Inequality in Household Adaptation to Schooling Shocks: Covid-Induced Online Learning Engagement in Real Time

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Motivation

- Covid-19 represented an unprecedented shock to the U.S. (and worldwide) education system.

- In mid-late March 2020, every U.S. state ordered or recommended closure of K-12 public schools, creating serious disruptions for 55 million students.

- Most schools began remote education, raising concerns about learning loss and a potential rise in inequality, given unequal access to and engagement with online resources.

- Many schools remain remote close to a year later.

- In today's talk, I'll focus on evidence about families' short-run (spring 2020) adaptation to this shock.

Vox

The shift to online learning could worsen educational inequality

As school goes digital, low-income students are being left behind.
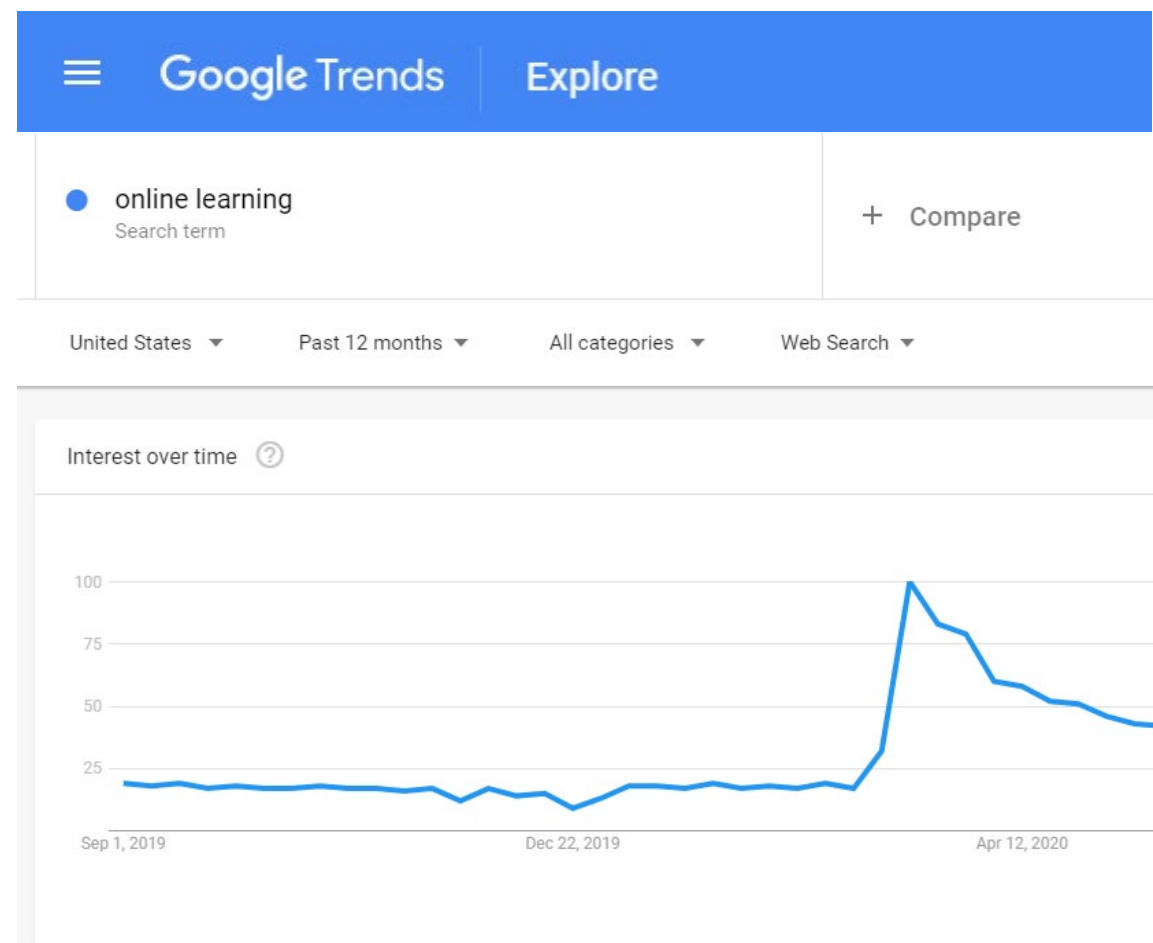
By Anna North | Apr 9, 2020, 1:10pm EDT

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The Paper in a 🥜 (All Research Is "Me-search")

Questions   How did US households adapt in the short run to Covid-induced school closures?

Did those responses differ by area socioeconomic status?

Data   We use high frequency Google search data to document in real time how parents and students sought out online resources as schools closed in response to the pandemic.

Approach   Nationwide event study, controlling for calendar effects

Difference-in-difference estimates by geographic measures of socioeconomic status

Findings   1. Search terms can be divided into "school-centered" and "parent-centered" resources, intensity of which historically follows the school calendar.

2. Covid disrupted this, triggering a huge increase in demand for both kinds of resources, as schools shift instruction modes and households seek to fill learning gaps.

3. Covid widened socioeconomic gaps in searches for online learning resources, with searches rising twice as much in above vs. below median SES areas.

Google Trends Search Data

- Google Trends makes public weekly measures of internet search behavior nationally and by Designated Market Area (DMA). DMAs are groups of counties, 210 of which cover the US.

- The available measure is "search intensity", the fraction of Google searches devoted to that term.

- Raw search volume/intensity are not available. Intensity is on a 0-100 scale, with 100 being the maximum intensity in a geography and time span.

- We use the logarithm of search intensity so estimates can be interpreted as percent changes.

- We assume increased search intensity means increased volume, given overall search volumes did not change much during the pandemic.

Categorizing Online Searches

- We brainstormed a long list of search terms and found they can be put into roughly 2 categories:

"School-centered resources"

- Largely educational platforms, such as Google Classroom and Schoology, that schools use to connect with students.

- Parents typically can not use these without the school's involvement.

"Parent-centered resources"

- Generic learning resources such as "math worksheets" and "home school"

- We interpret as parents (or guardians or students themselves) searching for resources on their own, without particular guidance from a school.

Categorizing Online Searches

- Search intensity for school-centered resources dwarfs that for parent-centered resources.

