Seasonal Products and Multilateral Methods

Ottawa Group Meeting, 08.06.2022

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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:

$$P_R = \frac{\sum_{i=1}^{I} p_i^{t,m} q_i^{0,m}}{\sum_{i=1}^{I} p_i^{0} q_i^{0,m}} \qquad p_i^0 = \frac{\sum_{m=1}^{12} p_i^{0,m} q_i^{0,m}}{\sum_{m=1}^{12} q_i^{0,m}}$$

- Variable weights method:

$$P_{VW} = \sum_{i=1}^{I} s_i^{0,m} \frac{p_i^{t,m}}{p_i^0} \qquad s_i^{0,m} = \frac{p_i^{0,m} q_i^{0,m}}{\sum_{i=1}^{I} p_i^{0,m} q_i^{0,m}}$$

- Fixed Weights method:

$$P_{FW} = \sum_{i=1}^{I} s_i^0 \frac{p_i^{t,m}}{p_i^0} \qquad s_i^0 = \frac{\sum_{m=1}^{12} p_i^{0,m} q_i^{0,m}}{\sum_{m=1}^{12} \sum_{i=1}^{I} p_i^{0,m} q_i^{0,m}} \qquad APR = \frac{\sum_{i \in U^{m,m-1}} s_i^0 \frac{p_i^{t,m}}{p_i^0}}{\sum_{i \in U^{m,m-1}} s_i^0 \frac{p_i^{t,m-1}}{p_i^0}} \qquad p_i^{t,m} = p_i^{t,m-1} * APR$$

Traditional Bilateral Methods - Disadvantages

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

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

- Fixed Weights method:
- necessity to make price imputations
- does not capture real monthly consumption patterns due to fixed weights structure

Multilateral Methods

- GEKS:

$$P_{GEKS}^{0,t} = \prod_{l=0}^{T} \left(P^{0l} / P^{tl} \right)^{(1/T+1)} = \prod_{l=0}^{T} \left(P^{0l} P^{lt} \right)^{(1/T+1)} \qquad P_T^{0,t} = \prod_{i \in N_0 \cap N_t} \left(\frac{p_i^t}{p_i^0} \right)^{0.5 \left(s_i^0 + s_i^t \right)}$$

- GK:

$$\tilde{p}^t = \frac{\sum_{i \in U_t} p_i^t q_i^t}{\sum_{i \in U_t} v_i q_i^t} \qquad P_{GK}^{0,t} = \frac{\tilde{p}^t}{\tilde{p}^0} = \frac{\sum_{i \in U_t} p_i^t q_i^t / \sum_{i \in U_0} p_i^0 q_i^0}{\sum_{i \in U_t} v_i q_i^t / \sum_{i \in U_0} v_i q_i^0} \qquad v_i = \frac{\sum_{z=0}^{T} q_i^z p_i^z / P_{GK}^{0,z}}{\sum_{z=0}^{T} q_i^z}$$

- WTPD:

$$\ln p_i^t = \alpha + \sum_{t=1}^{T} \delta^t D_i^t + \sum_{i=1}^{N-1} \gamma_i D_i + \varepsilon_i^t$$

Multilateral Methods

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

- ITGEKS:

$$P_{GEKS}^{0,t} = \prod_{l=0}^{T} \left(P^{0l} / P^{tl} \right)^{(1/T+1)} = \prod_{l=0}^{T} \left(P^{0l} P^{lt} \right)^{(1/T+1)} \quad P_{IT}^{o,t} = \prod_{i \in U_M^{o,t}} \left(\frac{p_i^t}{p_i^0} \right)^{\left(\frac{s_i^0 + s_i^t}{2} \right)} \prod_{i \in U_D^{o,t}} \left(\frac{\hat{p}_i^t}{p_i^0} \right)^{\left(\frac{s_i^0}{2} \right)} \prod_{i \in U_N^{o,t}} \left(\frac{p_i^t}{\hat{p}_i^0} \right)^{\left(\frac{s_i^t}{2} \right)}$$

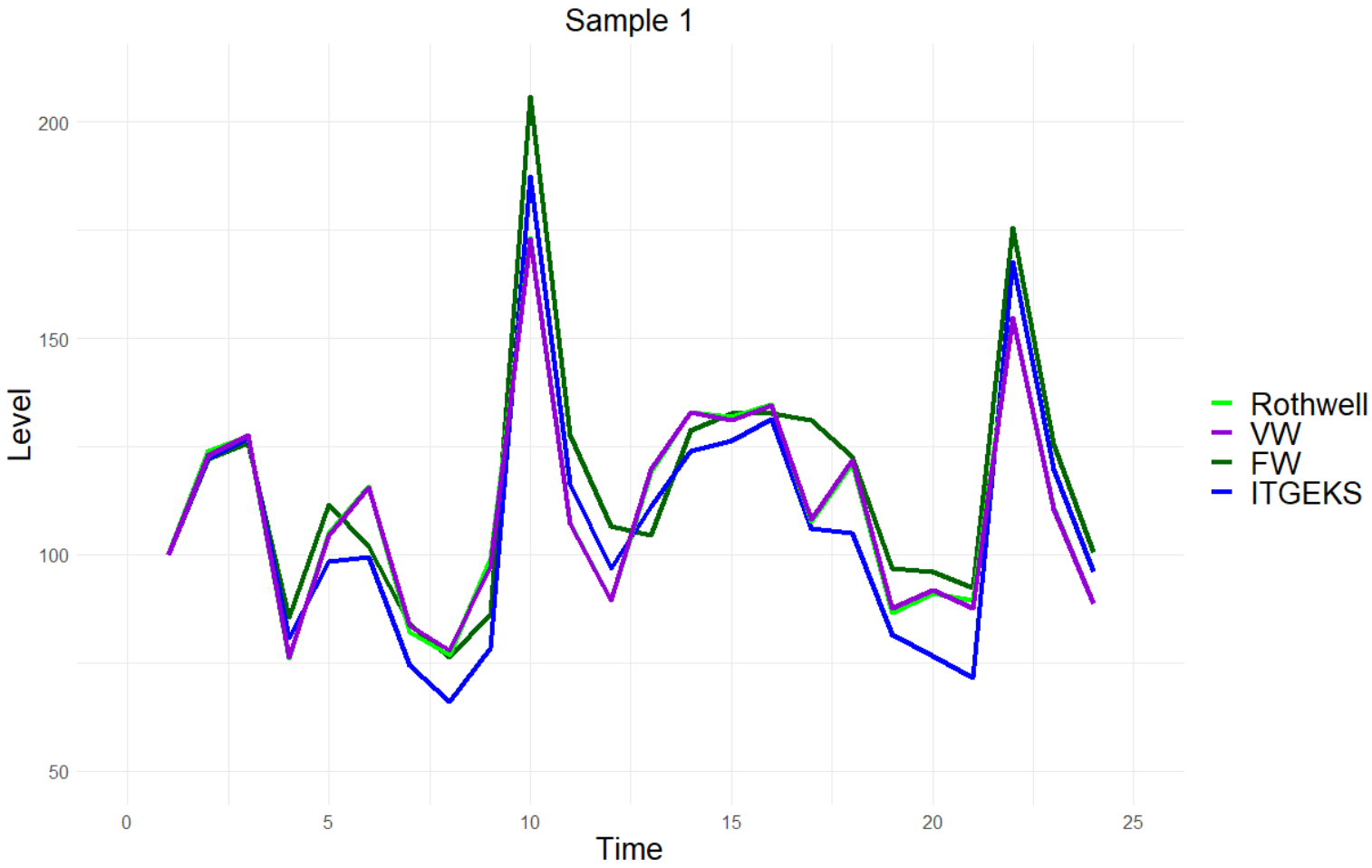
$$\hat{p}_i^t = exp(\hat{\alpha} + \delta^t + \hat{\gamma}_i) \text{ and } \hat{p}_i^0 = exp(\hat{\alpha} + \hat{\gamma}_i)$$

