Tracking the COVID-19 Crisis with High-Resolution Transaction Data

Nontraditional Data & Statistical Learning with Applications to Macroeconomics

Banca d’Italia and Federal Reserve Board Joint Conference

Vasco M. Carvalho, Juan R. García, Stephen Hansen, Álvaro Ortiz, Tomasa Rodrigo, José V. Rodríguez Mora, Pep Ruiz

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INTRODUCTION

Transaction data to measure consumption in real time and high definition

Financial data

Individual to firm transactions
Credit and debit cards + Point of Sales (PoS)

Reassuring data management process

Data Ingestion
Data Quality
Data Representativity

Measuring National Accounts in Real Time & High Definition

Use of card spending for nowcasting aggregate consumption and making granular economic analysis

Expenditure adjustments during the Covid-19 pandemic: the case of Spain
THE DATA

Transaction sample statistics for the Spanish data

Universe of transactions by BBVA - issued credit and debit cards and at BBVA - operated PoS
Jan 1st 2019 - 29th of June 2020

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Transactions</strong></td>
<td>1.4 Billion</td>
<td>0.7 Billion</td>
</tr>
<tr>
<td>% Offline</td>
<td>92</td>
<td>95</td>
</tr>
<tr>
<td><strong>Transaction Values</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th Percentile</td>
<td>1.6€</td>
<td>1.9€</td>
</tr>
<tr>
<td>25th Percentile</td>
<td>8.5€</td>
<td>8.4€</td>
</tr>
<tr>
<td>50th Percentile</td>
<td>19.8€</td>
<td>19.3€</td>
</tr>
<tr>
<td>75th Percentile</td>
<td>45.4€</td>
<td>44.0€</td>
</tr>
<tr>
<td>95th Percentile</td>
<td>191.2€</td>
<td>176.6€</td>
</tr>
<tr>
<td><strong>Number of Points of Sale</strong></td>
<td>2 Million</td>
<td>1.6 Million</td>
</tr>
<tr>
<td>% Offline</td>
<td>70</td>
<td>65</td>
</tr>
<tr>
<td><strong>BBVA Cardholders</strong></td>
<td>6.3 Million</td>
<td>5.9 Million</td>
</tr>
</tbody>
</table>

- Geographical detail – postal code
- Consumption categories (76)
- Cardholders:
  - home address postal code
  - education level
  - age
- International data:
  - Argentina, Colombia, Peru, Mexico, Southern United States and Turkey
  - 3.8 Bn transactions
The data

Card spending indicators in real time and high definition

Data may be analyzed between 1-3 months ahead than the official figures

Publication calendar for consumption according to the National Institutes of Statistics by country

End of the month

1 month ahead

2 months ahead

3 months ahead

Data has more granular detail on household spending than the official figures

Category
Transport, Food, Restaurants, Hotels,…

Geography
Regions, cities and even postal codes

Online / Offline
Performance of online vs face-to-face purchases

Card / Cash
Card purchases vs ATMs withdrawals

Nationality
National cards vs foreign cards
RESULTS: Tracking the COVID-19 Crisis in Real Time

A Global Expenditure Contraction and the Recovery

Cross country evolution of daily expenditure growth (YoY, in deviation from pre-March 8th mean growth, 14-day moving average)

Cross country monthly expenditure growth (YoY, in deviation from pre-March 8th mean growth)
RESULTS: Tracking the COVID-19 Crisis in Real Time
In and Out of Lockdown: evidence for Spain

Evolution of daily Spanish expenditure growth (YoY, in deviation from pre-March 8th mean growth, 7-day moving average)
RESULTS: Tracking the COVID-19 Crisis in Real Time

Province-level Variation in Timing + Extent of Easing

Evolution of daily Spanish expenditure growth by provinces: lockdown relaxation – switchers vs stayers
(average YoY expenditure growth for the provinces which eased into Phase 1/2/3 plotting it against the average for those provinces that stayed in the more restrictive Phase, centered around lockdown easing announcement days)

Extensive margin/size dependent shutdowns more damaging than capacity restrictions (conditional on being open)
RESULTS: BBVA card data as a consumption survey - Household spending and income