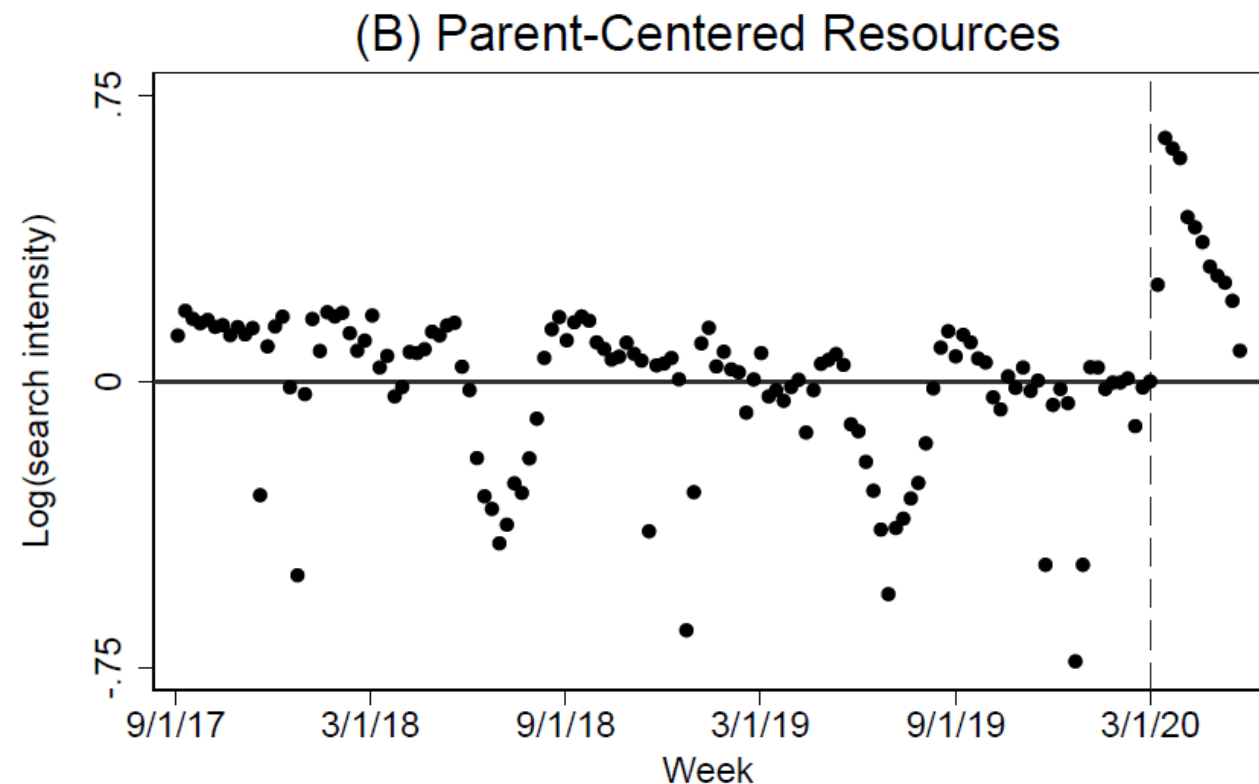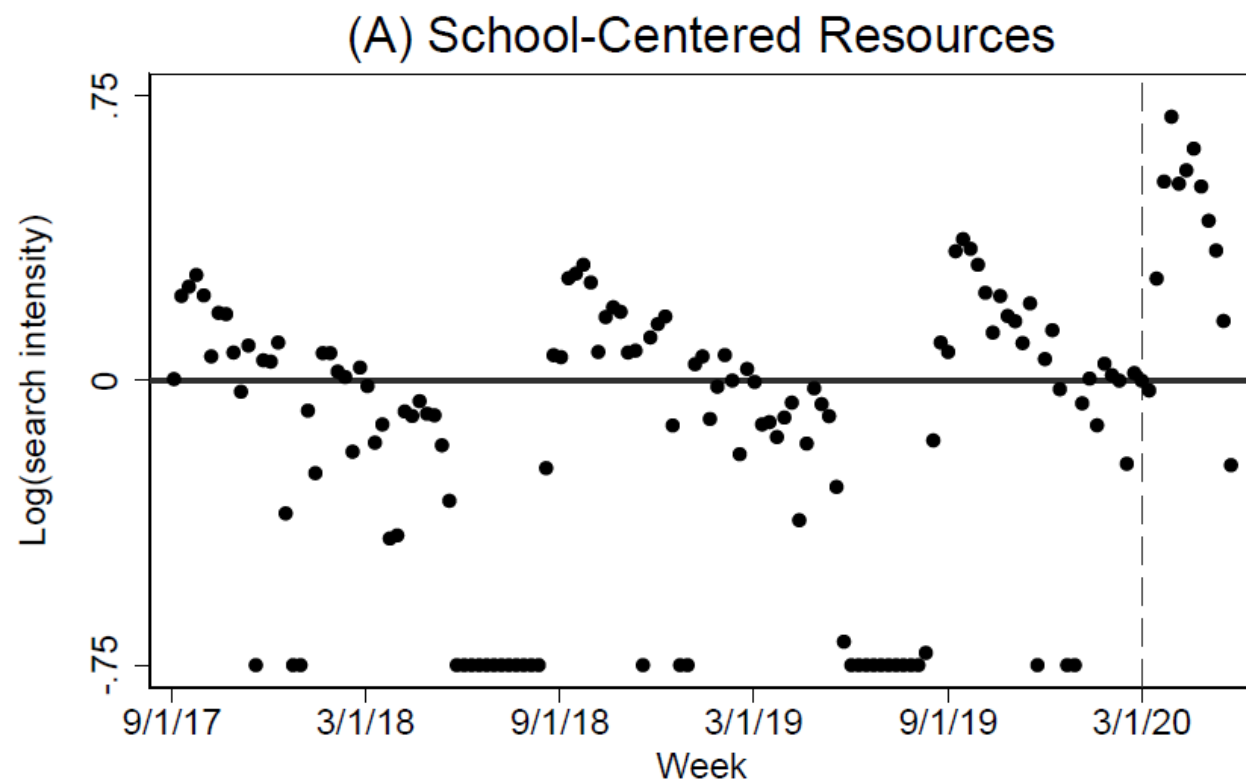- Google Classroom is by far the most searched term, both pre- and post-pandemic.

