What Can Stockouts Tell Us About Inflation? Evidence from Online Micro Data

Alberto Cavallo  
Harvard Business School

Oleksiy Kryvtsov  
Bank of Canada

35th SUERF Colloquium and 49th OeNB Economic Conference “The Return of Inflation”  
May 24, 2022

The views expressed here are ours, and they do not necessarily reflect the views of the Bank of Canada
What we do

- Create two high-frequency measures of **consumer product shortages** in 7 countries
  - temporary stockouts, discontinued products

- Are shortages associated with inflation?

- Are the inflation effects stronger for imported goods?

- What do observed prices and shortages imply about the cost to replenish inventories?
Data scraped from websites of large multi-channel retailers that sell mostly offline.

We focus on 70 retailers in 7 countries that show “out of stock” information.

<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>

Sectors: Food & Beverages, Furnishings & Household, Health, Electronics, Other goods

Not included: Alcohol & Tobacco, Apparel, Cars, Gasoline
Measuring shortages in retail (sector $j$, country $c$, date $t$)

Temporary Stockouts ($TOOS_{jc,t}$) = \[
\frac{\# \text{ out of stock}_{jc,t}}{\# \text{ total products}_{jc,t}}
\]

Figure 1: Identifying Stockouts on a Retailer’s Website
Measuring shortages in retail (sector \( j \), country \( c \), date \( t \))

- **Temporary Stockouts** \( (TOOS_{jc,t}) \) = \( \frac{\# \text{ out of stock}_{jc,t}}{\# \text{ total products}_{jc,t}} \)
- **Permanent Stockouts** \( (POOS_{jc,t}) \) = \( 1 - \frac{\# \text{ total products}_{jc,t}}{\# \text{ total products}_{jc,Jan-2020}} \)

Figure 1: Identifying Stockouts on a Retailer’s Website
Stockout dynamics in the United States

(a) All Stockouts

(b) Temporary and Permanent Stockouts
Stockout dynamics in 7 countries

(a) Temporary Stockouts

(b) Permanent Stockouts
In the United States, stockouts are more persistent in Food & Beverages.
Result 1: Shortages are associated with rising sector prices within 1-2 months

- Estimate the response of inflation to an exogenous stockout disturbance at the 3-digit level

- Doubling stockouts from 10% to 20% increases sector inflation by 1.6 ppt (annualized rate)
Result 2a: Inflation response is larger & longer in import intensive sectors

- Split 235 sectors (7 countries) into groups below/above weighted median import share (0.24)
  - Low shares: China, Japan, USA; unprocessed food, plants, printed material
  - High shares: Canada, Germany; video/audio equipment, furniture, jewelry and watches
Result 2b: After stockouts prices tend to rise, especially for imported goods

- Micro evidence from a large U.S. retailer

Price-relative = cum log p-change $t$ days before/after day -1 relative to cum log price change for all goods in sector

(a) All price changes

(b) Domestic versus Imported Goods
What can stockouts tell us about the cost of replenishing inventories?

- Our stockouts matched surveys of “supply disruptions” closely until May 2021, but have diverged since.
- Firms can adjust to changes in the replacement cost via stockouts and prices → we cannot infer the cost only from stockout dynamics.
- We use a model to endogenize inventory decisions, and estimate cost based on observable OOS and prices.
Use observed OOS and prices to estimate the cost of replenishing inventories

- Costs always higher for Electronics and now increasing for Food and Beverages
Result 3: Retailers pass through higher cost to both prices and shortages

- With endogenous stockouts
  - Inflation responses are stronger but less persistent
  - Inflation Inflationary impact twice as high for imported goods
Key results and takeaways

- Widespread increase in shortages during the pandemic

- The composition and visibility of shortages changes over time → from temporary stockouts affecting nearly all categories to permanently discontinued goods concentrated in fewer sectors

- Shortages have economically significant inflationary effects, within 1 to 3 months

- Effects are larger and more persistent for imported goods and import-intensive sectors

- Co-movement of stockouts and prices suggest higher cost of replenishing inventories was an important driver of inflation in this period
THANK YOU