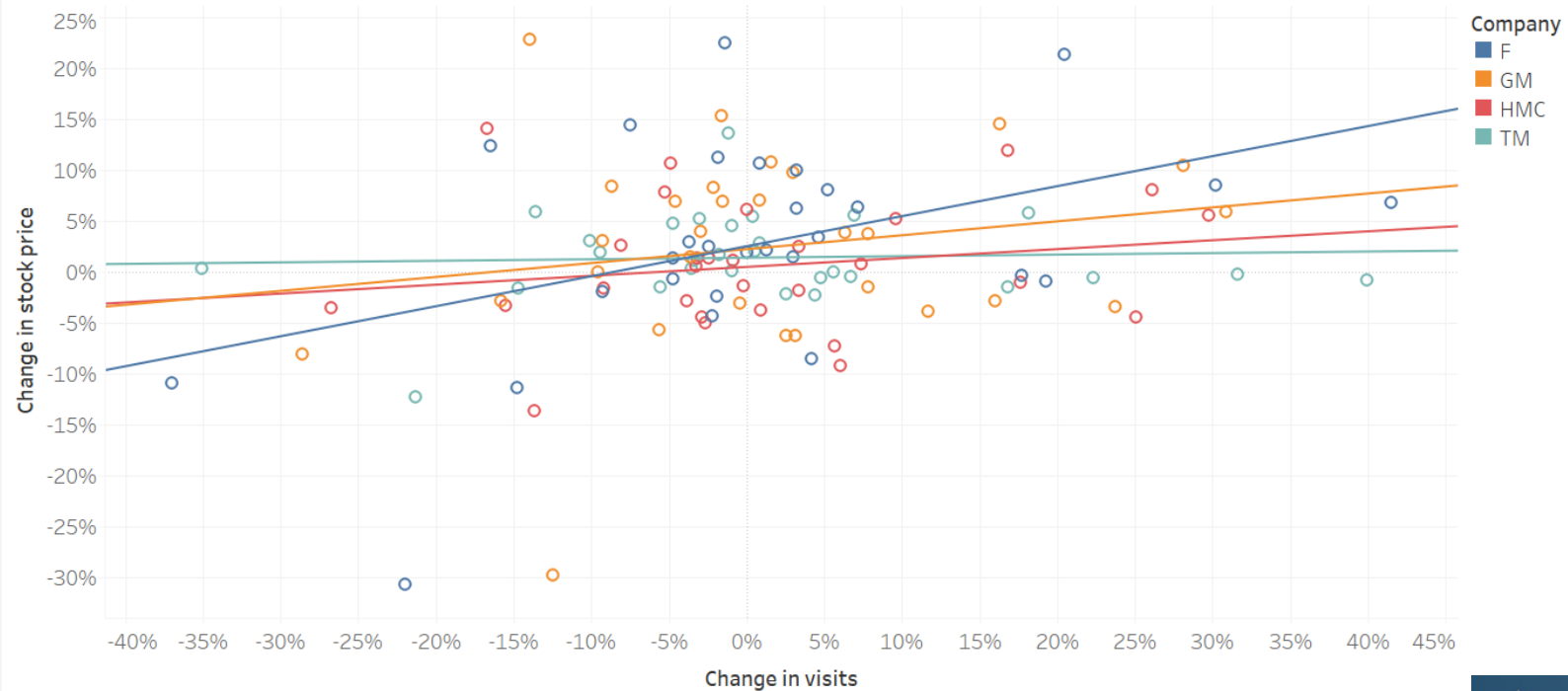
Sources: Bloomberg, SafeGraph
Each dot represents the month-over-month change in each respective measure.

It's, of course, much more complicated than that - lagged impacts

Contemporaneous Change in Stock Price with the Change in Visits
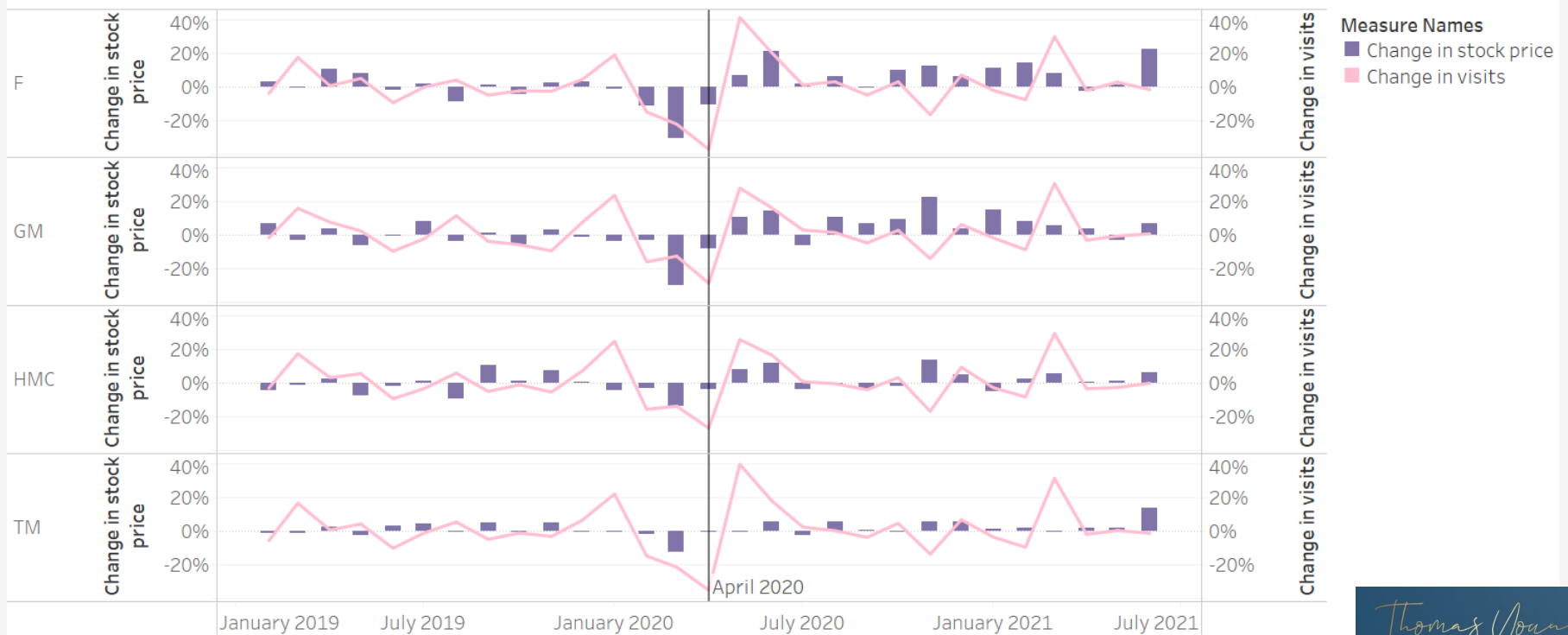
Sources: Bloomberg, SafeGraph