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



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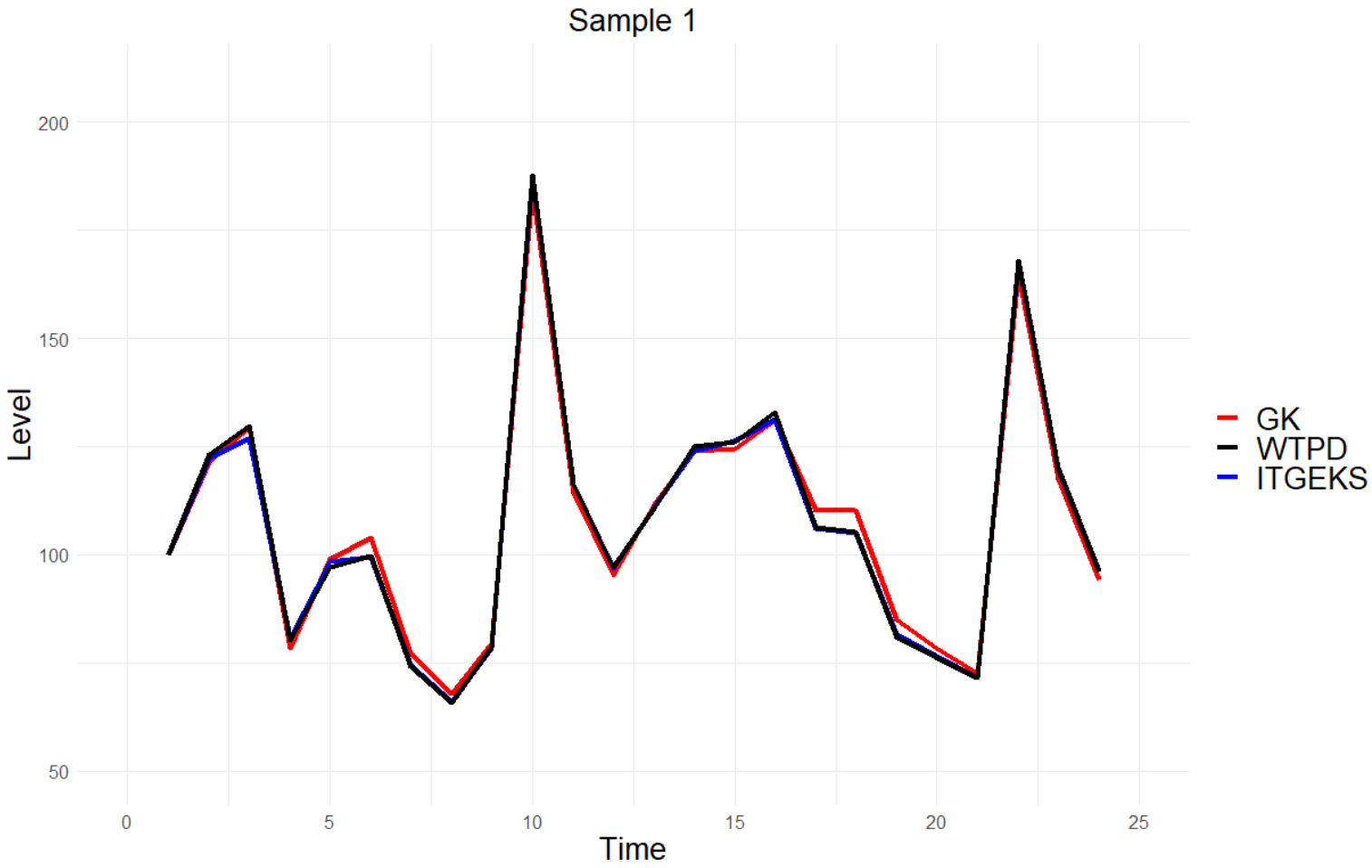