Table 1: Search Intensity of Top 10 Individual Keywords

School-Centered Resources			Parent-Centered Resources		
Keyword	Pre-Covid	Post-Covid	Keyword	Pre-Covid	Post-Covid
Google Classroom	1.00	1.95	Online school	0.04	0.06
Khan Academy	0.13	0.20	Online classes	0.03	0.05
Kahoot	0.33	0.19	Home school	0.03	0.03
Seesaw	0.02	0.15	Online class	0.00	0.02
Schoology	0.07	0.12	Math game	0.03	0.02
Class Dojo	0.01	0.06	Distance learning	0.00	0.02
Flipgrid	0.00	0.05	Math worksheets	0.00	0.02
D2L	0.05	0.05	Online math	0.00	0.01
Nearpod	0.02	0.02	Math problem	0.00	0.01
Edmodo	0.02	0.02	Online reading	0.00	0.00

Notes: Mean nationwide search intensity is shown for March-May 2019 (pre-Covid) and March-May 2020 (post-Covid). Search intensity of each term is measured relative to the pre-Covid search intensity for "Google Classroom". Searches are not case sensitive.
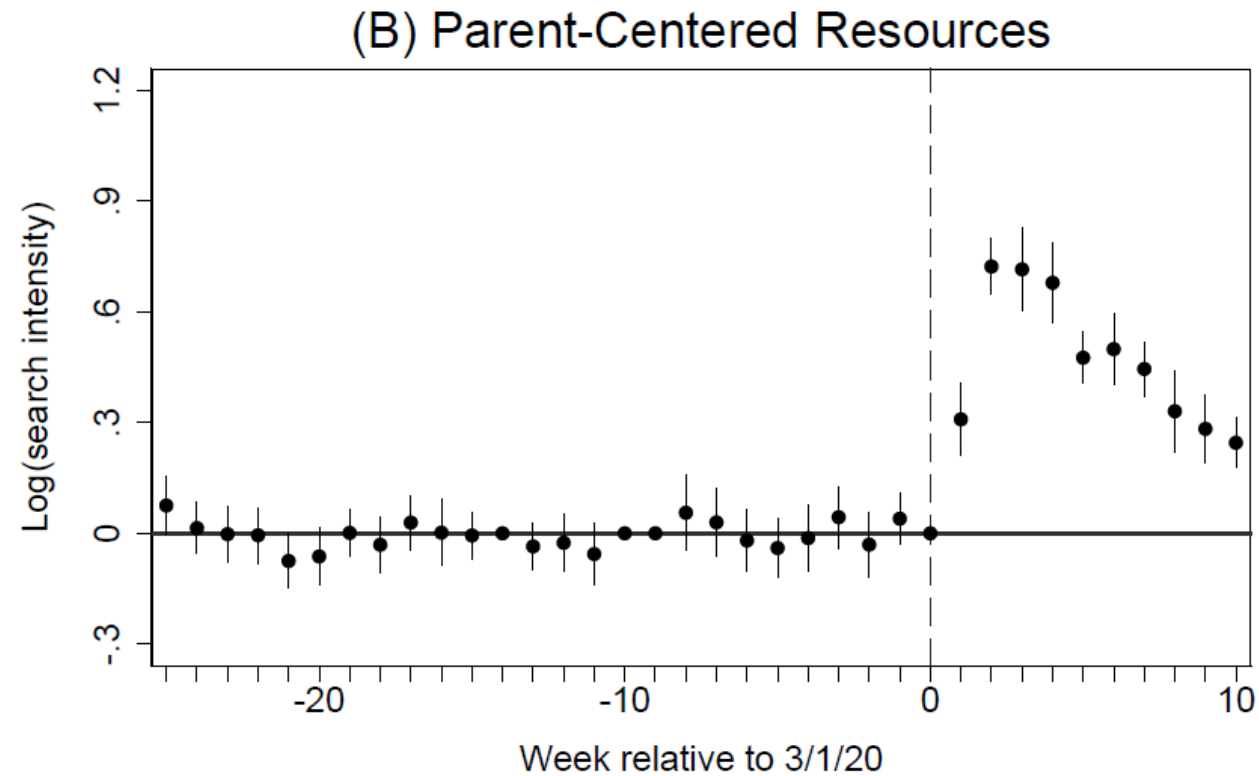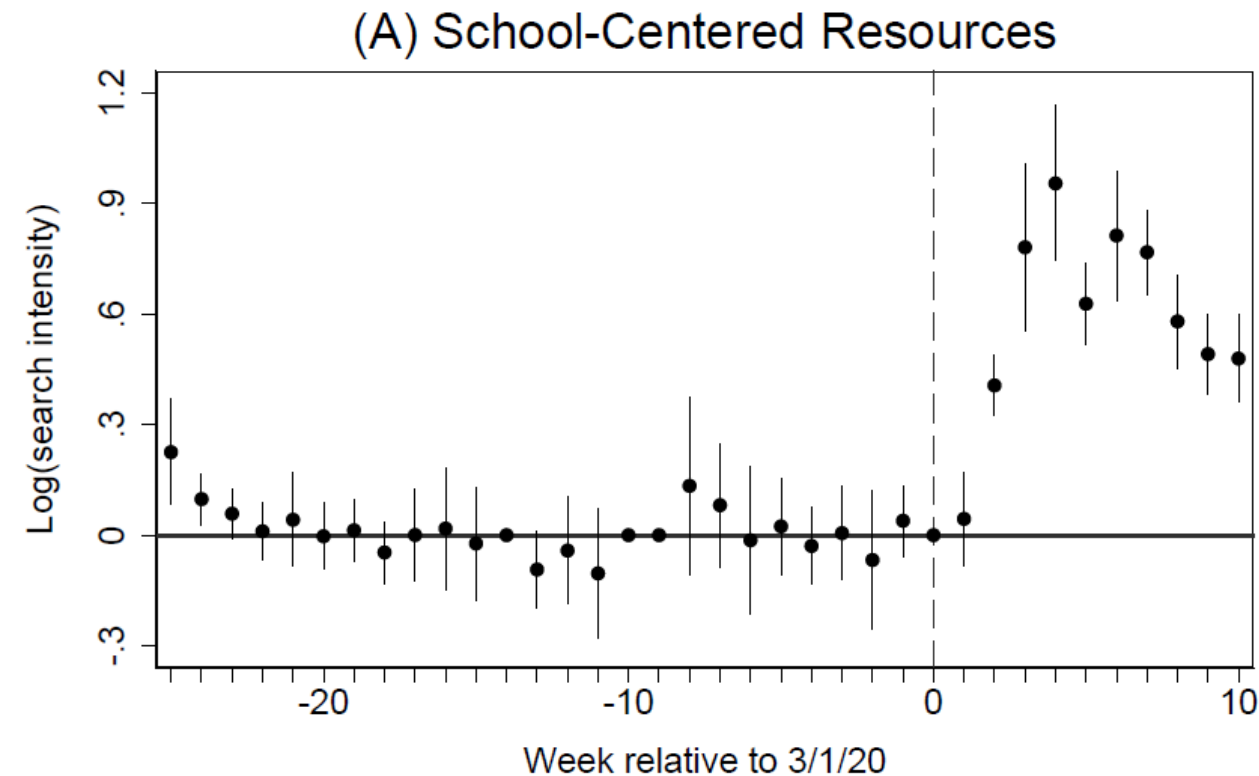
Rhythms of Search for Online Learning Resources

- Search intensity for online learning resources typically waxes and wanes with the school calendar.