Looking for "Leading Indicator" Evidence

Dependent Variable: F_CHANGE_IN_STOCK
Method: Dynamic Least Squares (DOLS)
Date: 08/09/21   Time: 13:10
Sample (adjusted): 2019M07 2020M12
Included observations: 18 after adjustments
Cointegrating equation deterministics: C
Automatic leads and lags specification (lead=5 and lag=5 based on AIC
    criterion, max=5)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth
    = 3.0000)

| Variable	Coefficient	Std. Error	t-Statistic	Prob.
F_CHANGE_IN_VISITS(1)	3.696614	0.938973	3.936867	0.0110
C	-0.005619	0.012738	-0.441134	0.6775

R-squared	0.900438	Mean dependent var		0.003982
Adjusted R-squared	0.661490	S.D. dependent var		0.112407
S.E. of regression	0.065400	Sum squared resid		0.021386
Long-run variance	0.002644			

Dependent Variable: GM_CHANGE_IN_STOCK
Method: Dynamic Least Squares (DOLS)
Date: 08/09/21   Time: 13:13
Sample (adjusted): 2019M07 2020M12
Included observations: 18 after adjustments
Cointegrating equation deterministics: C
Automatic leads and lags specification (lead=5 and lag=5 based on AIC
    criterion, max=5)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth
    = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GM_CHANGE_IN_VISITS...	5.783088	2.107288	2.744327	0.0406
C	-0.018903	0.020626	-0.916446	0.4015

R-squared	0.911578	Mean dependent var		0.017117
Adjusted R-squared	0.699367	S.D. dependent var		0.113924
S.E. of regression	0.062465	Sum squared resid		0.019509
Long-run variance	0.005404			

Thomas Young
ECONOMETRIC STUDIOS

Looking for "Leading Indicator" Evidence

Dependent Variable: HMC_CHANGE_IN_STOCK
Method: Dynamic Least Squares (DOLS)
Date: 08/09/21   Time: 13:15
Sample (adjusted): 2019M07 2021M01
Included observations: 19 after adjustments
Cointegrating equation deterministics: C
Automatic leads and lags specification (lead=4 and lag=5 based on AIC criterion, max=5)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HMC_CHANGE_IN_VISITS(1)	1.066065	2.853739	0.373568	0.7198
C	0.006987	0.017687	0.395033	0.7046

R-squared	0.868596	Mean dependent var	0.006524
Adjusted R-squared	0.662105	S.D. dependent var	0.073423
S.E. of regression	0.042680	Sum squared resid	0.012751
Long-run variance	0.003226		

Dependent Variable: TM_CHANGE_IN_STOCK
Method: Dynamic Least Squares (DOLS)
Date: 08/09/21   Time: 13:16
Sample (adjusted): 2019M07 2020M12
Included observations: 18 after adjustments
Cointegrating equation deterministics: C
Automatic leads and lags specification (lead=5 and lag=5 based on AIC criterion, max=5)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TM_CHANGE_IN_VISITS(1)	0.972051	0.973310	0.998707	0.3638
C	0.005004	0.011766	0.425289	0.6883

R-squared	0.819233	Mean dependent var	0.010941
Adjusted R-squared	0.385393	S.D. dependent var	0.044674
S.E. of regression	0.035023	Sum squared resid	0.006133
Long-run variance	0.001765		

GameStop – An Event Study in STATA: Did the Robinhood-Reddit Burning of January 2021 Help or Hurt GameStop?

Thomas Young, Ph.D.

Raw Visits

GameStop Visits

Visit Counts (y-axis): 0, 200,000, 400,000, 600,000, 800,000, 1,000,000, 1,200,000, 1,400,000, 1,600,000, 1,800,000, 2,000,000, 2,200,000

x-axis: November 2020, January 2021, March 2021, May 2021
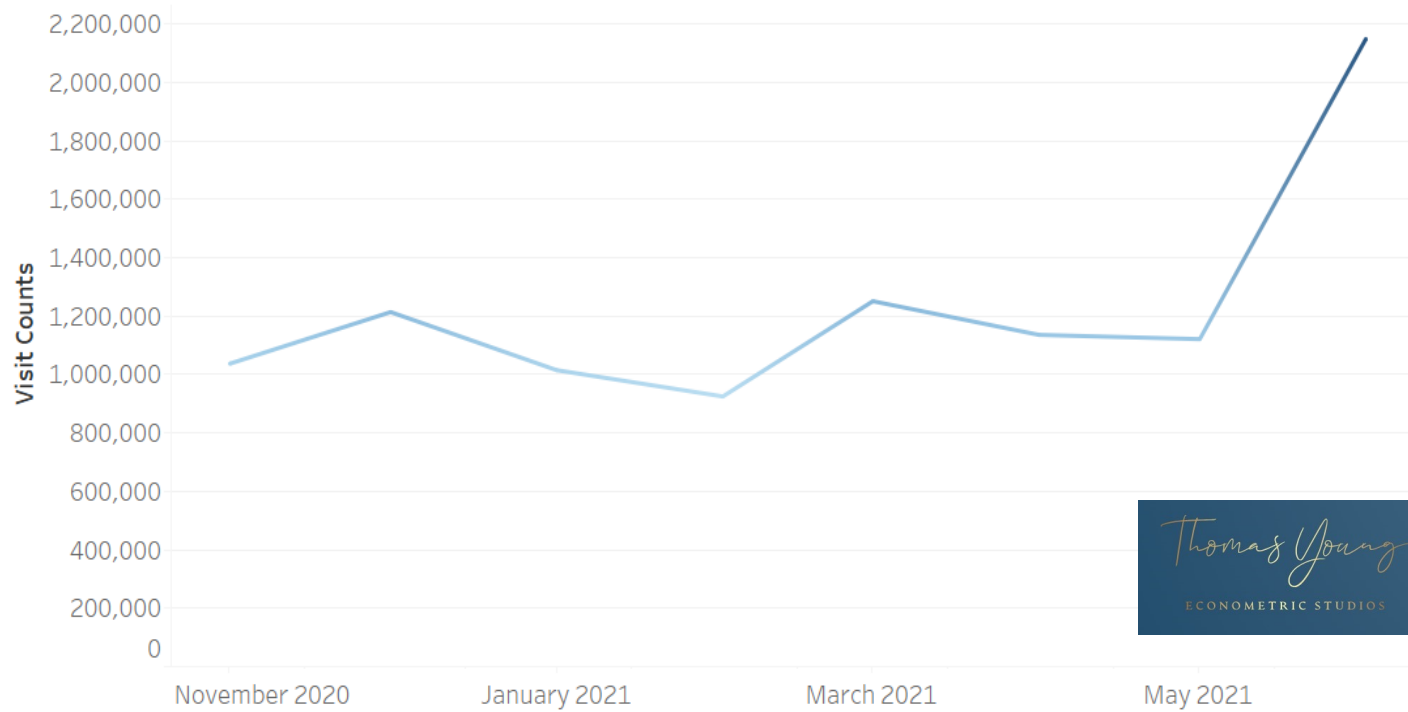
Source: SafeGraph
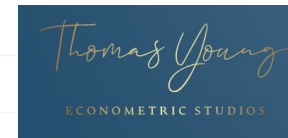
Raw Changes