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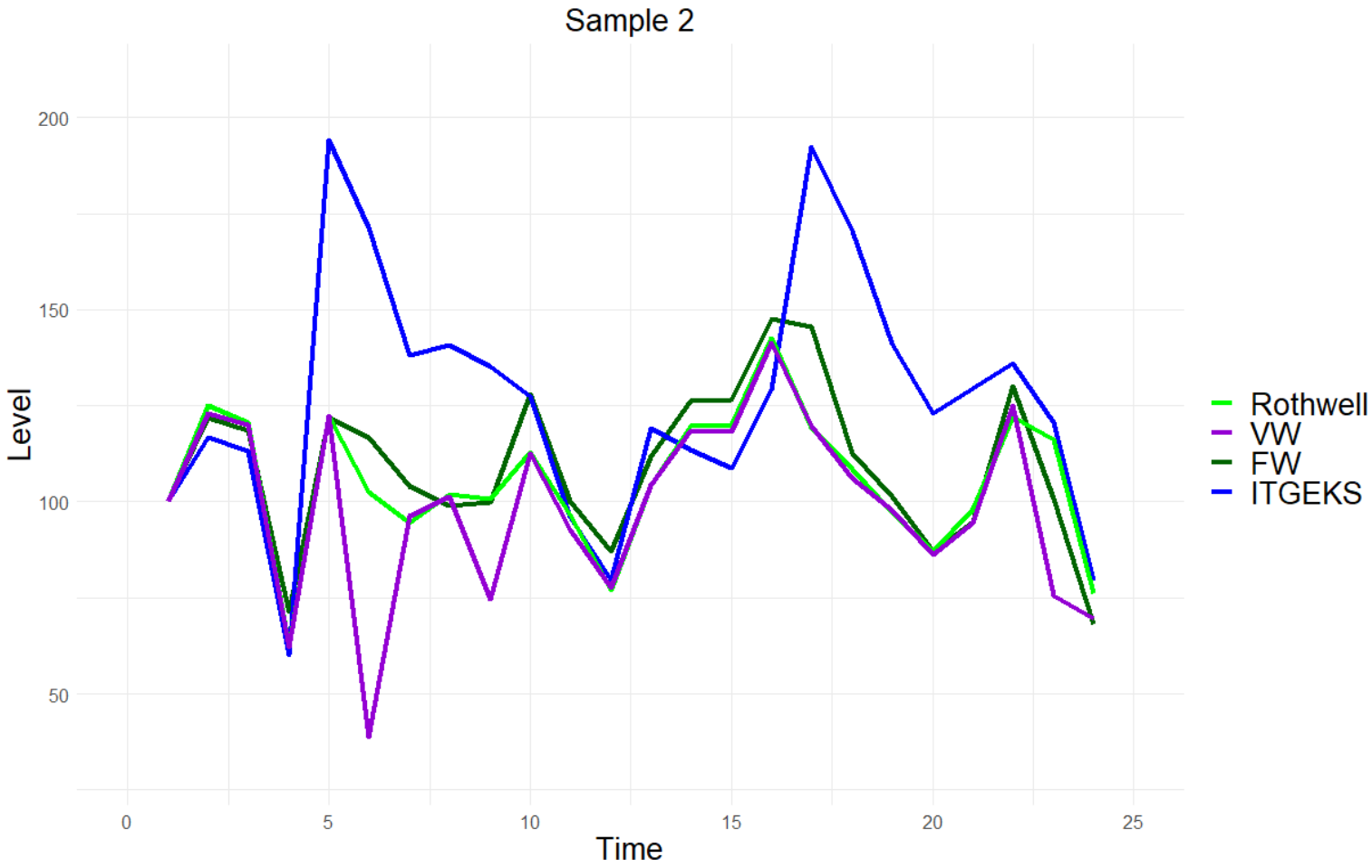

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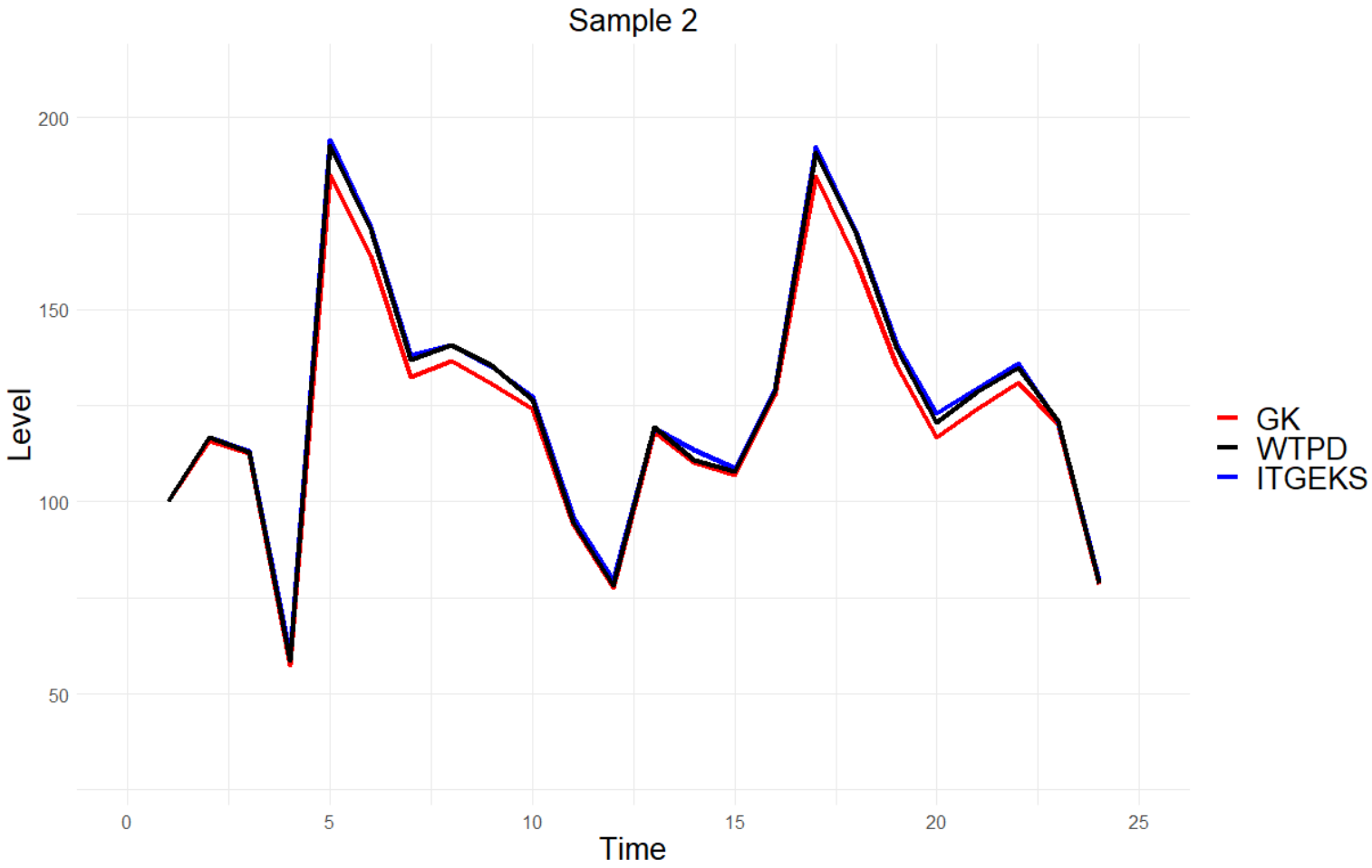