- That annual rhythm was broken for the first time in spring 2020, with search intensity for online learning resources spiking dramatically (as seen in the raw data below).
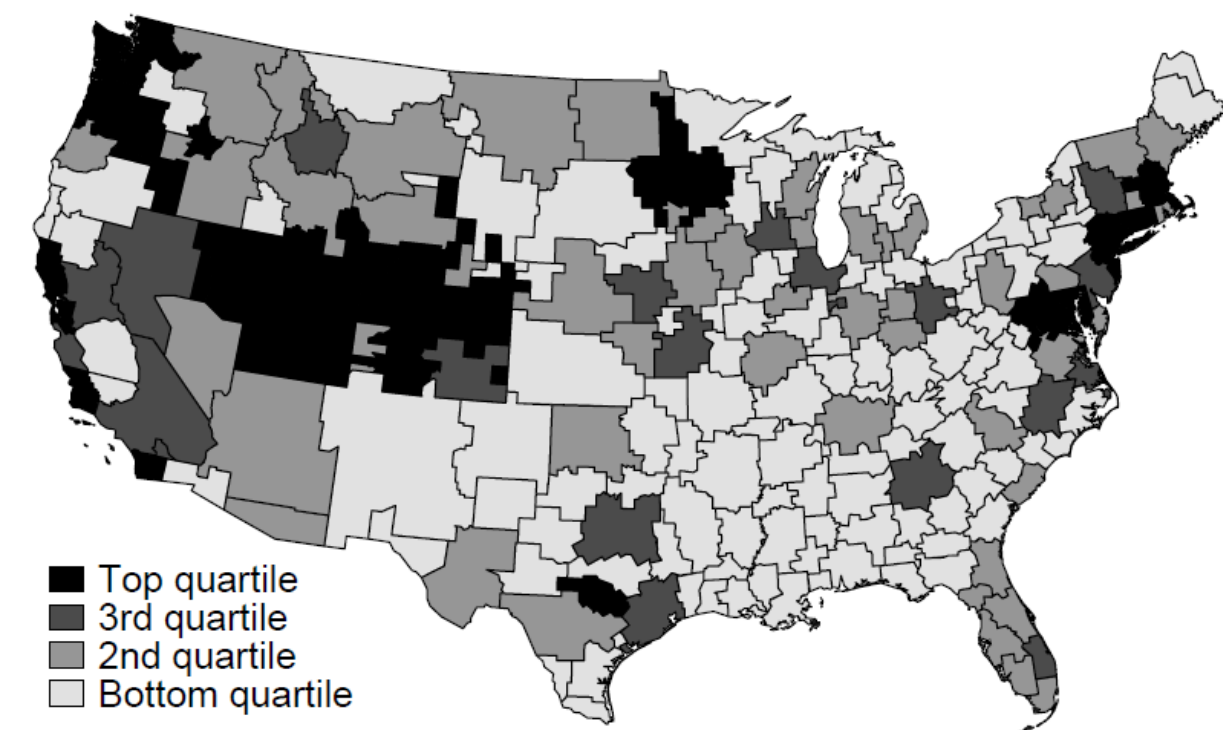

(A) School-Centered Resources

(B) Parent-Centered Resources

Nationwide Event Study

- Controlling for calendar effects makes the spring 2020 spike even clearer, with search intensity roughly doubling at its peak in late March.

- In April and May, search intensity for school-centered resources was 67% (51 log points) above average and for parent-centered resources was 40% (34 log points) above average.
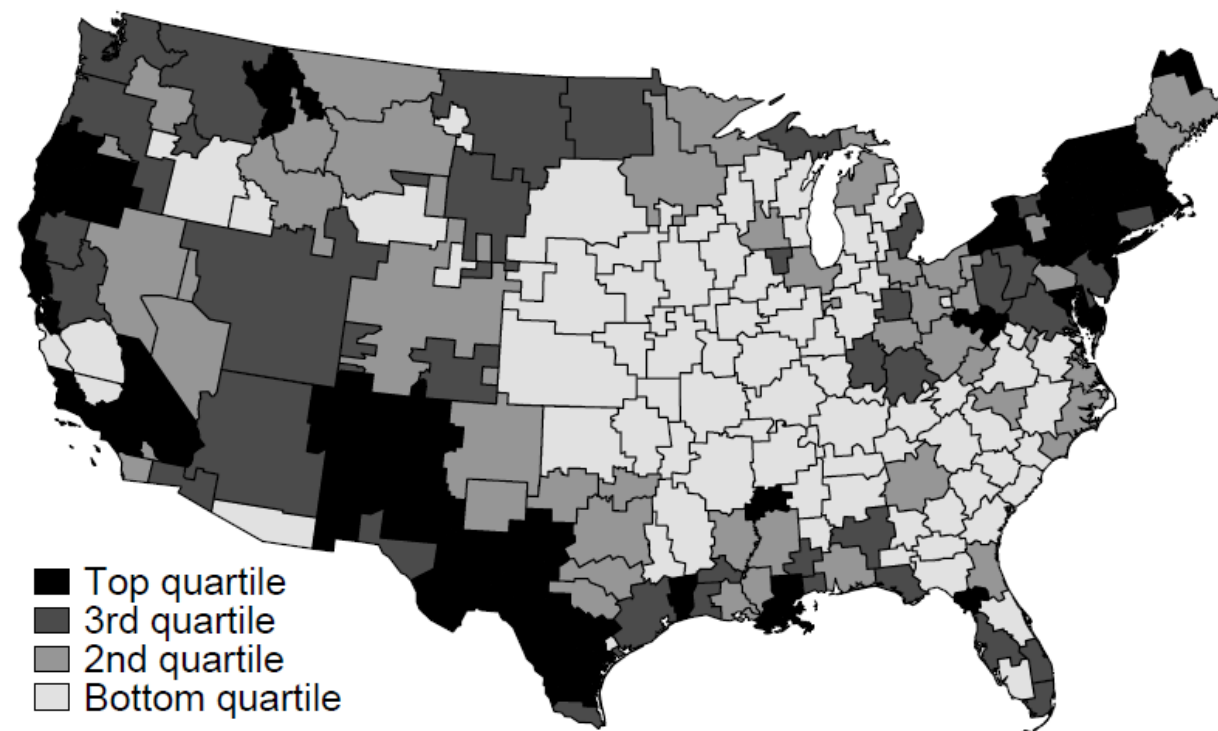

(A) School-Centered Resources   (B) Parent-Centered Resources

Raw Data on SES and Search Intensity Change

- Panel A shows DMAs by quartile of the SES distribution (population-weighted).