	Month				
	February 2021	March 2021	April 2021	May 2021	June 2021
GameStop	-9%	23%	12%	10%	112%
All Other	-10%	15%	11%	14%	118%
Difference	**1%**	**8%**	**1%**	**-4%**	**-6%**

Can we use cell phone tracking to predict inflation by metro area?

Thomas Young, Ph.D.

Thomas Young
ECONOMETRIC STUDIOS

Raw Inflation on a Year-over-Year Basis by Metro Area

Consumer Prices by Metro Area
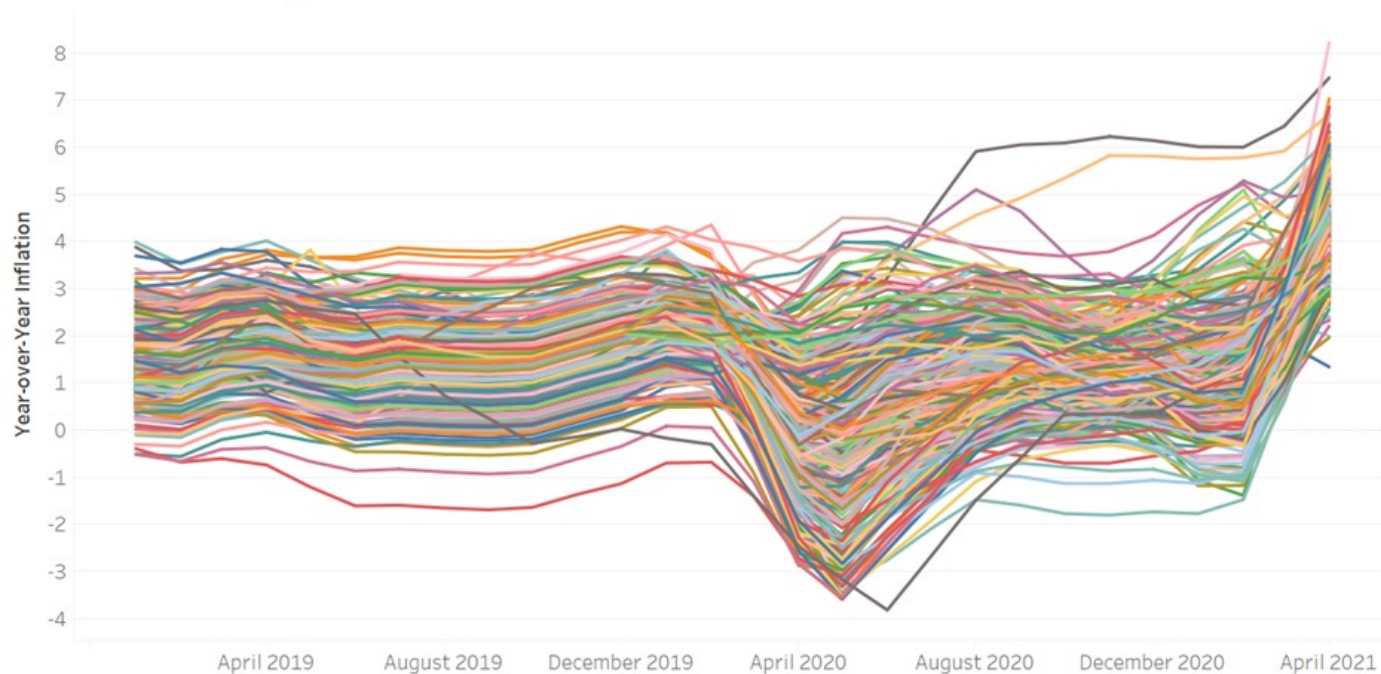
Sources: Bureau of Labor Statistics, Federal Reserve
Note: each color represents an MSA.

Raw Inflation on a Year-over-Year Basis by Metro Area

Top 10 Fastest Growing Areas for Consumer Prices

Metro Area	Inflation Rate
Odessa, TX Metropolitan Statistical Area	8.2
San Rafael, CA Metropolitan Division	7.5
Des Moines-West Des Moines, IA Metropolitan Statistical ..	7.0
Cedar Rapids, IA Metropolitan Statistical Area	6.9
Ames, IA Metropolitan Statistical Area	6.9
Waterloo-Cedar Falls, IA Metropolitan Statistical Area	6.8
Fairbanks, AK Metropolitan Statistical Area	6.7
Atlantic City-Hammonton, NJ Metropolitan Statistical Area	6.7
Iowa City, IA Metropolitan Statistical Area	6.7
Cheyenne, WY Metropolitan Statistical Area	6.5