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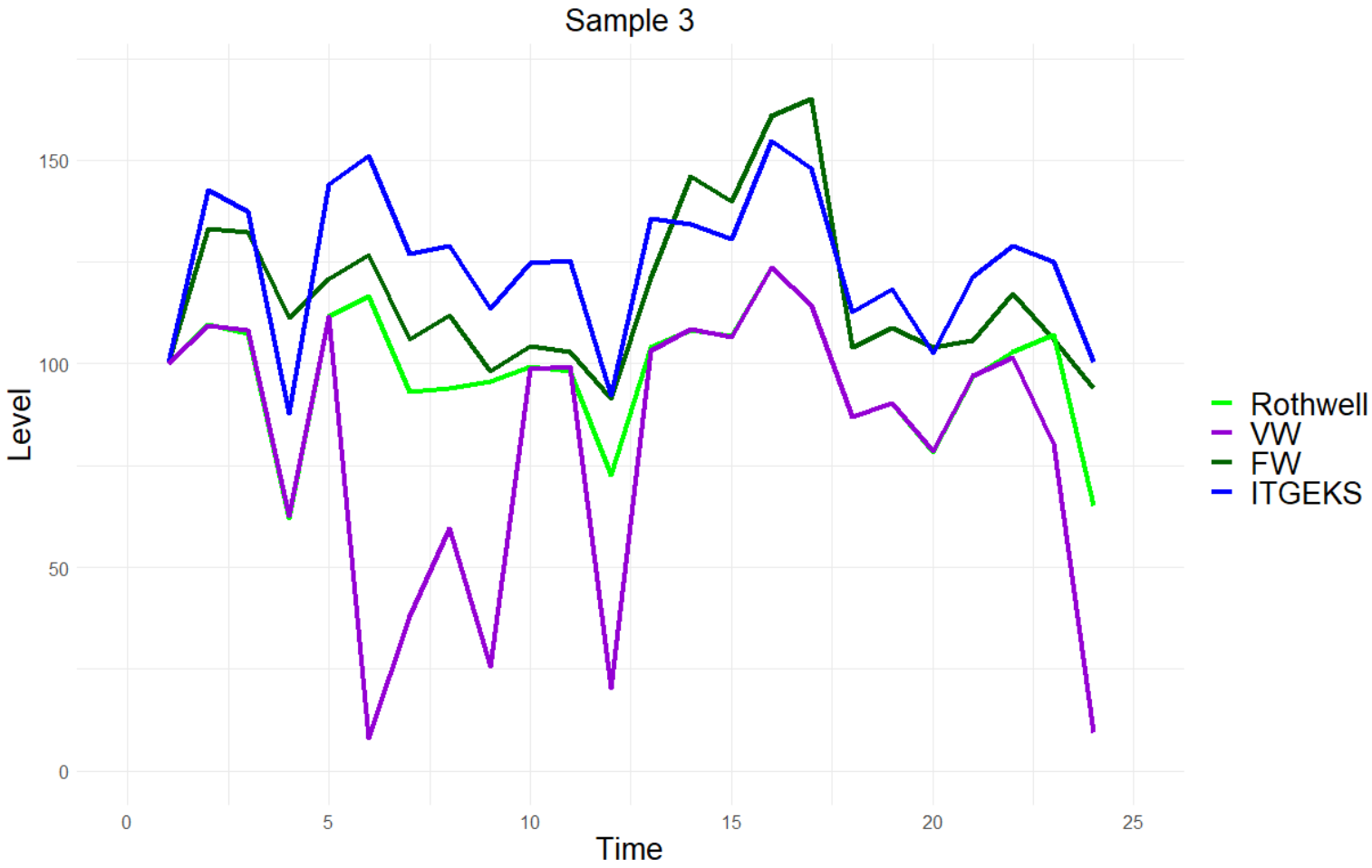

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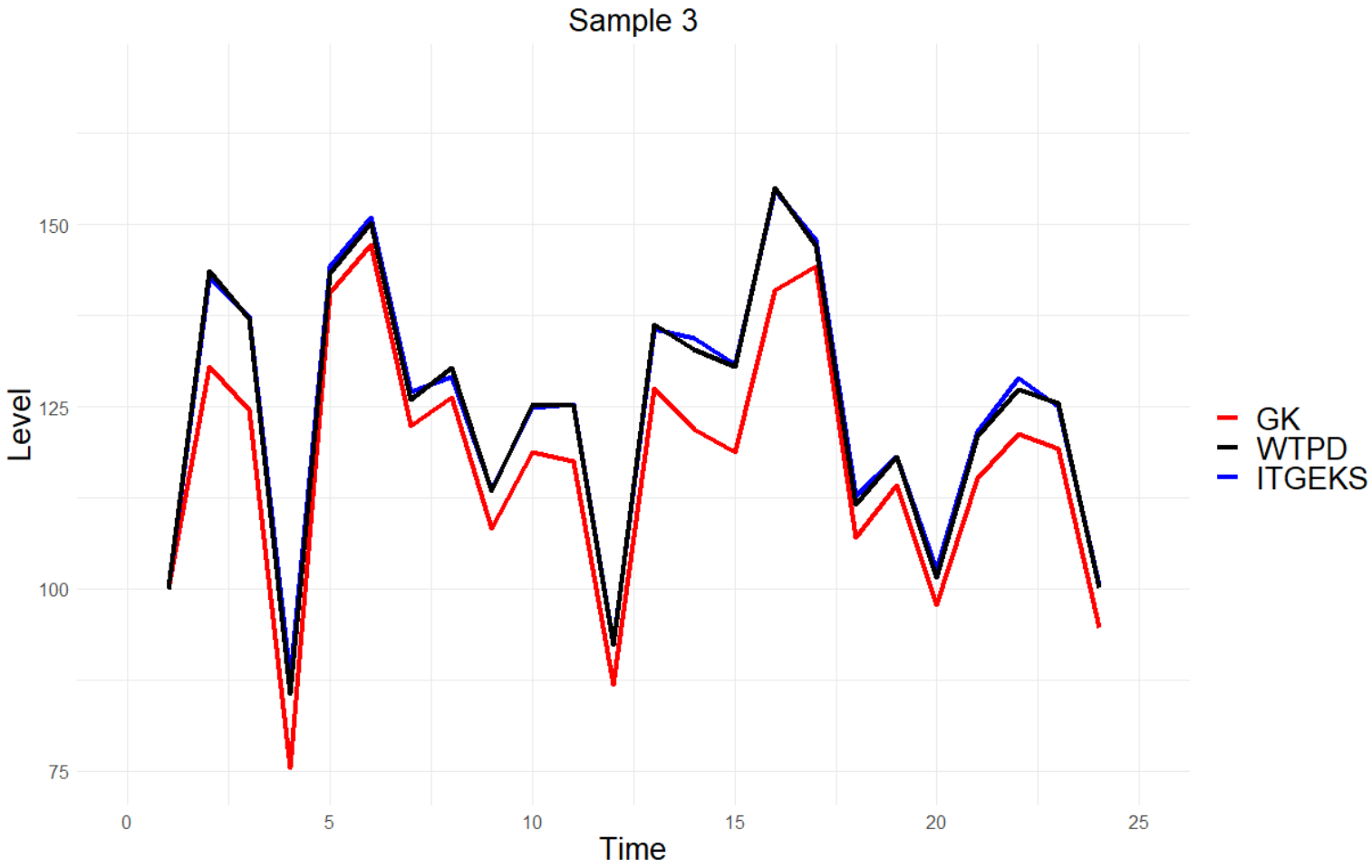

