Seasonal Products and Multilateral Methods

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Introduction

• Research question: which method to prefer for seasonal products?

• Seasonal scanner data samples are used to compare and to discuss traditional bilateral methods and the most common multilateral methods to find out which of these methods could be preferred for seasonal products
Traditional Bilateral Methods

- Rothwell method:
  \[ P_R = \frac{\sum_{i=1}^{l} p_i^{t,m} q_i^0}{\sum_{i=1}^{l} p_i^0 q_i^0} \quad p_i^0 = \frac{\sum_{m=1}^{12} p_i^{0,m} q_i^0}{\sum_{m=1}^{12} q_i^{0,m}} \]

- Variable weights method:
  \[ P_{VW} = \sum_{i=1}^{l} s_i^{0,m} \frac{p_i^{t,m}}{p_i^0} \quad s_i^{0,m} = \frac{p_i^{0,m} q_i^{0,m}}{\sum_{i=1}^{l} p_i^{0,m} q_i^{0,m}} \]

- Fixed Weights method:
  \[ P_{FW} = \sum_{i=1}^{l} s_i^0 \frac{p_i^{t,m}}{p_i^0} \quad s_i^0 = \frac{\sum_{m=1}^{12} p_i^{0,m} q_i^{0,m}}{\sum_{m=1}^{12} \sum_{i=1}^{l} p_i^{0,m} q_i^{0,m}} \quad APR = \frac{\sum_{i \in U^{m,m-1}} s_i^0 \frac{p_i^{t,m}}{p_i^0}}{\sum_{i \in U^{m,m-1}} s_i^0 \frac{p_i^{t,m-1}}{p_i^0}} \quad p_i^{t,m} = p_i^{t,m-1} \times APR \]
Traditional Bilateral Methods – Disadvantages

- Rothwell method:
  - Quantities and weights reflect fluctuations of a base year’s months
  - Usage of only matched products between months m of a base year and of a comparison year

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- Fixed Weights method:
  - Necessity to make price imputations
  - Does not capture real monthly consumption patterns due to fixed weights structure
Multilateral Methods

• GEKS:

\[
P_{GEKS}^{0,t} = \prod_{l=0}^{T} \left( \frac{P_{t}^{0,l}}{P_{t}^{l}} \right)^{(1/T+1)} = \prod_{l=0}^{T} \left( P_{t}^{0,l} P_{t}^{l} \right)^{(1/T+1)} = \prod_{i \in N_{0} \cap N_{t}} \left( \frac{p_{i}^{t}}{p_{i}^{0}} \right)^{0.5 (s_{i}^{0} + s_{i}^{t})}
\]

• GK:

\[
\hat{p}_{t}^{i} = \frac{\Sigma_{i \in u_{t}} p_{i}^{t} q_{i}^{t}}{\Sigma_{i \in u_{t}} v_{i} q_{i}^{t}} \quad P_{GK}^{0,t} = \frac{\hat{p}_{t}^{t}}{\hat{p}_{t}^{0}} = \frac{\Sigma_{i \in u_{t}} p_{i}^{t} q_{i}^{t}/\Sigma_{i \in u_{0}} p_{i}^{0} q_{i}^{0}}{\Sigma_{i \in u_{t}} v_{i} q_{i}^{t}/\Sigma_{i \in u_{0}} v_{i} q_{i}^{0}} \quad v_{i} = \frac{\Sigma_{z=0}^{T} q_{i}^{z} p_{i}^{z}/P_{GK}^{0,z}}{\Sigma_{z=0}^{T} q_{i}^{z}}
\]

• WTPD:

\[
\ln p_{i}^{t} = \alpha + \sum_{t=1}^{T} \delta^{i} D_{i}^{t} + \sum_{i=1}^{N-1} \gamma_{i} D_{i} + \varepsilon_{i}^{t}
\]
Multilateral Methods