Inflation Rate, Year-over-Year

Sources: Bureau of Labor Statistics, Federal Reserve

Thomas Young
ECONOMETRIC STUDIOS

Raw Inflation on a Year-over-Year Basis by Metro Area

Bottom 10 Fastest Growing Areas for Consumer Prices

Metro Area	Inflation Rate, Year-over-Year
Providence-Warwick, RI-MA Metropolitan Statistical Area	2.7
New Orleans-Metairie, LA Metropolitan Statistical Area	2.6
Redding, CA Metropolitan Statistical Area	2.6
Yuma, AZ Metropolitan Statistical Area	2.4
West Palm Beach-Boca Raton-Delray Beach, FL Metropolit..	2.4
Port St. Lucie, FL Metropolitan Statistical Area	2.3
Ocean City, NJ Metropolitan Statistical Area	2.2
Sebastian-Vero Beach, FL Metropolitan Statistical Area	2.0
Hilton Head Island-Bluffton-Beaufort, SC Metropolitan St..	2.0
Naples-Immokalee-Marco Island, FL Metropolitan Statisti..	1.3

Inflation Rate, Year-over-Year

Thomas Young
ECONOMETRIC STUDIOS

Mobility by Metro Area

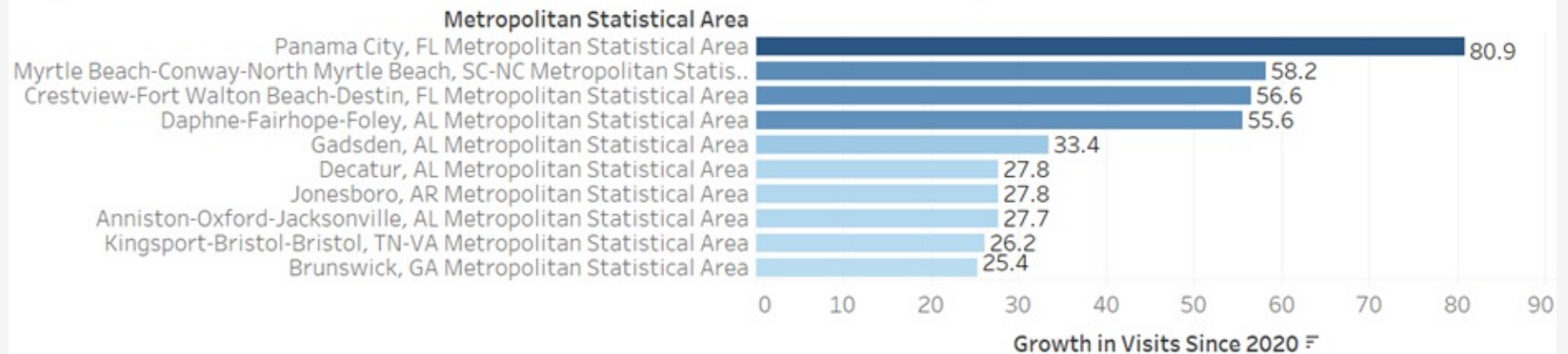Mobility by Metro Area

Growth in Visits Since 2020

Month

Sources: SafeGraph
Note: each color represents an MSA.

Mobility by Metro Area

Top 10 Metro Areas for Movement Growth Since January 2020

Metropolitan Statistical Area

Metropolitan Statistical Area	Growth
Panama City, FL Metropolitan Statistical Area	80.9
Myrtle Beach-Conway-North Myrtle Beach, SC-NC Metropolitan Statis..	58.2
Crestview-Fort Walton Beach-Destin, FL Metropolitan Statistical Area	56.6
Daphne-Fairhope-Foley, AL Metropolitan Statistical Area	55.6
Gadsden, AL Metropolitan Statistical Area	33.4
Decatur, AL Metropolitan Statistical Area	27.8
Jonesboro, AR Metropolitan Statistical Area	27.8
Anniston-Oxford-Jacksonville, AL Metropolitan Statistical Area	27.7
Kingsport-Bristol-Bristol, TN-VA Metropolitan Statistical Area	26.2
Brunswick, GA Metropolitan Statistical Area	25.4

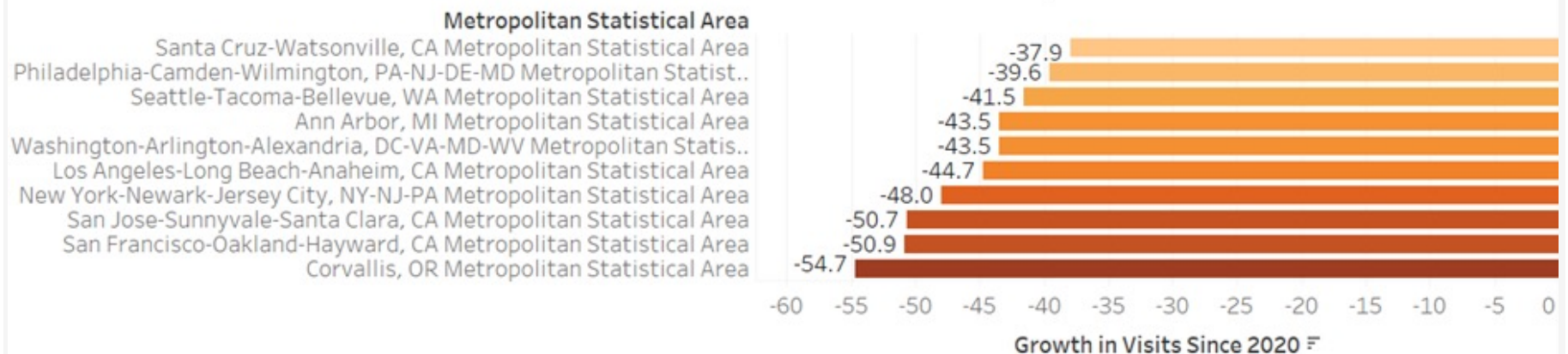**Growth in Visits Since 2020**

Sources: Thomas Young analysis of raw SafeGraph data.
Note: each color represents an MSA.

