The views expressed in this paper are those of the authors and should not be attributed to the Bank of Latvia; the International Monetary Fund, its Executive Board, or its management.
Motivation

- Revisit external sector adjustment during a balance of payments crisis
- Focus on expenditure switching from imports to domestic goods

**Conventional Macro models:** Expenditure switching is
  - Central ingredient of external sector rebalancing
  - Driven solely by changes in the relative price of foreign/domestic goods

**Needed:** Empirical evidence
This Paper

- Examines 2008–09 crisis in Latvia with a novel supermarket scanner dataset with home/imported goods
  - Classic boom-bust episode with a sudden stop
  - Limited role for nominal exchange rate in adjustment due to euro peg
  - Majority of CA adjustment via imports – similar in other Baltic States and Eurozone periphery (Kang and Shambaugh, 2013)

- Measures the role of expenditure switching
- Measures relative price changes
- Asks whether relative price changes can explain the observed expenditure switching through the lens of standard models
Preview of Results

- Expenditure switching accounted for 1/3 of the fall in imports
- No corresponding change in relative prices
- Fall in income induced consumers to switch towards cheaper domestic substitutes $\implies$ Expenditure switching driven by *income effect*, not changes in relative prices
Outline

1. Data
2. Empirical findings
3. Theoretical framework
4. Estimation strategy and results
5. Conclusion
Data

Supermarket transaction data for food & beverages (F&B) from one of largest retailers in Latvia

- Cover May 2006 – May 2011
- Monthly expenditure on and quantity sold for each item
- Identify domestic/foreign origin of each item
- Aggregated by type of store in Latvia
- 2-, 3- and 4-digit classification of items (Example: Food → Hot drinks → Tea → Herbal tea → UPC items)
Data

Representative of household expenditures on food:

- Add up to 15% of aggregate household expenditures on food in NIA
- Stable grocery retail market share of around 20%
- Broadly match: (i) official CPI for F&B; (ii) aggregate F&B imports

Food accounts for 30% of household expenditures

▶ Summary Statistics
Data

Advantages of scanner data

- Consistent measurement of expenditures on domestic/imported goods within a large dataset
- Not only domestic/imported breakdown of final consumer prices, but also of quantities

Limitations of scanner data

- Demand for food only
- No matching supply side or export data
Three Empirical Findings about the Crisis

1. Expenditure switching
   - Took place between goods *within* product groups
Three Empirical Findings about the Crisis

1. **Expenditure switching**
   - Took place between goods *within* product groups

2. **Relative price adjustment**
   - Took place *across* product groups
Three Empirical Findings about the Crisis

1. Expenditure switching
   - Took place between goods within product groups

2. Relative price adjustment
   - Took place across product groups

3. Within-group item mix
   - Shifted towards cheaper domestic substitutes
Finding 1. Expenditure Switching

- Crisis year: Q4:09/Q4:08 (largest y-o-y fall in food consumption)

- Did expenditure switching contribute to the fall in consumption of imported food?

\[
\Delta x^F_{\text{crisis}} = \Delta x_{\text{crisis}} + (\Delta x^F_{\text{crisis}} - \Delta x_{\text{crisis}})
\]

Imported food: $-26\%$
All food: $-18\%$

Expenditure switching: $-8\%$

$\implies$ YES!
Finding 1. Expenditure Switching

or... 3% of expenditures reallocated (imports $\rightarrow$ domestic)
Finding 1. Expenditure Switching

Two sources of expenditure switching: (i) **within** product groups and (ii) **across** product groups

**Notation:**
- \( g \in \{1, \ldots, G\} \): 4-digit product group
- \( s_{gt} \): product group’s expenditure share
- \( s^{F}_{gt} \): product group’s imports to total expenditures
- \( \varphi^{F}_{gt} \): share of imports in a product group (\( = s^{F}_{gt}/s_{gt} \))
- \( s^{F}_{t} \equiv \sum_{g} s_{gt} \varphi^{F}_{gt} \): total import share
Finding 1. Expenditure Switching

