PlaceIQ Exposure Indices

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We develop and publish the PlaceIQ Exposure Indices for policy and academic users.

PlaceIQ conducts and releases its own research for commercial users.
PlaceIQ Exposure Indices

- We publish the following two indices daily:
  - Location Exposure Index (LEX): County-to-county movement
  - Device Exposure Index (DEX): Social contact within commercial venues

- We will soon release a companion paper:
  - Discuss suitability of smartphone data to quantifying movement and social contact.
  - Detailed description of our LEX and DEX data source and computations.
PlaceIQ Exposure Indices: Objectives

- Lower entry costs for new research
- Ease of comparing different research studies using data
- Transparent methodology
- Indices are IRB approved for release
PlaceIQ Exposure Indices: Device Visit Data

- Devices: Produce GPS “ping” whenever app request location data.

- Devices: Have unique ad ID, allows PlaceIQ to aggregates pings from different apps.

- Visit: Intersection of ping with basemap of two dimensional polygons (“venues”)

- Visit cleaning based on:
  - Number and density of pings in or near venue
  - Source of ping data
  - Venue size
PlaceIQ Exposure Indices: Devices Covered

- Smartphone sample varies through time:
  - Typical device remains 6 months in sample, lots of heterogeneity.
  - Some devices don’t ping regularly.

- Selecting our sample:
  - Keep devices that pinged 11 days over any 14-day period since Nov 2019 (53M devices).
  - If need demographics: Keep device where we can assign home location (30M devices).

- Large drop in devices generating pings starting March 2020
  - Can adjust our indices for sheltering-in-place
  - Even in normal times, smartphone sample size varies.
Smartphone datasets cover significant fraction of US

- \( \approx 80 \) percent of US adults own a smartphone
- \( \approx 10 \) percent of US adult population in our daily clean device sample.

Unrepresentative samples may arise from:

- Bias in smartphone ownership (only 53 percent of 65 year and older own a smartphone)
- Bias in app use and privacy settings
- Sample selection rules specific to research application
- Small geographic units.
Number of Devices vs Census Residential Population

**State**

- Smartphone Devices Residing in State (logged)
- State Population (logged)
- \( \beta = 1.08, \ R^2 = 0.96 \)

**County**

- Smartphone Devices Residing in County (logged)
- County Population (logged)
- \( \beta = 0.93, \ R^2 = 0.95 \)
Proportion of devices residing in a characteristic decile is close to 10%.
Device vs IRS Yearly Out-of-State Mover Share

\[ \beta = 0.74, \quad R^2 = 0.85, \quad \text{Num. Devices} = 5357528 \]
Device vs NHTS Trip Length Distribution

Density vs Distance Traveled (km)

- NHTS Low Pop Density
- NHTS High Pop Density
- PlaceIQ Low Pop. Density
- PlaceIQ High Pop. Density
Exposure Indices Definition

- Location Exposure (LEX)
  - Measures cross-county movement
  - Location-to-location matrix: exposure to county A within county B:
    - The share of the devices that pinged in a county B that also pinged in county A at least once during the last 14 days.

- Device Exposure (DEX)
  - Measures social contact within commercial venue
  - Average exposure of devices to other devices at commercial venues.
  - The number of distinct devices that visit any commercial venue that device visited on a given day, averaged over all devices in a county.
Conclusion

- Smartphone data captures movement and contact in real time.

- Smartphone data is broadly representative, but with a number of caveats.

- The PlaceIQ Exposure Indices are updated daily and available at:
  https://github.com/COVIDExposureIndices/COVIDExposureIndices

- Thank you!