- Panel B shows DMAs by quartile of spring 2020 vs. spring 2019 search intensity for school-centered resources.
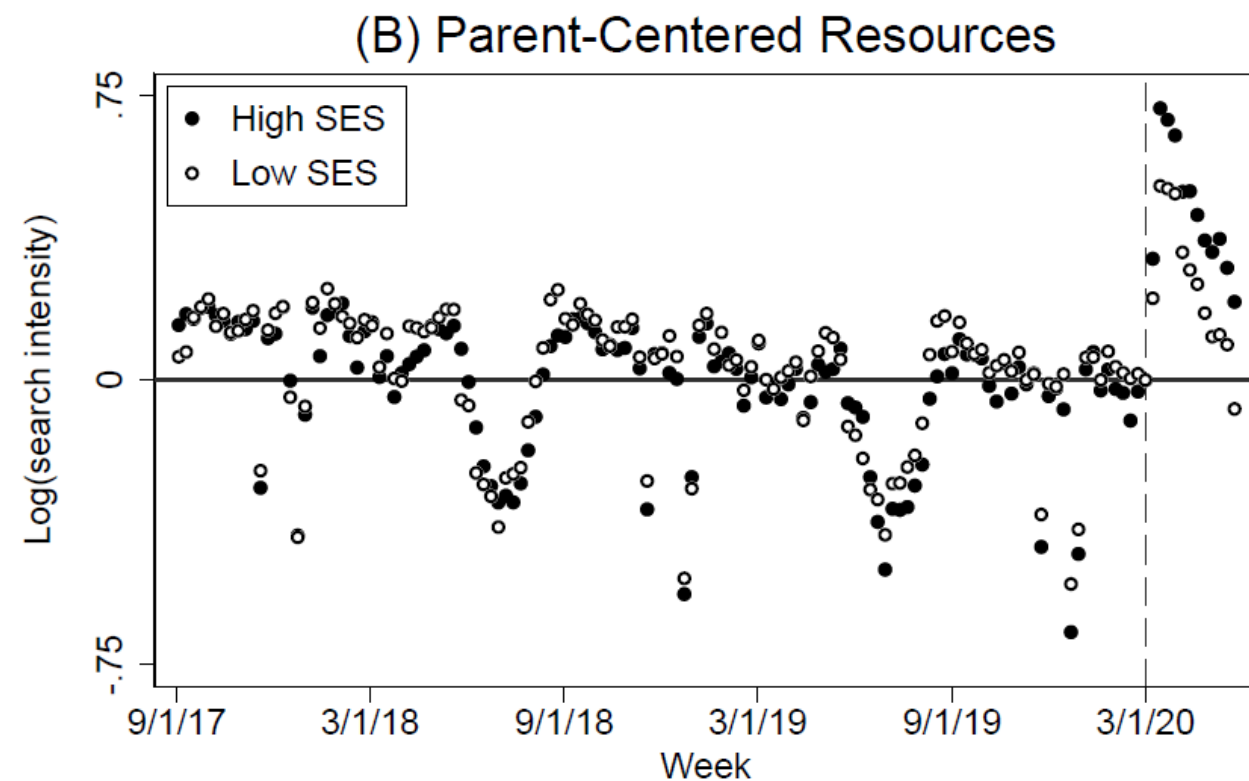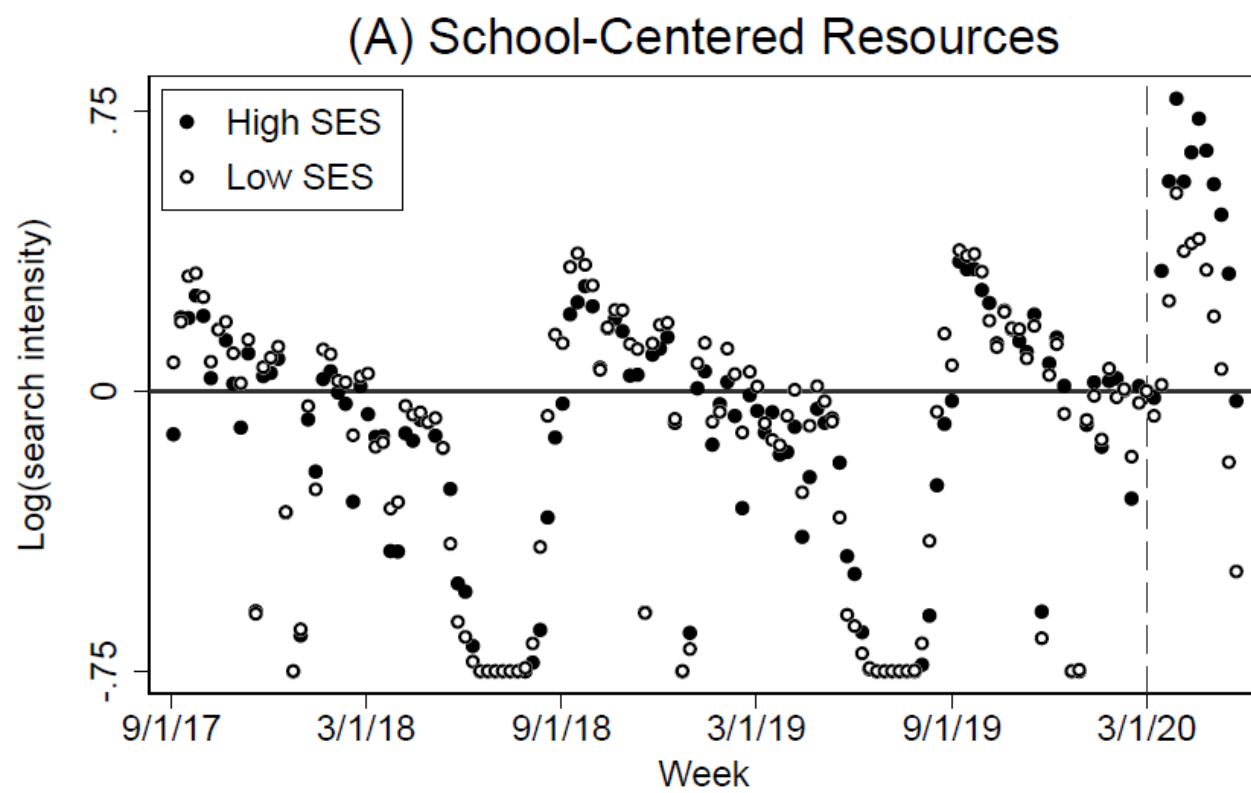
(A) Socioeconomic Status

