Nowcasting Economic Activity with Mobility Data

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A brief summary

- What
  - Develop a high-frequency index to measure real-time demand in service industries and production activities in manufacturing industry.

- How
  - Use GPS mobility data from a mobile App, which estimate the hour-by-hour number of people in each 100m×100m square mesh;
  - Generate a real-time economic indicator (EIG) for a sector at time t as: # of people associated with the activity interested in at time t / # of people at reference time s

- When & Where
  - 2017:01 – 2020:03; Japan

- Why
  - Population in specified areas (associated with the activities interested in) can well predict certain economic activities in a timely manner, including consumption in service industries, and production in labor-intensive industries

Use of untraditional dataset

- Academic researches
  - Real-time potential customer search pattern provides additional information on firm earnings (Froot, Kang, Ozik, and Sadka, 2017);
  - Tradable investment strategy base on Amazon customer reviews (Huang, 2018);
  - Availability of alternative data improves price informativeness and helps discipline corporate managers (Zhu, 2019)
  - Disaggregated sales estimated from customer credit card spending provide accurate and persistent signals of customer demand relevant to a firm's stock pricing (Agarwal, Qian, and Zou, 2021)

- Real applications
  - Hedge funds use satellite image to infer consumer traffic at retailers (*The Wall Street Journal*, 2016);
  - Technology companies actively collecting individual's real-time bank account and credit card spending information (*The New York Times*, 2017)

Findings

- Echoes previous studies and show that the EIG generated from real-time mobile GPS data can accurately capture the economic activities at a timely manner.
  - The EIG closely mimics the population (i.e., potential customers) pattern in service industries including amusement park, shopping center, and food service industry
  - The EIG closely captures the labor input in labor-intensive manufacturing industries (transportation equipment and production machinery), but less precise for capital-intensive industries (electronic parts and devices)

Comments

- Very interesting paper!

- A hot topic

- Can be directly implemented for real applications
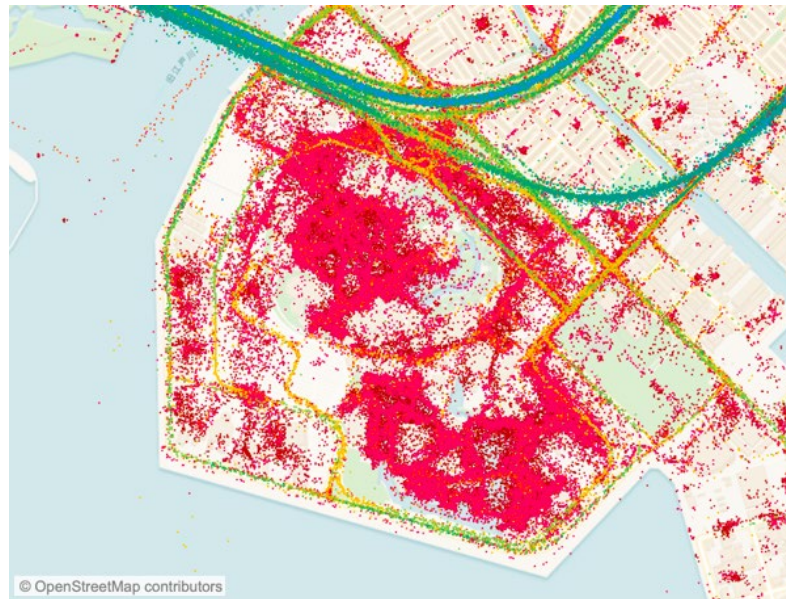
(Source: Agoop)

Comments

- 1. Representativeness of the data
  - The population data is collected through smartphone applications with the approval of users → potential selection bias?

  - How widely is the mobile App used?
    - Can provide some user statistics

  - Are these people approved data collection representative of the general population?
    - Can show the distribution of demographics for the general population and the mobile App users in the sample to check the difference

Comments

- 2. More explanation and justification of the EIG
  - How is the weight for each mesh exactly determined?

  - How to disentangle the relevant population (i.e., potential customers or workers) from the irrelevant population (i.e., the people just pass by)?

  - What's the economic meaning of the denominator (i.e., total # of people at reference point of time)? How can that solve the problem that the set of meshes selected "does not necessarily include meshes that cover all the facilities and buildings related to the industry"?

  - A real example will be helpful (eg., how the indicator for amusement park is computed)

Comments

- **3.** Empirical tests
  - Most evidence are shown in pictures, and at most correlations. More (advanced) statistical tests can help confirm and quantify the effect. Eg., regressions.

  - Selection criteria seems arbitrary / ex post
    - "we choose a combination of thresholds for the ratios so that the correlation between labor input and the population will be the highest".
    - If no industrial production data (which is low frequency and comes much later), how can the thresholds be determined?

Comments

- 4. External validity
  - Time dimension
    - Currently use all data to fit the historical trend: how closely does the EIG mimic the economic activities both at time t. Can we use the EIG at time t to predict economic activities at time t+1?
      - Can split the sample into a training period and prediction period.
      - May potentially solve the issue of the arbitrary selection criteria
    - With the trend of switching to online shopping and capital-intensive production, how long/well can this measure work?

  - Cross-sectional dimension
    - Only applicable to limited industries. Is that important enough?

Comments

- ## 5. Extensions
  - ### Potential mechanism
    - A more timely measure without additional information?
      - Customer characteristics and spending patterns offer signals to gauge the sustainability of customer interest (Agarwal, Qian, and Zou, 2021).

  - ### Tradable strategy?
    - Can we generate investment strategy out of the more timely data?
      - A spread portfolio longing stocks with high abnormal customer ratings and shorting stocks with low abnormal customer ratings delivers significant positive abnormal return (Huang, 2018).

Thank You

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