Decompose expenditure switching as:

\[ \Delta s^F_t \equiv s^F_t - s^F_k \]

\[ = \sum_g s_{gt} \phi^F_{gt} - \sum_g s_{gk} \phi^F_{gk} \]

\[ = \sum_g s_{gk} \Delta \phi^F_{gt} + \sum_g \phi^F_{gk} \Delta s_{gt} + \sum_g \Delta \phi^F_{gt} \Delta s_{gt} \]

Note: *intensive margin* drove expenditure switching

Intensive-Extensive ES
Finding 1. Within and Across Components

Driven by reallocation of expenditures within narrow (4-digit) product groups
Finding 2. Relative Price Adjustment

Did relative prices adjust?

Notation:

- $p_{igt}$: unit value of item $i$ in group $g$
- $P_{Fgt}^F$: price indexes for (F)oreign food in group $g$
- $P_t^F$: aggregate price indexes for food imports
- $P_t$: aggregate price indexes for food

Construct aggregate prices with a discrete Divisia (Tornqvist) price index:

$$\Delta \ln P_t = \sum_g \sum_j \sum_{i \in I_{gt}^j} w_{igt} \Delta \ln p_{igt}, \quad j = \{D, F\},$$

and $w_{igt} = 0.5(s_{igt} + s_{igt-1})$
Finding 2. Relative Price Adjustment

Relative price of imports, defined as $P^F_t / P_t$, increased during the crisis: 4.5% y-o-y (2009Q4–2008Q4) and 6% trough-to-peak
Finding 2. Relative Price Adjustment

Again, decompose changes into within and across components:

\[
\Delta \ln \frac{P^F_t}{P_t} \equiv \ln \frac{P^F_t}{P_t} - \ln \frac{P^F_k}{P_k}
\]

\[
= \sum_g \frac{w^F_{gt}}{w^F_t} \left( \ln \frac{P^F_{gt}}{P_{gt}} + \ln \frac{P_{gt}}{P_t} \right) - \sum_g \frac{w^F_{gk}}{w^F_k} \left( \ln \frac{P^F_{gk}}{P_{gk}} + \ln \frac{P_{gk}}{P_k} \right)
\]

\[
= \sum_g \frac{w^F_{gk}}{w^F_k} \Delta \ln \frac{P^F_{gt}}{P_{gt}} + \sum_g \frac{w^F_{gk}}{w^F_k} \Delta \ln \frac{P_{gt}}{P_t}
\]

Within

Across

\[
+ \sum_g \Delta \left( \frac{w^F_{gt}}{w^F_t} \right) \ln \frac{P^F_{gk}}{P_k}
\]

\[\approx 0\]
Finding 2. Within and Across Components

No systematic change in relative price **within** product groups
Findings 1 and 2. A Puzzle?

The findings presented thus far show

1. Expenditure switching occurs \textit{within} product groups

2. Relative price changes occurs \textit{across} product groups

\textbf{Puzzle:}

Why are consumers buying more domestic varieties even though they are not becoming less expensive than their foreign counterparts?

\textbf{Potential Explanation}

25\% fall in income induced switching towards cheaper substitutes within product groups
Finding 3. Unit Values

- Compare price **levels** within 4-digit product groups

**Notation:**
- $p_{igt}$: unit value of item $i$ in group $g$
- $q_{igt}$: units (e.g., kg) sold for item $i$ in group $g$
- $V_{gt}^j = \sum_{i \in I_g^j} \phi_{igt} p_{igt}$, where $\phi_{igt} = \frac{q_{igt}}{\sum_{i \in I_g^j} q_{igt}}$

- Unit values exhibit:
  - Large dispersion across items: $p_{igt}^{75\%}/p_{igt}^{25\%} = 1.70$
  - Larger values for imports on average: $V_{gt}^F/V_{gt}^D = 1.33$
Finding 3. Flight Towards Cheaper Substitutes