Top quartile
3rd quartile
2nd quartile
Bottom quartile

(B) Post-Covid Change in Search Intensity

Top quartile
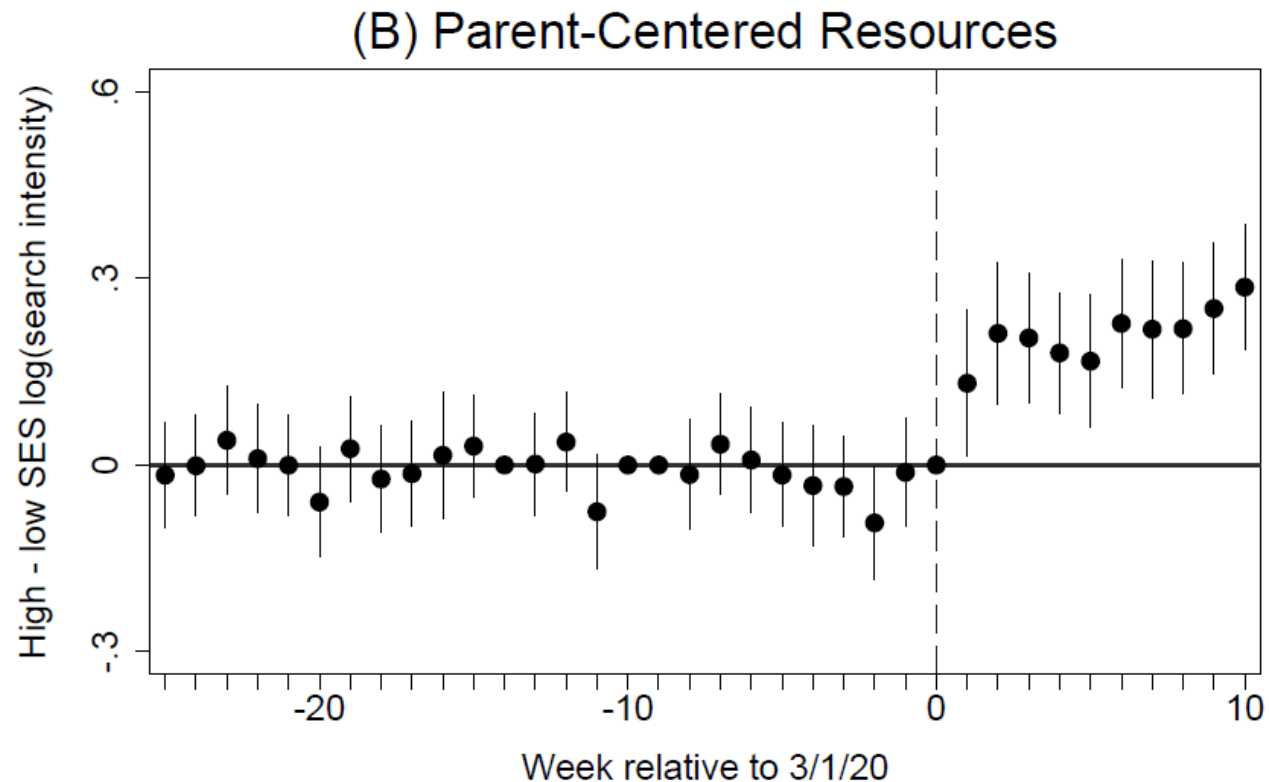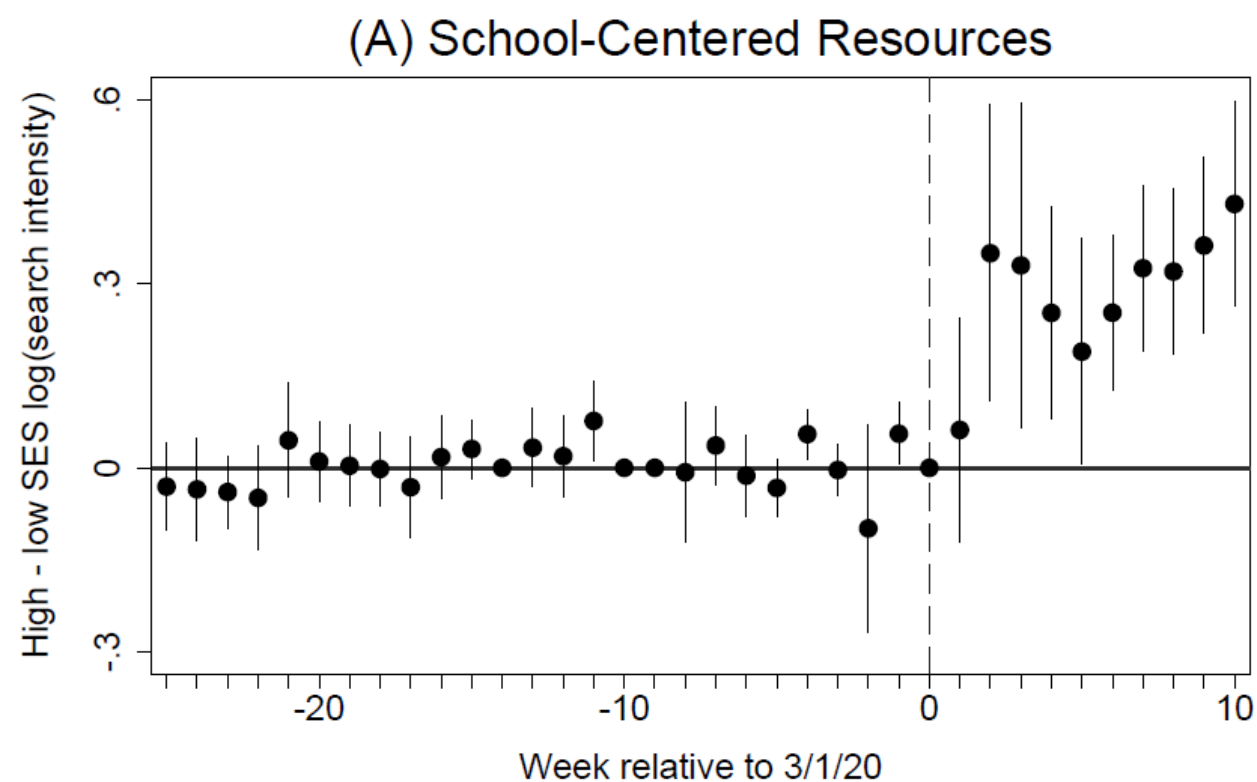3rd quartile
2nd quartile
Bottom quartile

Rhythms of Search, by SES

- Pre-Covid, search intensity for both school- and parent-centered resources varies little by SES.

- Post-Covid, a clear gap opens, with high SES areas seeing larger spikes in search intensity.