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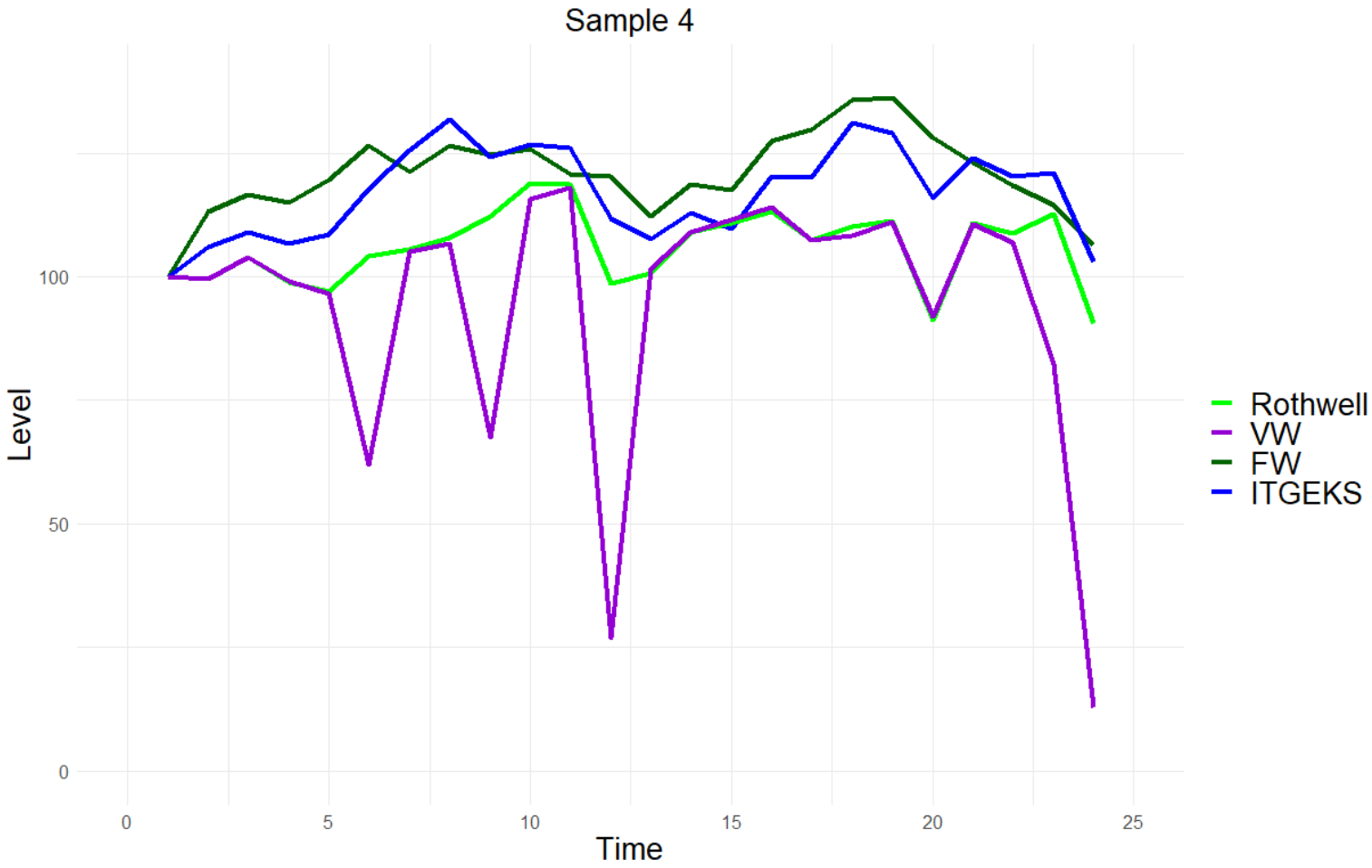