- Did consumers switch towards cheaper items during the crisis?
- For group $g$ compare changes in the average unit value and the price index:

$$\Delta \ln W_{gt} = \Delta \ln V_{gt} - \Delta \ln P_{gt},$$

where differences are due to
  - Changes in quantities consumed (item mix)
  - Entry/exit of items

$\Delta \ln W_{gt}$ is an index of changes in consumed item mix within product groups (Boorstein and Feenstra, 1987)
Finding 3. Flight Towards Cheaper Substitutes

Consumer switched to cheaper substitute items
Finding 3. Implications for Expenditure Switching

- Did the shift in item mix induce expenditure switching?
- Construct partial price and unit value indices, which impose homogeneity in items within Foreign/Domestic in each product group
- Calculate difference between indices as above
Finding 3. Flight Towards Cheaper Domestic Substitutes

Consumer switched to cheaper domestic substitute items
Summary of Empirical Findings

- **Across:**
  - Prices adjusted, but very little expenditure switching
  - Likely more important when $\Delta \text{NEER} > 0$

- **Within:**
  - Expenditure switching, but no relative price adjustment
  - A puzzle for conventional macro
  - Consumers switched to cheaper domestic substitutes
Theoretical Framework: Demand System

- Goal: quantify the role of prices and income in expenditure switching

- **Expenditure allocation problem** of a representative consumer
  - Given $C_t$ and $p_{igt}$, allocate expenditures across and within product groups
  - Focus on *within* product groups
  - Changes in income induce substitution between high and low unit value items
Theoretical Framework: Demand System

- Preferences:

\[ U_t = \left( \sum_{g=1}^{G} \omega_{gt} c_{gt}^\rho \right)^{\frac{\rho}{\rho-1}} \]

\[ c_{gt} = \left( \frac{1}{N_{gt}} \right) \frac{1}{\sigma_g} \sum_{i \in I_{gt}} \frac{\sigma_g - 1}{\sigma_g} \widehat{c}_{igt} \]

where \( \widehat{c}_{igt} = \theta_{ig}^{\lambda_g(C_t)} c_{igt} \), and \( \sum_g \sum_i p_{igt} c_{igt} = C_t \)

- \( c_{igt} \): quantity of item \( i \)

- \( \theta_{ig} \): quality of item \( i \), which depends on income \( \lambda_g(C_t) \) (Hallak, 2006)
Theoretical Framework: Demand System

Solving the demand system subject to a consumer’s budget constraint yields the across and within expenditure shares:

\[ s_{gt} \equiv \frac{p_{gt} c_{gt}}{P_t C_t} = \omega_{gt} p_{gt}^{(1-\rho)} \quad \text{(Across)} \]

\[ \varphi_{igt} \equiv \frac{p_{igt} c_{igt}}{p_{gt} c_{gt}} = \frac{1}{N_{gt}} \left( \frac{p_{igt}}{\theta_{igt}^{\gamma g}(C_t)} \right)^{1-\sigma_g} \quad \text{(Within)} \]
Estimation Strategy

1. Model yields an estimable equation of an item’s *within* share as a function of (i) relative prices, and (ii) income

2. Aggregate predicted item expenditure shares to predict switching between foreign/domestic goods

3. Do steps (1) and (2) for a standard homothetic model (CES) and the non-homothetic model (NH) and compare predictions with data
Estimation Strategy

- **Estimation equation**

\[
\Delta \ln \varphi_{igt} = \alpha_{gt} + \beta_{1g} \ln \Delta \left( \frac{p_{igt}}{p_{gt}} \right) + \beta_{2g} \ln \bar{p}_{ig} \Delta \ln C_t + \varepsilon_{igt}
\]

- \( \alpha_{gt} \): 4-digit product group \( \times \) time fixed effect
- \( \bar{p}_{ig} \): item’s median relative unit value, \( p_{igt}/V_{gt} \) (quality)
- \( C_t \): total real per capita household spending
- \( \varepsilon_{igt} \): random disturbance term