Mobility by Metro Area

Bottom 10 Metro Areas for Movement Growth Since January 2020

Metropolitan Statistical Area

Metropolitan Statistical Area	Growth in Visits Since 2020
Santa Cruz-Watsonville, CA Metropolitan Statistical Area	-37.9
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metropolitan Statist..	-39.6
Seattle-Tacoma-Bellevue, WA Metropolitan Statistical Area	-41.5
Ann Arbor, MI Metropolitan Statistical Area	-43.5
Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statis..	-43.5
Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area	-44.7
New York-Newark-Jersey City, NY-NJ-PA Metropolitan Statistical Area	-48.0
San Jose-Sunnyvale-Santa Clara, CA Metropolitan Statistical Area	-50.7
San Francisco-Oakland-Hayward, CA Metropolitan Statistical Area	-50.9
Corvallis, OR Metropolitan Statistical Area	-54.7

Growth in Visits Since 2020 ⚲

Sources: Thomas Young analysis of raw SafeGraph data.
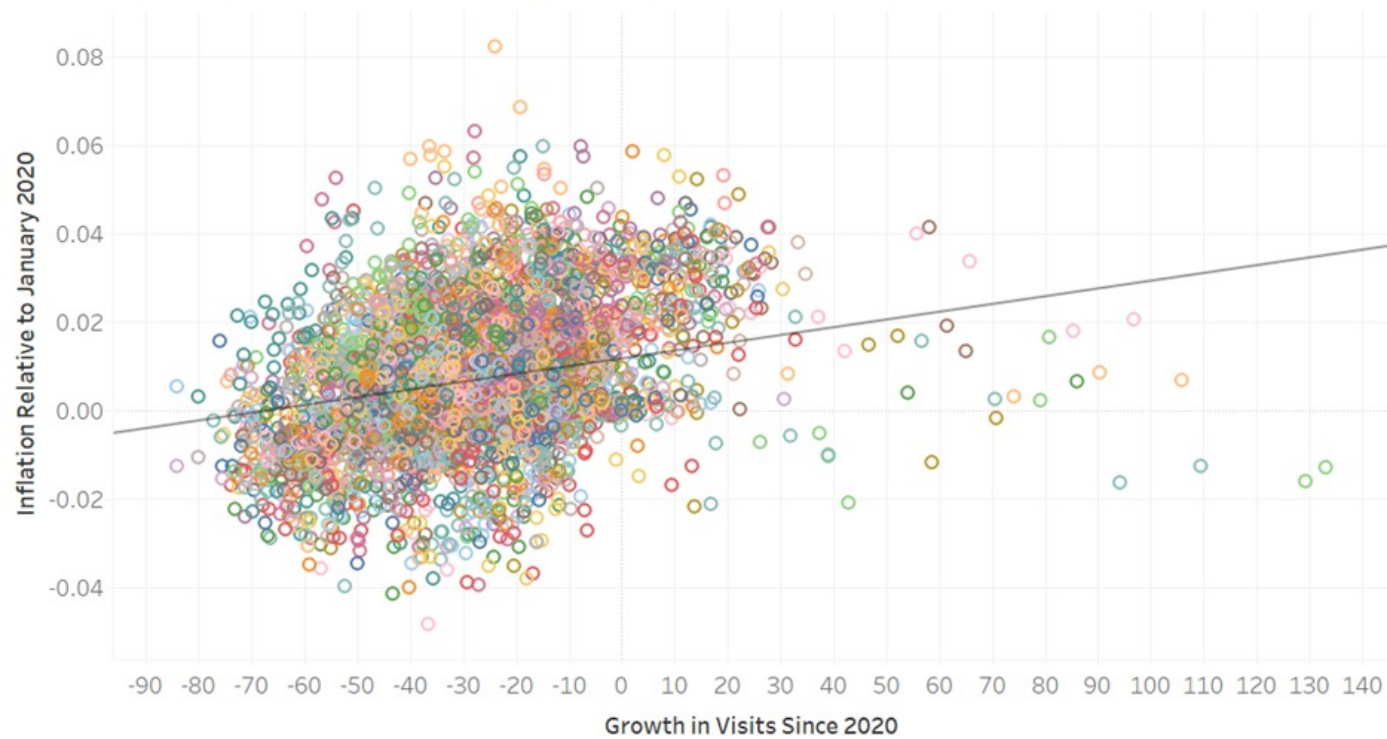Note: each color represents an MSA.