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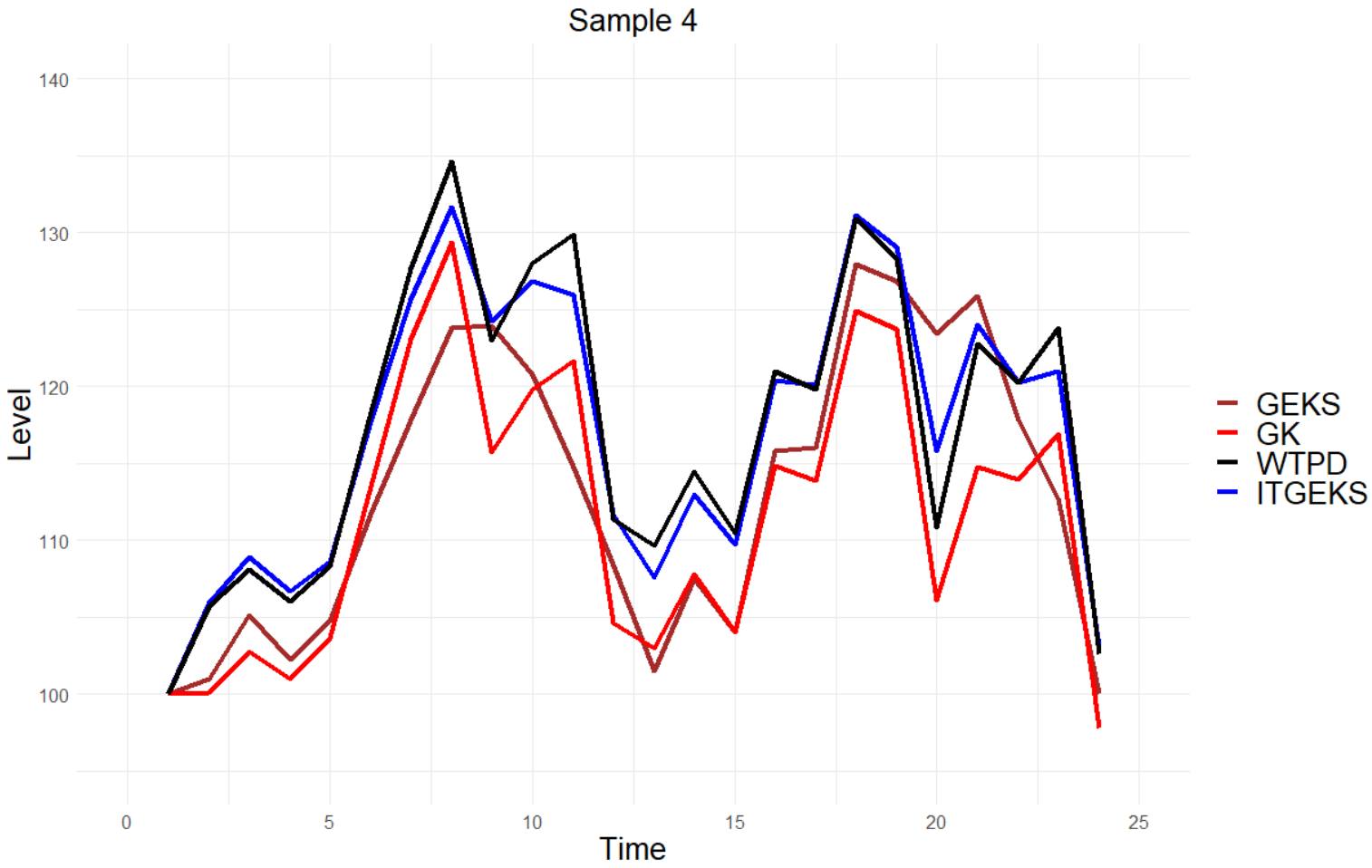


Splices

- Movement splice

$$P_{MS}^{0,t} = P_{MS}^{0,t-1} P_{t-T+1,t}^{t-1,t}$$

- Window splice (and window splice on published indices - WISP)

$$P_{WS}^{0,t} = P_{0,T}^{0,1} P_{1,T+1}^{1,2} \cdots P_{t-T,t}^{t-T+1,t}$$

- Half splice (and half splice on published indices - HASP)

$$P_{HS}^{0,t} = P_{HS}^{0,t-1} \frac{P_{t-T+1,t}^{t-\frac{T+1}{2}+1,t}}{P_{t-T,t-1}^{t-\frac{T+1}{2}+1,t-1}}$$

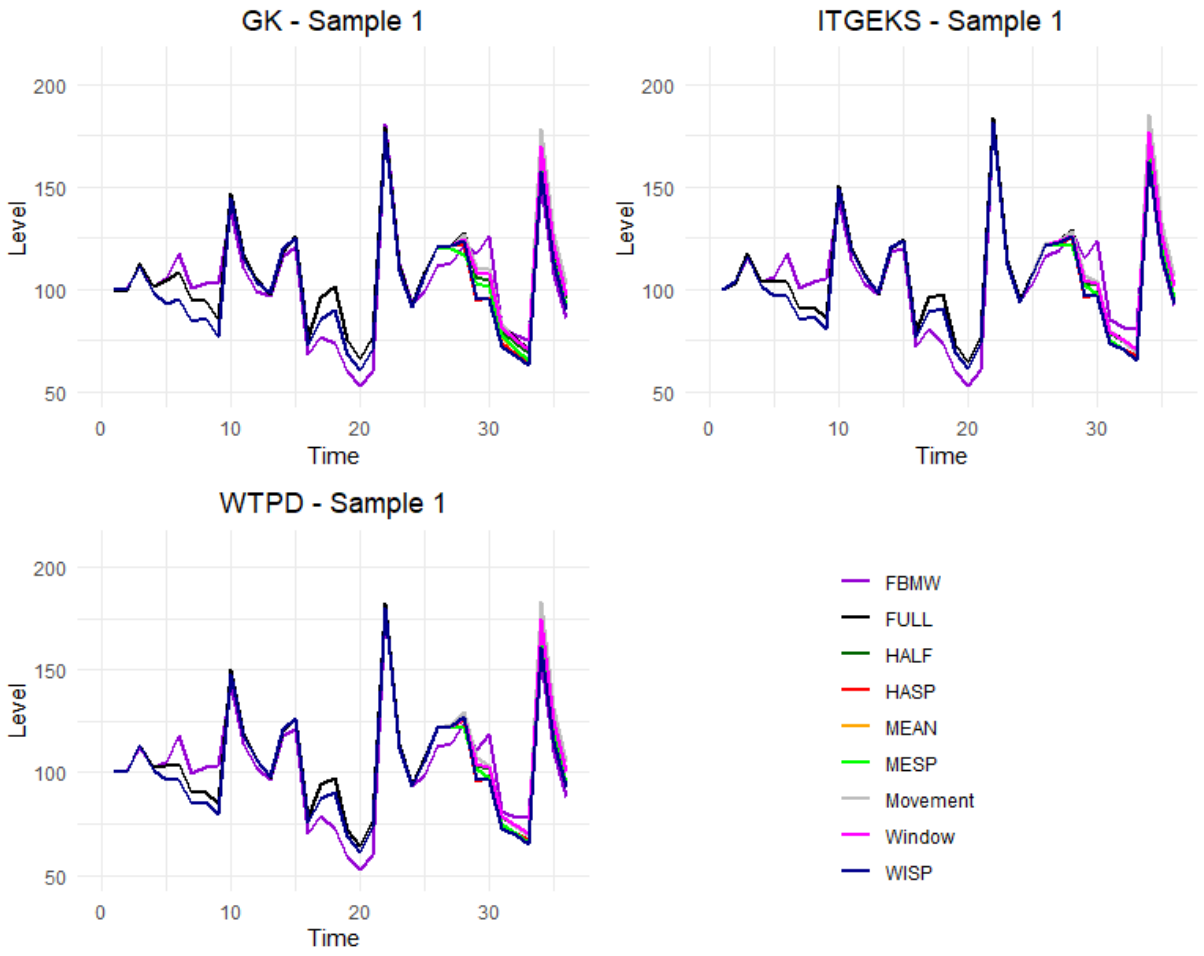
- Mean splice (and mean splice on published indices - MESP)