- Homothetic (CES) model restricts \( \beta_{2g} = 0 \)
Expenditure Switching (Within): Data, CES, and NH

\[ Y_{t} = Y_{t-1} + \text{Expenditure Switching} \]

- Data
- CES
- Non-homothetic

Regressions

R. Bems and J. di Giovanni

Income-Induced Expenditure Switching

ESSIM 2014, May 27–30, 2014
NH Model Within: Total, Price and Income Effects

![Graph showing changes in import expenditure share from 2007.5 to 2011. The graph compares total, price, and income effects over time.]
Conclusion

- Expenditure switching driven by income effect, not changes in relative prices
- A more general phenomenon across countries?
  - Fall in quality of European exports during the crisis (Berthou & Emlinger, 2010)
  - International trade literature:
    - Rich/poor countries are net exporters/importers of high quality goods, or
    - Alchian-Allen effect: “ship the good apples out”
Latvian Experience During the Crisis

Note: Time 0 is 2008Q3
### Two-Digit Product Group Summary Statistics

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Share</th>
<th>Foreign Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Meat, fresh and frozen</td>
<td>0.0100</td>
<td>0.0109</td>
</tr>
<tr>
<td>11</td>
<td>Fish</td>
<td>0.0200</td>
<td>0.1188</td>
</tr>
<tr>
<td>12</td>
<td>Processed meat</td>
<td>0.0428</td>
<td>0.0320</td>
</tr>
<tr>
<td>13</td>
<td>Prepared food</td>
<td>0.0111</td>
<td>0.0331</td>
</tr>
<tr>
<td>14</td>
<td>Fresh bread</td>
<td>0.0766</td>
<td>0.0180</td>
</tr>
<tr>
<td>21</td>
<td>Dairy products</td>
<td>0.0852</td>
<td>0.0159</td>
</tr>
<tr>
<td>20</td>
<td>Eggs and eggs preparations</td>
<td>0.0198</td>
<td>0.0000</td>
</tr>
<tr>
<td>22</td>
<td>Yogurts &amp; dairy snacks</td>
<td>0.0491</td>
<td>0.1246</td>
</tr>
<tr>
<td>23</td>
<td>Edible fats</td>
<td>0.0157</td>
<td>0.1782</td>
</tr>
<tr>
<td>24</td>
<td>Cheese</td>
<td>0.0464</td>
<td>0.1526</td>
</tr>
<tr>
<td>25</td>
<td>Frozen foods</td>
<td>0.0182</td>
<td>0.4035</td>
</tr>
<tr>
<td>26</td>
<td>Ice cream</td>
<td>0.0139</td>
<td>0.0846</td>
</tr>
<tr>
<td>30</td>
<td>Grain products</td>
<td>0.0264</td>
<td>0.3617</td>
</tr>
<tr>
<td>31</td>
<td>Biscuits and wafers</td>
<td>0.0163</td>
<td>0.1711</td>
</tr>
<tr>
<td>32</td>
<td>Canned (jarred) foods</td>
<td>0.0231</td>
<td>0.3393</td>
</tr>
<tr>
<td>33</td>
<td>Juices</td>
<td>0.0228</td>
<td>0.2136</td>
</tr>
<tr>
<td>34</td>
<td>Hot drinks</td>
<td>0.0439</td>
<td>0.8580</td>
</tr>
<tr>
<td>35</td>
<td>Baby foods and drinks</td>
<td>0.0089</td>
<td>0.9993</td>
</tr>
<tr>
<td>36</td>
<td>Baby care products</td>
<td>0.0145</td>
<td>0.9059</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Share</th>
<th>Foreign Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Pet foods</td>
<td>0.0134</td>
<td>0.8581</td>
</tr>
<tr>
<td>38</td>
<td>Pet accessories</td>
<td>0.0018</td>
<td>0.8455</td>
</tr>
<tr>
<td>40</td>
<td>Dry ingredients</td>
<td>0.0059</td>
<td>0.6770</td>
</tr>
<tr>
<td>41</td>
<td>Seasoning &amp; preserve</td>
<td>0.0455</td>
<td>0.4278</td>
</tr>
<tr>
<td>42</td>
<td>Sweets</td>
<td>0.0467</td>
<td>0.6632</td>
</tr>
<tr>
<td>43</td>
<td>Snacks</td>
<td>0.0085</td>
<td>0.4524</td>
</tr>
<tr>
<td>44</td>
<td>Dried fruit and nuts</td>
<td>0.0091</td>
<td>0.1788</td>
</tr>
<tr>
<td>45</td>
<td>Natural &amp; pharm. prods.</td>
<td>0.0020</td>
<td>0.7623</td>
</tr>
<tr>
<td>48</td>
<td>Brewery + mild alc. bevs.</td>
<td>0.0532</td>
<td>0.1595</td>
</tr>
<tr>
<td>49</td>
<td>Alcoholic products</td>
<td>0.1497</td>
<td>0.6481</td>
</tr>
<tr>
<td>50</td>
<td>Soft drinks</td>
<td>0.0372</td>
<td>0.4710</td>
</tr>
<tr>
<td>60</td>
<td>Tissues</td>
<td>0.0133</td>
<td>0.7304</td>
</tr>
<tr>
<td>62</td>
<td>Disposable tableware, etc.</td>
<td>0.0074</td>
<td>0.7129</td>
</tr>
<tr>
<td>63</td>
<td>Intimate hygiene</td>
<td>0.0065</td>
<td>0.9836</td>
</tr>
<tr>
<td>64</td>
<td>Body wash and care</td>
<td>0.0265</td>
<td>0.9771</td>
</tr>
<tr>
<td>65</td>
<td>Cosmetics</td>
<td>0.0064</td>
<td>0.8908</td>
</tr>
<tr>
<td>66</td>
<td>Jewelry &amp; optical prods.</td>
<td>0.0015</td>
<td>0.8145</td>
</tr>
<tr>
<td>68</td>
<td>Detergents</td>
<td>0.0006</td>
<td>0.5648</td>
</tr>
</tbody>
</table>