To make price imputations for missing products, ITGEKS method is used

- ITGEKS:

\[ P_{GEKS}^{0,t} = \prod_{l=0}^{T} \left( \frac{p_{0l}}{p_{lt}} \right)^{(1/T+1)} = \prod_{l=0}^{T} (p_{0l}^{0l} p_{lt})^{(1/T+1)} \]

\[ P_{IT}^{0,t} = \prod_{i \in U_{ml}^{0,l}} \left( \frac{p_{l}^{t}}{p_{l}^{0}} \right)^{s_{l}^{0} + s_{l}^{t}} \prod_{i \in U_{dl}^{0,l}} \left( \frac{p_{l}^{t}}{p_{l}^{0}} \right)^{s_{l}^{0}} \prod_{i \in U_{nl}^{0,l}} \left( \frac{p_{l}^{t}}{p_{l}^{0}} \right)^{s_{l}^{0}} \]

\[ p_{i}^{t} = \exp(\hat{\alpha} + \delta_{i}^{t} + \hat{\gamma}_{i}) \text{ and } \hat{p}_{i}^{0} = \exp(\hat{\alpha} + \hat{\gamma}_{i}) \]

Due to absence of products' quality characteristics, price imputations are based on WTPD regression run on pooled data of all available months
Seasonal Scanner Data Samples

- Sample 1: 12 strongly seasonal products (products’ seasons of availability do not change over comparison years)
- Sample 2: 6 strongly seasonal products (products’ seasons of availability do not change over comparison years) and 6 strongly seasonal products (products’ seasons of availability slightly change over comparison years)
- Sample 3: 4 strongly seasonal products (products’ seasons of availability do not change over comparison years), 4 strongly seasonal products (products’ seasons of availability slightly change over comparison years) and 4 random strongly seasonal products (products’ seasons of availability are not pronounced over comparison years)
- Sample 4: 3 strongly seasonal products (products’ seasons of availability do not change over comparison years), 3 strongly seasonal products (products’ seasons of availability slightly change over comparison years), 3 random strongly seasonal products (products’ seasons of availability are not pronounced over comparison years) and 3 weakly seasonal products (available over comparison years)
Empirical Results - Price Indices of the Selected Bilateral and Multilateral Methods

Sample 1

Level

Time

Rothwell
VW
FW
ITGEKS
Empirical Results - Price Indices of the Selected Bilateral and Multilateral Methods

Sample 1

Level

Time

GK
WTPD
ITGEKS
Empirical Results - Price Indices of the Selected Bilateral and Multilateral Methods

![Graph showing price indices over time for different methods: Rothwell, VW, FW, ITGEKS.](image-url)
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Sample 3

Level

Time

0  5  10  15  20  25

75  100  125  150

GK
WTPD
ITGEKS
Empirical Results - Price Indices of the Selected Bilateral and Multilateral Methods
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### Splices

- **Movement splice**
  \[ p_{MS}^{t} = p_{MS}^{t-1} p_{t-T+1,t}^{t-1} \]

- **Window splice (and window splice on published indices - WISP)**
  \[ p_{WS}^{t} = p_{0,t}^{1,t} p_{1,t+1}^{2,t} \ldots p_{t-T,t}^{t+1,t} \]

- **Half splice (and half splice on published indices - HASP)**
  \[ p_{HS}^{t} = p_{HS}^{t-1} \frac{p_{t-T+1,t}^{t+1,t}}{p_{t-T,t}^{t+1,t}} \]

- **Mean splice (and mean splice on published indices - MESP)**
  \[ p_{MS}^{t} = p_{MS}^{t-1} \prod_{i=t-T+1}^{t-1} \left( \frac{p_{i,t+1,t}^{i,t}}{p_{i,t-1,t}^{i,t}} \right)^{1-T-I} \]

- **Fixed based moving window splice (FBMW)**
  \[ p_{FBMW}^{t} = p_{b-T,b}^{b-t} p_{t-T,t}^{b-t} \]
Empirical Results - The Spliced Price Indices of GEKS, GK, ITGEKS and WTPD Methods
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Conclusion

- All traditional bilateral methods have disadvantages and should not be used for seasonal products

- GEKS method rather than GK or WTPD methods can be considered as a somewhat preferred method for seasonal products if proper GEKS calculations are possible
  - GEKS method is less sensitive to splicing choices
  - GEKS method is generally consistent with economic approach to index number theory
  - GEKS method is responsive to price imputations

- If proper GEKS calculations are impossible due to no bilateral product matches, ITGEKS method might be seen an alternative to GEKS method.
Thank you! / Merci !