$$P_{MS}^{0,t} = P_{MS}^{0,t-1} \prod_{l=t-T+1}^{t-1} \left(\frac{P_{t-T+1,t}^{l,t}}{P_{t-T,t-1}^{l,t-1}} \right)^{\frac{1}{T-1}}$$

- Fixed based moving window splice (FBMW)

$$P_{FBMW}^{0,t} = P_{b-T,b}^{b-T,b} P_{t-T,t}^{b,t}$$

Empirical Results - The Spliced Price Indices of GEKS, GK, ITGEKS and WTPD Methods



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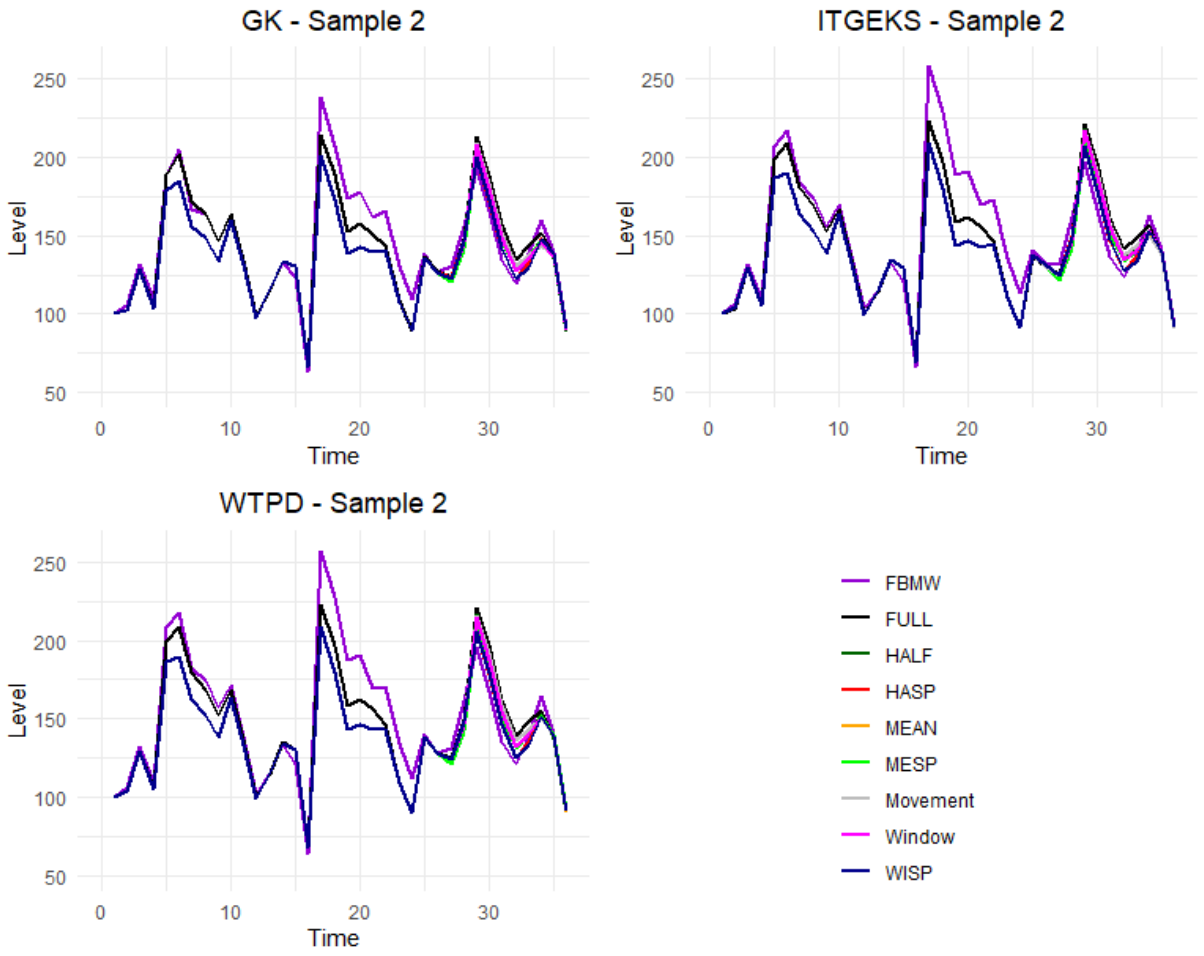