Correlations

Raw Correlation Between Raw Visits and Inflation by Metropolitan Statistical Area
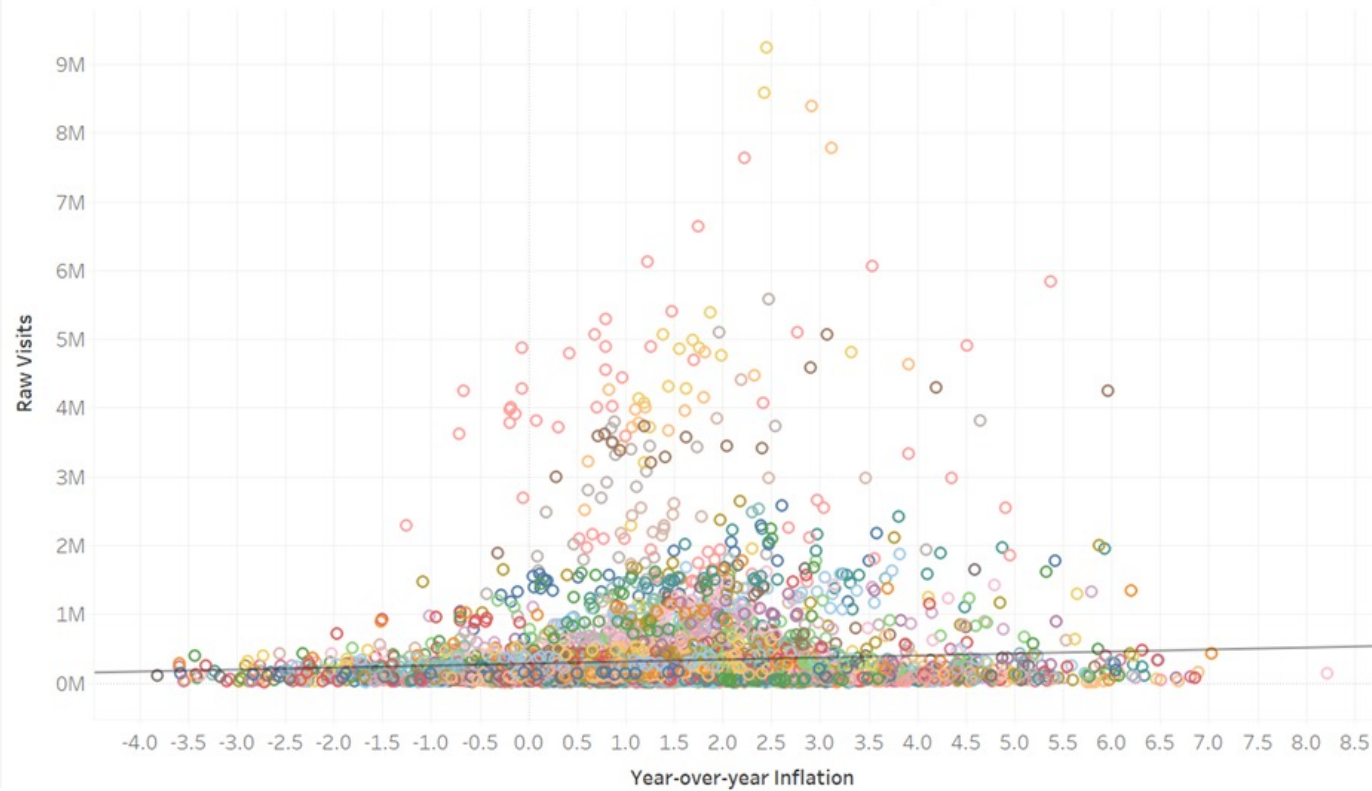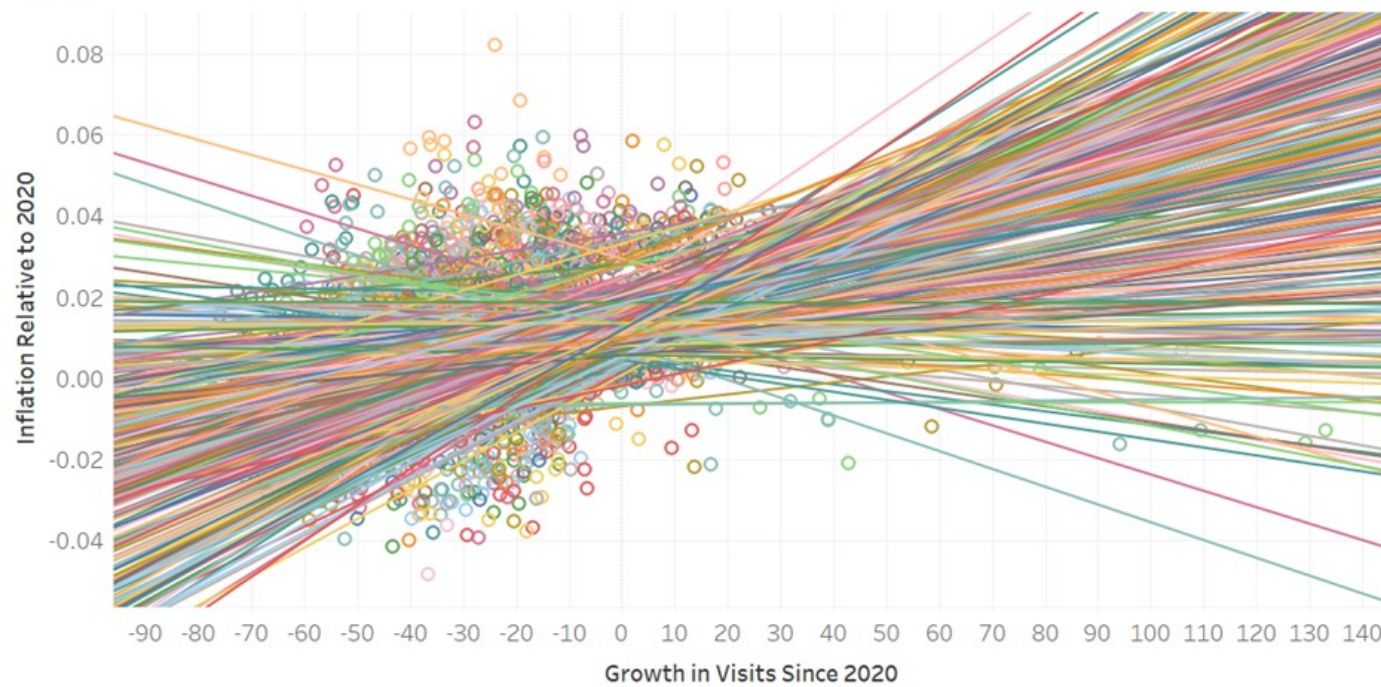
Correlations