Reallocation of Consumption During COVID-19: spending by income

Categories more positively and negatively correlated with average income across Madrid postal codes
(In red, categories restricted during the lockdown)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Taxi</td>
<td>0.67</td>
<td>Gas Stations</td>
<td>-0.48</td>
</tr>
<tr>
<td>Sports</td>
<td>0.62</td>
<td>Supermarkets</td>
<td>-0.35</td>
</tr>
<tr>
<td>Beauty &amp; Hairdressers</td>
<td>0.58</td>
<td>Car Technical Inspection</td>
<td>-0.35</td>
</tr>
<tr>
<td>Restaurants</td>
<td>0.58</td>
<td>Telephony</td>
<td>-0.26</td>
</tr>
<tr>
<td>Parking</td>
<td>0.53</td>
<td>DIY: Small Retail</td>
<td>-0.25</td>
</tr>
<tr>
<td>Fashion: Small Retail</td>
<td>0.42</td>
<td>Insurance</td>
<td>-0.25</td>
</tr>
<tr>
<td>Mid- &amp; Long-Distance Trains</td>
<td>0.41</td>
<td>Tobacco</td>
<td>-0.23</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>0.40</td>
<td>Auto Sales/Repair/Parts</td>
<td>-0.23</td>
</tr>
<tr>
<td>Travel Agency: Physical Location</td>
<td>0.38</td>
<td>Veterinary</td>
<td>-0.22</td>
</tr>
<tr>
<td>Bars &amp; Coffee Shops</td>
<td>0.37</td>
<td>Miscellaneous</td>
<td>-0.18</td>
</tr>
</tbody>
</table>
RESULTS: BBVA card data as a consumption survey - Composition of Consumption in the Lockdown

Reallocation of Consumption During COVID-19: categories

Evolution of market shares of offline spending by consumption categories (% of total)

Cross sector October monthly Spanish expenditure growth (YoY, in deviation from pre-March 8th mean growth)
RESULTS: BBVA card data as a consumption survey - Composition of Consumption in the Lockdown

Reallocation of Consumption During COVID-19: Madrid postal codes

Evolution of daily Spanish expenditure growth in Madrid’s postal codes (by postal code average income - in quintiles according to their average income per capita in 2017-, 7-day moving average)

Evolution of daily Spanish expenditure growth in Madrid’s postal codes (by postal code average income - in quintiles according to their average income per capita in 2017-, YoY, in deviation from pre-March 8th mean growth, 7-day moving average)
RESULTS: Transaction data as a Real Time Mobility Proxy

Card spending on transportation tracks mobility during lockdown very closely

BBVA card data spending on transportation subcategories vs Google Mobility data for Spain
(percent change)

Evolution of daily Spanish expenditure in transport in Madrid’s postal codes by income decile
(percent change)
**RESULTS: The infection cost of mobility**

**Urban Transport, Income and Disease Incidence**

### Daily Covid-19 incidence within postal code.

**Estimated coefficients of disease model**

(Standard errors in parentheses)

<table>
<thead>
<tr>
<th>Daily COVID-19 incidence within Postal Code</th>
</tr>
</thead>
</table>
| Lagged spending on urban transport | 0.5729***  
  | (0.008120)  
| lockdown | 1.590***  
  | (0.01792)  
| Lagged daily incidence | 0.02644***  
  | (0.0001981)  

| Postal Code F.E. | Y  
|-----------------|----|
| N               | 26784  

![Percent reduction of cases in counterfactual exercise by income decile with a bar chart showing the reduction in cases for each income decile.](chart)

* Percent reduction of cases in counterfactual exercise by income decile:

- **Counterfactual exercise in which we impose the mobility patterns of the highest-income decile of Madrid postal codes on all postal codes during lockdown, in percentage of the total cases**
RESULTS

Main takeaways

Transaction data can be used to assess economic conditions, capturing relevant patterns in spending in near-real time and high-definition.

Transaction data has proved to be useful to track the economy and exploit time series, cross-sectional and geographical dimensions.

Useful data for policy-makers and researchers specially in a middle-income and developing countries.

Tracking the COVID-19 crisis

Expenditure adjustments during the pandemic.

Sharp decline in expenditure as a response to the lockdown.

Fast recovery during the progressive easing (V shape).

Large reallocation across expenditure categories and income groups.

Detailed transaction data on transportation and commuting spending can be used to explain disease incidence at the local level – Madrid postal codes.

Differential mobility (to work) induced unequal disease outcomes across income groups.
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