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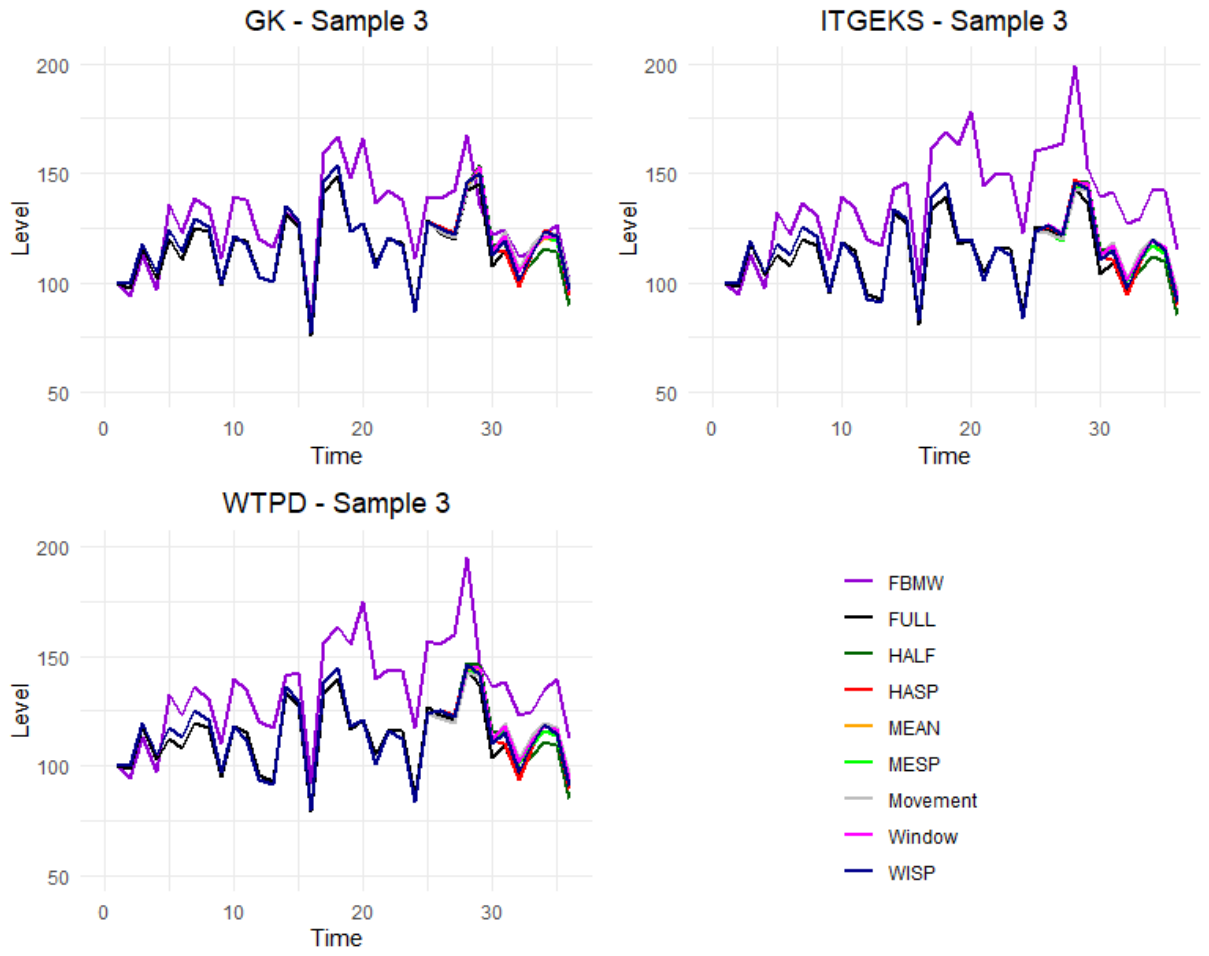

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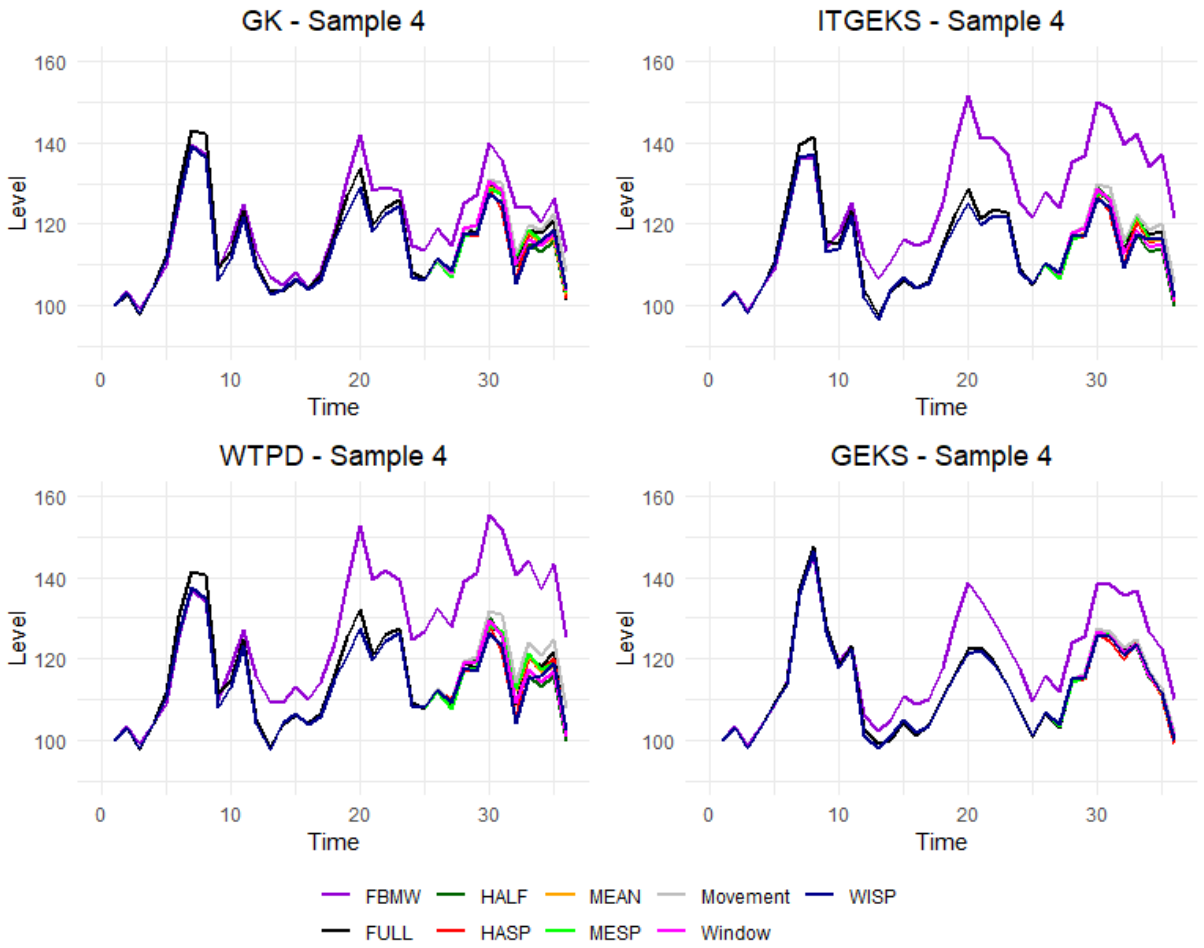

Conclusion

- 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.

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