Big Data, Covid Inflation and Stockouts

Alberto Cavallo
Harvard Business School, NBER

Banque de France– June 27, 2022

Disclaimer: Alberto Cavallo is a shareholder of PriceStats LLC, a private company that provided proprietary data used in this presentation without any requirements to review the findings.
Inflation Measurement with Online Data

• History:
  – 2007: Argentina Lies – “Inflacion Verdadera”

“Web Scraping”

<html>
<descripcion> Leche Condensada </descripcion>
<brand> Nestlé </brand>
<td price> $1.199 Uni </td>
Inflation Measurement with Online Data

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Source: PriceStats, INDEC, The Billion Prices Project
Inflation Measurement with Online Data

• History:
  – 2007: Argentina Lies – “Inflacion Verdadera”
  – 2008: The Billion Prices Project
Inflation Measurement with Online Data

- History:
  - 2007: Argentina Lies – “Inflacion Verdadera”
  - 2008: The Billion Prices Project
  - 2010: PriceStats (www.pricestats.com)
    - Real-time inflation in 23 countries
      - Daily data collected online
      - Over 1000 large retailers
    - PPP indicators in 8 countries
    - Data shared with Central Banks, policymakers, NSOs, and researchers
Online Data vs CPI

• Speed – Real-time (3-day lag)

• High frequency – Daily

• Low cost per observation (vs traditional survey method)

• Full price history for all goods in each retailer (micro analysis)

• Same methodology in every country & over time (comparisons)

• Official basket weights and main CPI methods

• No hedonics, seasonal adjustments, or other special index methods

• More Limited Coverage
  – Retailers: multi-channel (online and offline)
  – Sectors: Most goods, but few services and no housing
What are online price indices useful for?

- Cannot match the CPI inflation rates every month
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"Used cars and trucks"
What are online price indices useful for?

- Anticipating changes in inflation trends

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• Anticipating changes in inflation trends
Covid “Turning Points”

Source: State Street Global Markets, PriceStats
Nearly all countries are now at the highest inflation level in 13 years
Can we use real-time data to understand current inflation dynamics?

Three factors:

1) Measurement Distortions (basket weights)

2) Supply/Demand Disruptions (shortages)

3) The War in Ukraine (supply shock)
Measurement Distortions: CPI Weights

Cavallo (2020) “Inflation with Covid Consumption Baskets” NBER WP 27352

• The US CPI weights are adjusted every December with 2-year lagged expenditure data

• But the Pandemic dramatically changed consumption patterns → more food, less transportation

Measurement Distortions: CPI Weights

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- The US CPI weights are adjusted every December with 2-year lagged expenditure data
- But the Pandemic dramatically changed consumption patterns → more food, less transportation

In 2020, the CPI was **underestimating** the annual inflation rate
Measurement Distortions: CPI Weights

- Also affecting core (non-energy transportation)
- Inflation inequality (low-income households consume more food, less transport)
- Temporary bias in countries with divergence in sectoral inflation rates
By late 2020, online inflation was already increasing at historical rates

- In the US, above-average inflation for the last 21 months

Note: * June 2022 numbers based on 15 days of data.
Source: PriceStats.
Are supply disruptions pushing prices up?


- Covid Supply and Demand Disruptions:
  - Operational shut-downs, hoarding, sudden change in distribution channels, costs of operating with social distancing, global supply-chain bottlenecks, labor shortages, and surge in demand
  - Can we track shortages at the retail level? Can we estimate the impact on prices?