Relative to 2020: Growth in Raw Visits and Inflation

Correlations

Relative to 2020: Growth in Raw Visits and Inflation - Trendlines for Each MSA
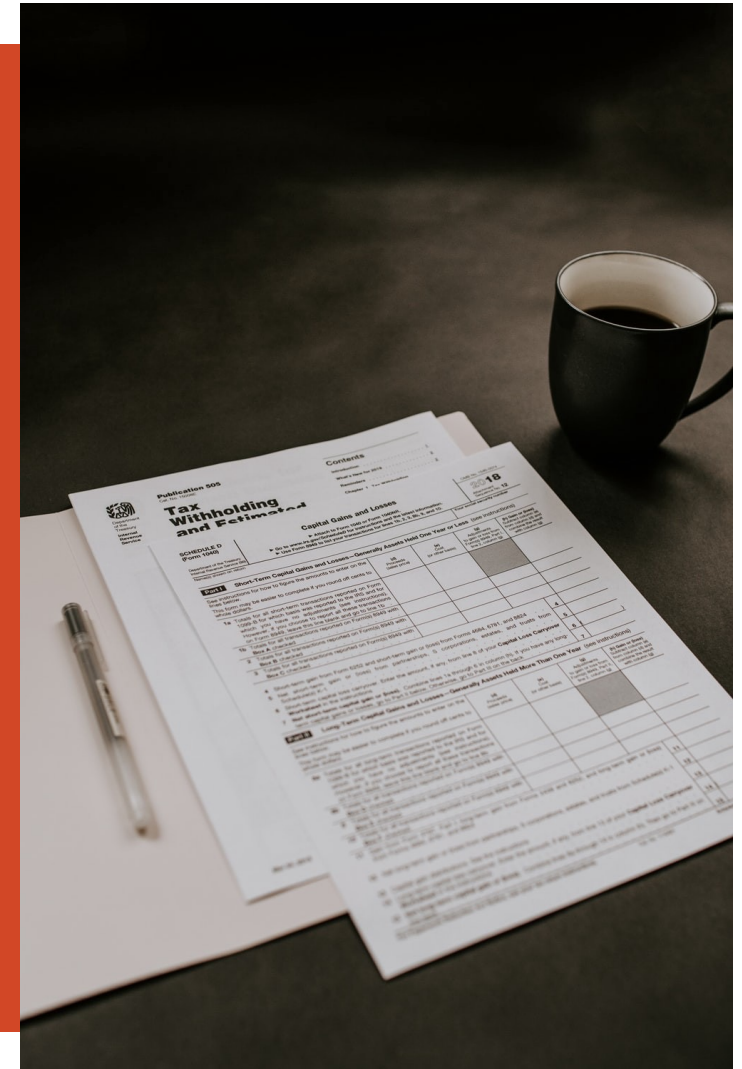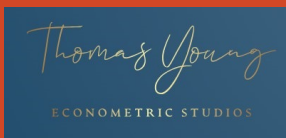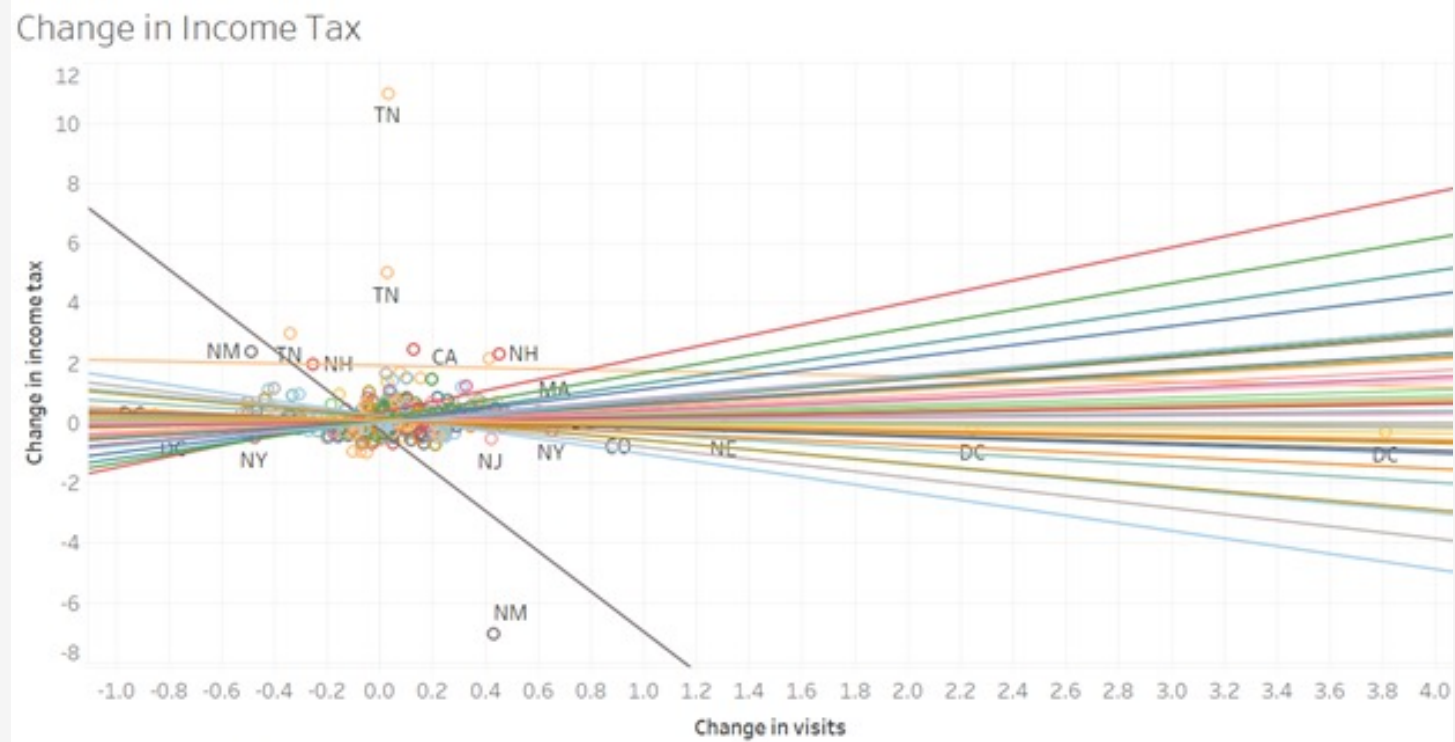

Sources: SafeGraph, BLS
Note: Regression lines done using Tableau.