SES Differences in Search Intensity (Difference-in-Difference)
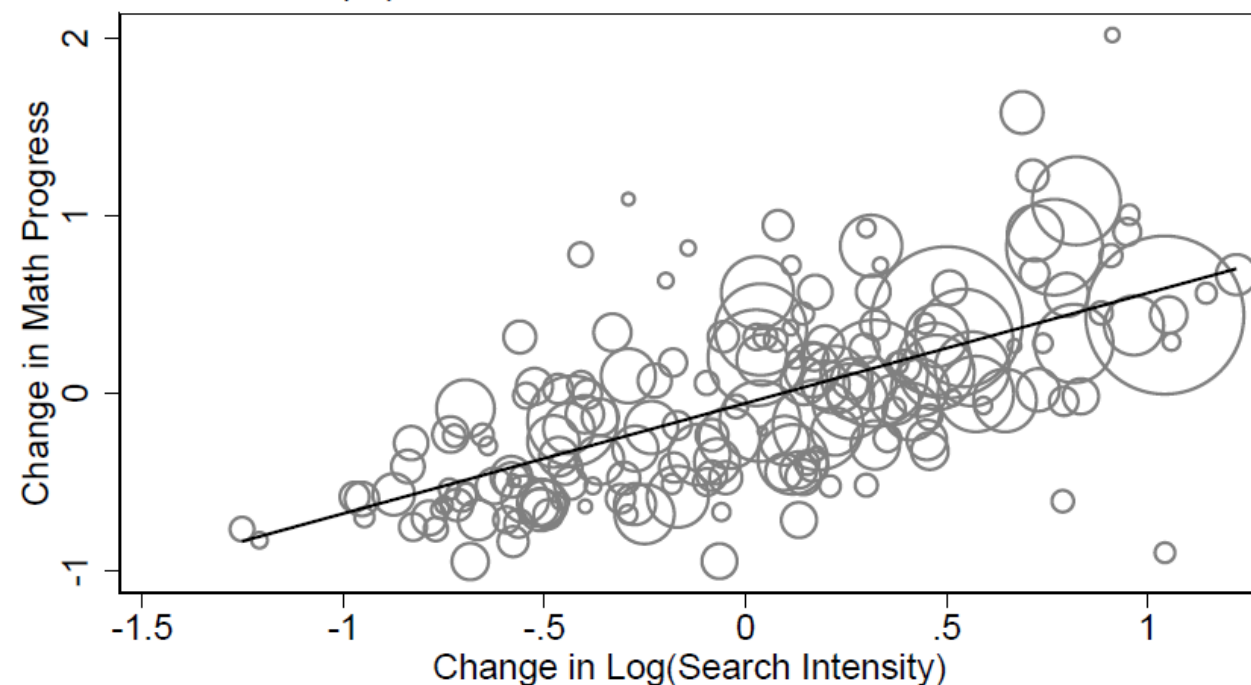
- Controlling for calendar effects makes the widening SES gap even clearer.

- Relative to low SES areas, high SES areas see a substantially larger post-Covid jump in search for both school- and parent-centered resources.

(A) School-Centered Resources

(B) Parent-Centered Resources
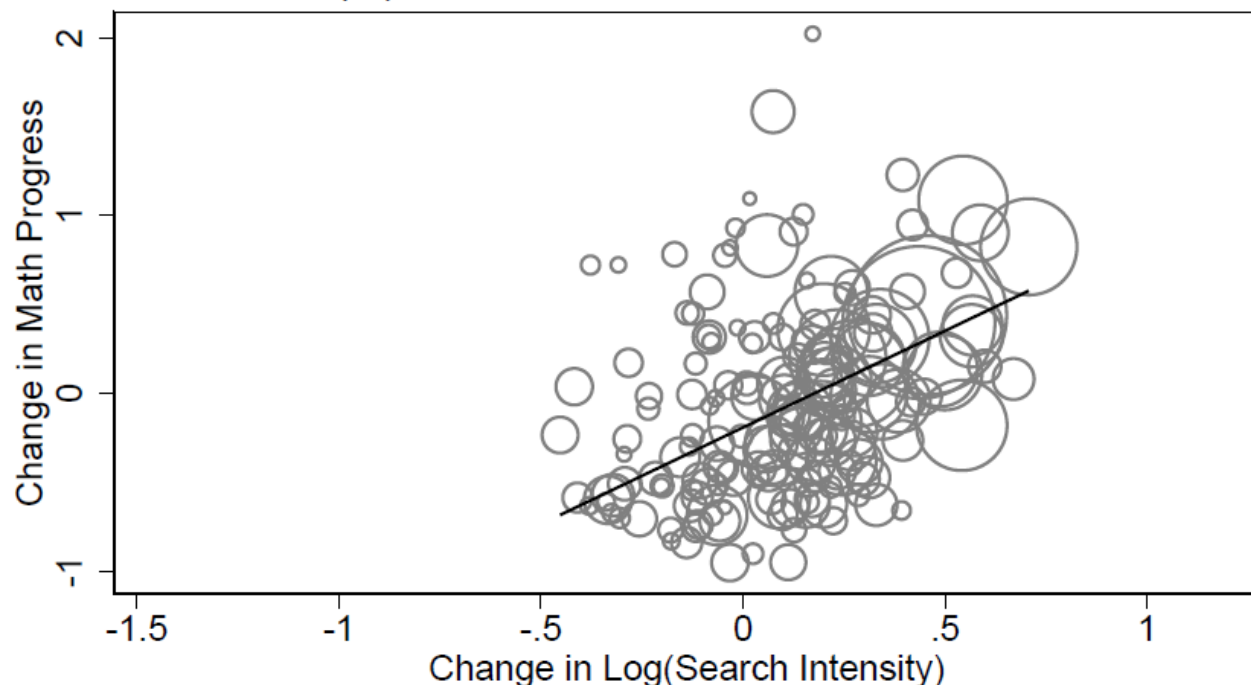
Actual Learning Outcomes

- Is online search behavior related to actual educational behavior or learning outcomes?