- We measured stockouts in 70 large retailers in 7 countries

<table>
<thead>
<tr>
<th>Products</th>
<th>Retailers</th>
<th>Coverage of All CPI Weights, (%)</th>
<th>Coverage of Goods CPI Weights, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>194,151</td>
<td>11</td>
<td>27</td>
</tr>
<tr>
<td>China</td>
<td>49,685</td>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>France</td>
<td>372,962</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>Germany</td>
<td>297,320</td>
<td>13</td>
<td>27</td>
</tr>
<tr>
<td>Japan</td>
<td>95,313</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td>Spain</td>
<td>171,400</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td>USA</td>
<td>777,554</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>All</td>
<td>1,958,385</td>
<td>70</td>
<td>29</td>
</tr>
</tbody>
</table>

Disclaimer: The views expressed here are ours, and they do not necessarily reflect the views of the Bank of Canada.
Measuring Retail Stockouts

• Two ways to track stockouts:
  – the fraction of goods that are out-of-stock ("temporary stockouts")
  – the fraction of good that were discontinued ("permanent stockouts")

![Figure 1: Identifying Stockouts on a Retailer’s Website](source)

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US Shortages are still 15% higher than pre-Covid levels

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Note: This chart includes both temporary stockouts and the net change in product variety (permanent stockouts). These numbers can be negative when there are more products for sale than before the Pandemic.
Stockout dynamics in 7 countries
The inflation impact of stockouts lasts about 3 months


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US Shortages are more persistent in Food and Beverages

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Note: This chart includes both temporary stockouts and the net change in product variety (permanent stockouts). These numbers can be negative when there are more products for sale than before the Pandemic.
Not surprisingly, US food inflation has continued to increase
Globally, food and fuel prices were important drivers of inflation since mid-2021
The War in Ukraine accelerated some of these trends

- Fuel prices at the pump increased 20% since the started for a weighted average of 23 countries

![Global Fuel Price Index graph](Source: State Street Global Markets, PriceStats)

- +10% since mid-march
- +10% in first 10 days (Feb 28 to March 10)
The fuel price increases were immediate in *developed* economies.
Fuel cost pass-through could be quicker in the current context

- Fuel prices are gradually incorporated into the prices of other goods and services
  - gas-price passthrough into CPI is ~20% in 1 quarter

- The passthrough may be faster in the current context
  - High inflation makes it easier for firms to pass-on additional costs
  - Higher pass-through for large shocks (more reaction after given size thresholds)
  - Covid led to increases in online retail → quicker price changes and passthrough of wholesale price increases
Food prices have risen more in *emerging* economies since the war started.

<table>
<thead>
<tr>
<th>Country</th>
<th>3 weeks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>5.8</td>
</tr>
<tr>
<td>Argentina</td>
<td>4.0</td>
</tr>
<tr>
<td>Russia</td>
<td>3.2</td>
</tr>
<tr>
<td>Uruguay</td>
<td>2.0</td>
</tr>
<tr>
<td>Germany</td>
<td>1.1</td>
</tr>
<tr>
<td>EM Average</td>
<td>1.2</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.5</td>
</tr>
<tr>
<td>China</td>
<td>0.4</td>
</tr>
<tr>
<td>Canada</td>
<td>0.9</td>
</tr>
<tr>
<td>USA</td>
<td>0.7</td>
</tr>
<tr>
<td>China</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: PriceStats
Global food inflation continues to rise, with no end in sight

Source: State Street Global Markets, PriceStats
Russia’s prices surged in March, but have been relatively stable since then.
Conclusions

• Covid caused many inflation measurement problems (baskets, missing data)
  • But also prompted efforts to modernize official statistics

• Supply disruptions put significant pressure on inflation from the beginning
  • Stockouts are again rising in the US, Spain, China
  • US stockouts remain 15% above pre-Covid levels, more persistent for food and beverages, electronics
  • But many sectors are “back to normal” (health, household & furniture)

• Food and energy price increases continue to be the main drivers of global inflation in 2022
  • The war in Ukraine exacerbated these trends
    • Gas prices at the pump have already increased 20% since the war started, more in developed countries
    • The fuel-cost passthrough into retail prices could be quicker in the current context (high inflation, size of the shock, online retailing)
    • Food prices are increasing faster in emerging economies, adding to ‘historic’ highs
Online Inflation in France

France Daily PriceStats Inflation Index (%MoM)

Source: State Street Global Markets, PriceStats