Can we use cell phone tracking to predict revenue – income tax and sales tax?
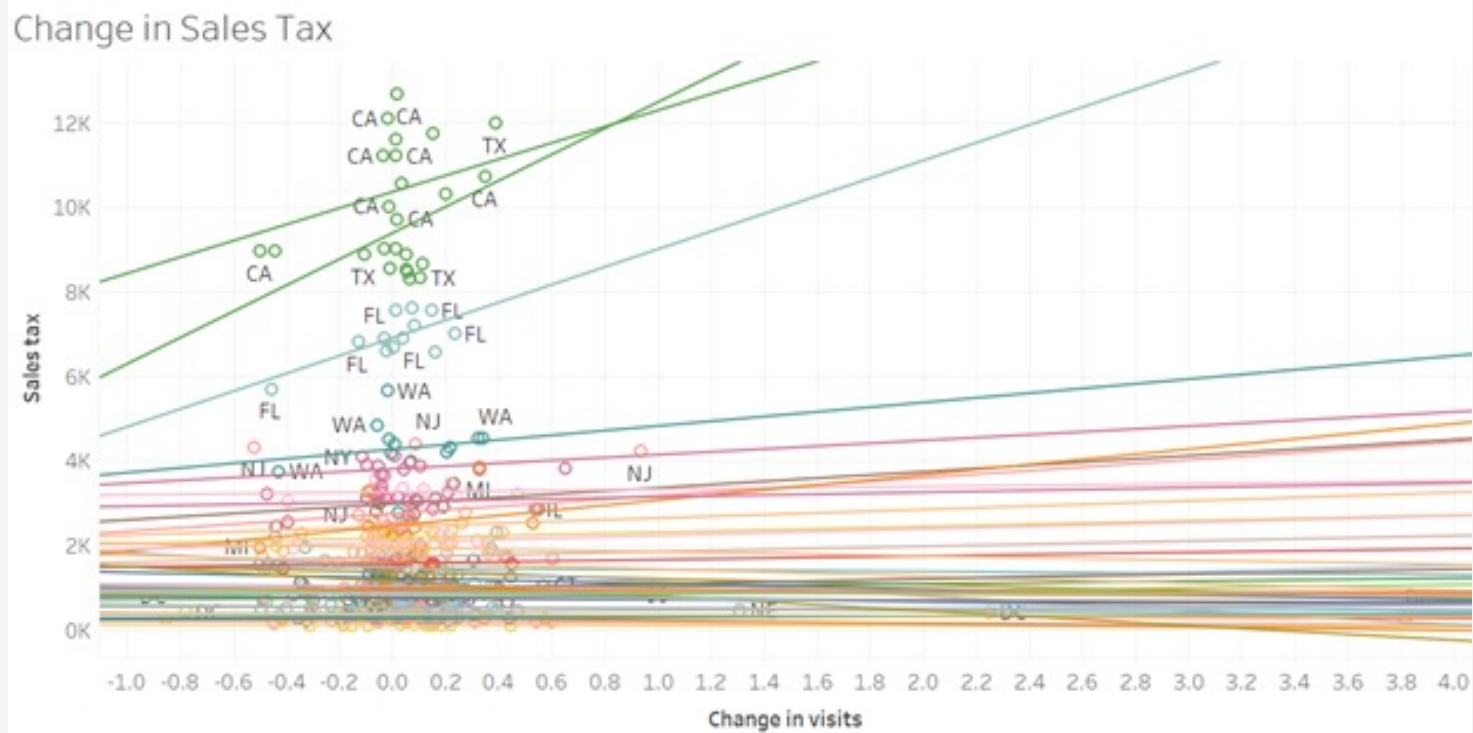
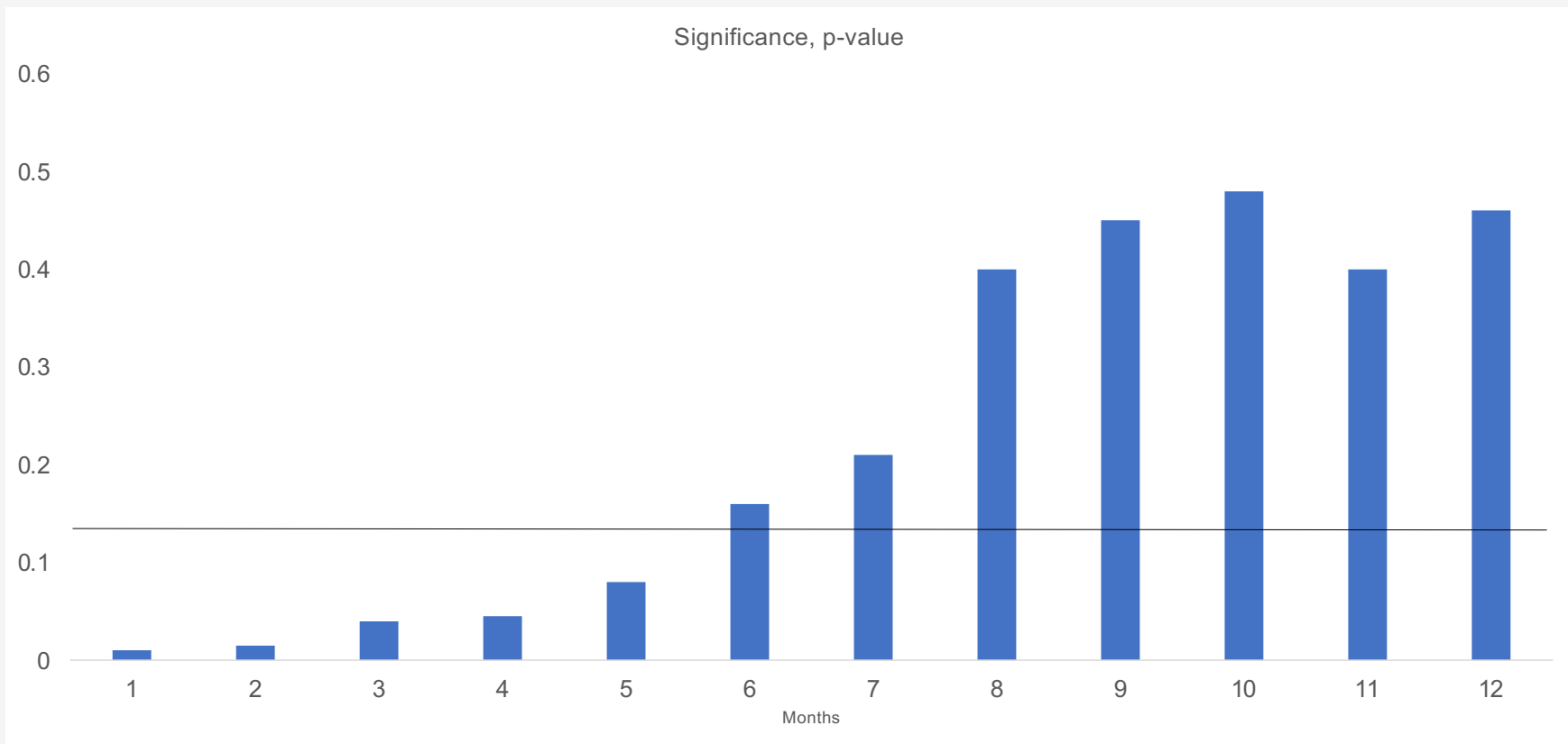Thomas Young, Ph.D.

The Correlations

Change in Income Tax

Sources: Census Bureau, SafeGraph
Analysis by Econometric Studios

The Correlations

Change in Sales Tax

Sources: Census Bureau, SafeGraph
Analysis by Econometric Studios

The Problem: Cell Phone Records Don't Come with Forecasts

Significance, p-value

How far out can those 5 months affect an up to 2-year forecast?

Thank You!

Thomas Young, Ph.D.
thomas.young@econometricstudios.com
(801) 647-4979
Bear White Investments
Econometric Studios, LLC