- We see strong correlations between DMA-level increases in search intensity for learning resources and DMA-level student progress on the Zearn math app (data via OI's tracktherecovery.org).
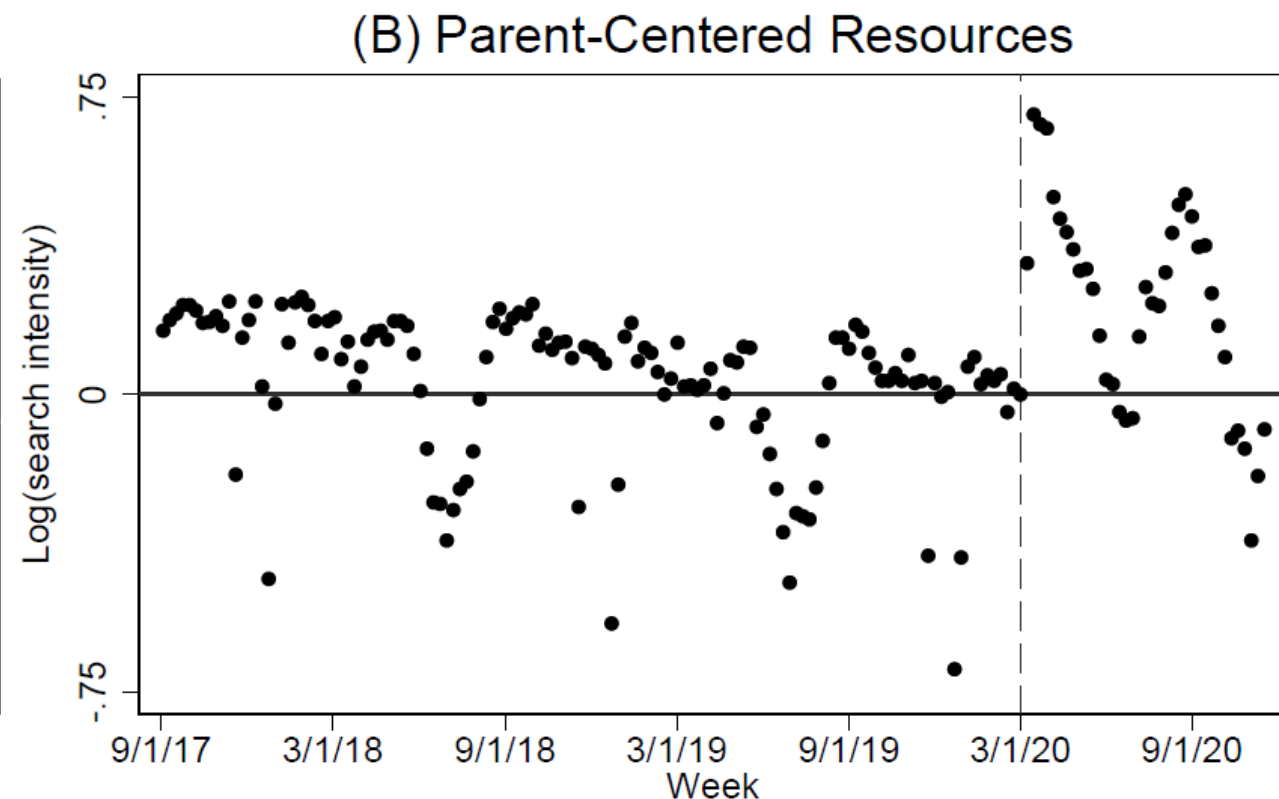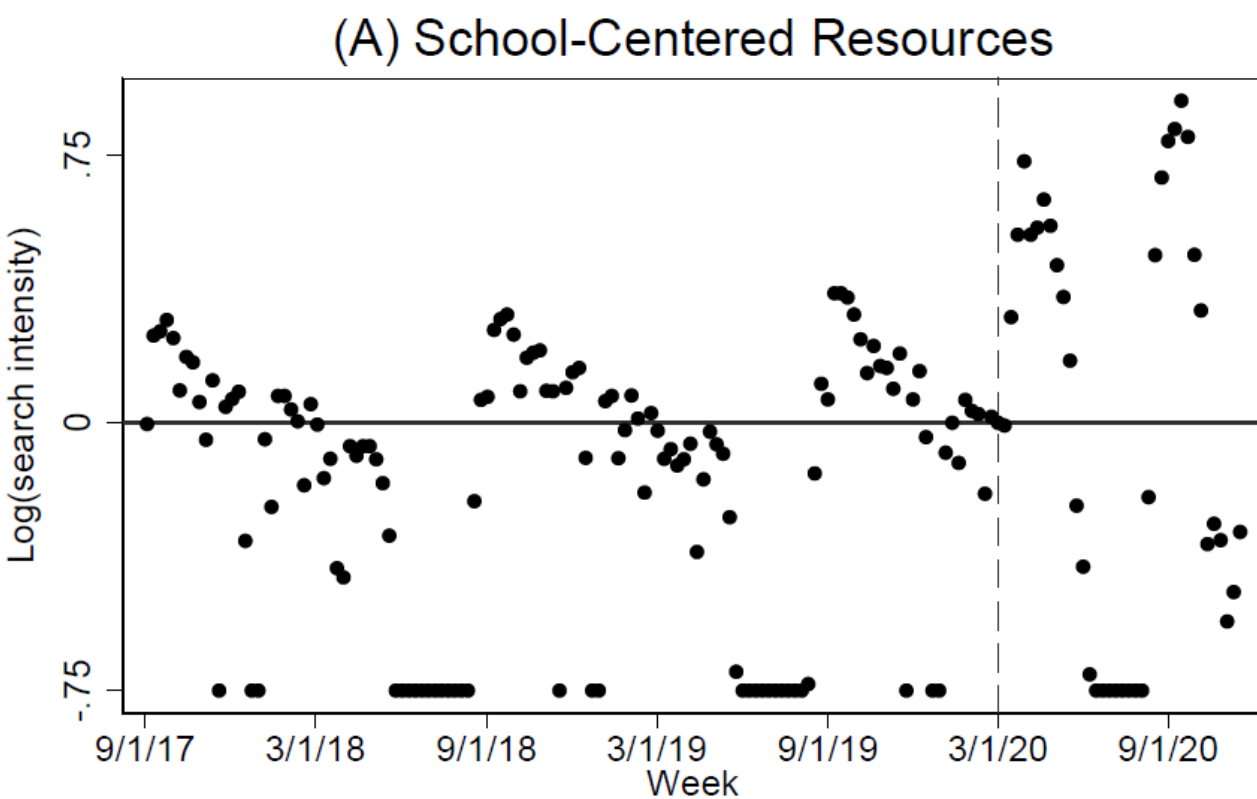

(A) School-Centered Resources

(B) Parent-Centered Resources

Correlation = 0.70

Correlation = 0.55

Fall 2020 Update (next paper?)

- Search intensity for school-centered resources vanished over the summer as usual, then roared back even higher in September than it had been in spring 2020.

- Search intensity for parent-centered resources dropped over the summer, though not nearly as much as usual, then spiked again in September.

(A) School-Centered Resources

(B) Parent-Centered Resources

Conclusions

- By April 2020, search intensity for online learning resources had doubled relative to baseline, both for school's instructional platforms and for supplemental resources sought by households.

  - The spike in search intensity was more than twice as large in high SES areas as in low ones.

  - These online resources are likely to be important drivers of student learning.

- Publicly available, high frequency internet search data help illuminate the evolution of educational choices made by households, as well as socioeconomic inequalities in those choices.

  - Our work can be updated in real time, done with different terms, replicated in other countries.

  - Understanding adaptive responses by parents and students will be critical to predicting the long-term effects of the pandemic, as well as understanding broader educational phenomena.

  - If you have data you want to share with us, please be in touch!