**Aggregate:**

<table>
<thead>
<tr>
<th>Share</th>
<th>Foreign Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>0.3683</td>
</tr>
</tbody>
</table>

**Notes:** This table presents summary statistics for two-digit product groups, aggregated across stores over the sample period May 2006–May 2011. The ‘Share’ column presents a product group’s share of total sales over the sample period. The ‘Foreign Share’ column presents the share of foreign sales within a product group over the sample period. The ‘Aggregate’ foreign share is a ‘Share’-weighted average of product groups’ foreign shares.
Finding 1. Intensive and Extensive Margins

Expenditure switching driven by the **intensive margin**
<table>
<thead>
<tr>
<th></th>
<th>CES Model</th>
<th>NH Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>$\beta_{1g}$</td>
<td>-3.595</td>
<td>-3.588</td>
</tr>
<tr>
<td>10th pctile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25th pctile</td>
<td>-2.814</td>
<td>-2.837</td>
</tr>
<tr>
<td>50th pctile</td>
<td>-1.925</td>
<td>-1.955</td>
</tr>
<tr>
<td>75th pctile</td>
<td>-1.115</td>
<td>-1.102</td>
</tr>
<tr>
<td>90th pctile</td>
<td>-0.067</td>
<td>-0.092</td>
</tr>
<tr>
<td>Observations</td>
<td>236,595</td>
<td>236,595</td>
</tr>
<tr>
<td>Group×time pairs</td>
<td>7,294</td>
<td>7,294</td>
</tr>
<tr>
<td>Groups</td>
<td>384</td>
<td>384</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.099</td>
<td>0.103</td>
</tr>
</tbody>
</table>

Notes: The number of coefficients significant at the 1In Column (1), 270 coefs are significant at the 10% level or lower; in Column (2), 273 coefs are significant at the 10% level or lower; in Column (3), 101 coefs are significant at the 10% level or lower.