A Quarterly Input-Output Framework to Analyse the Water Footprint of Scotland in 2018

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Introduction

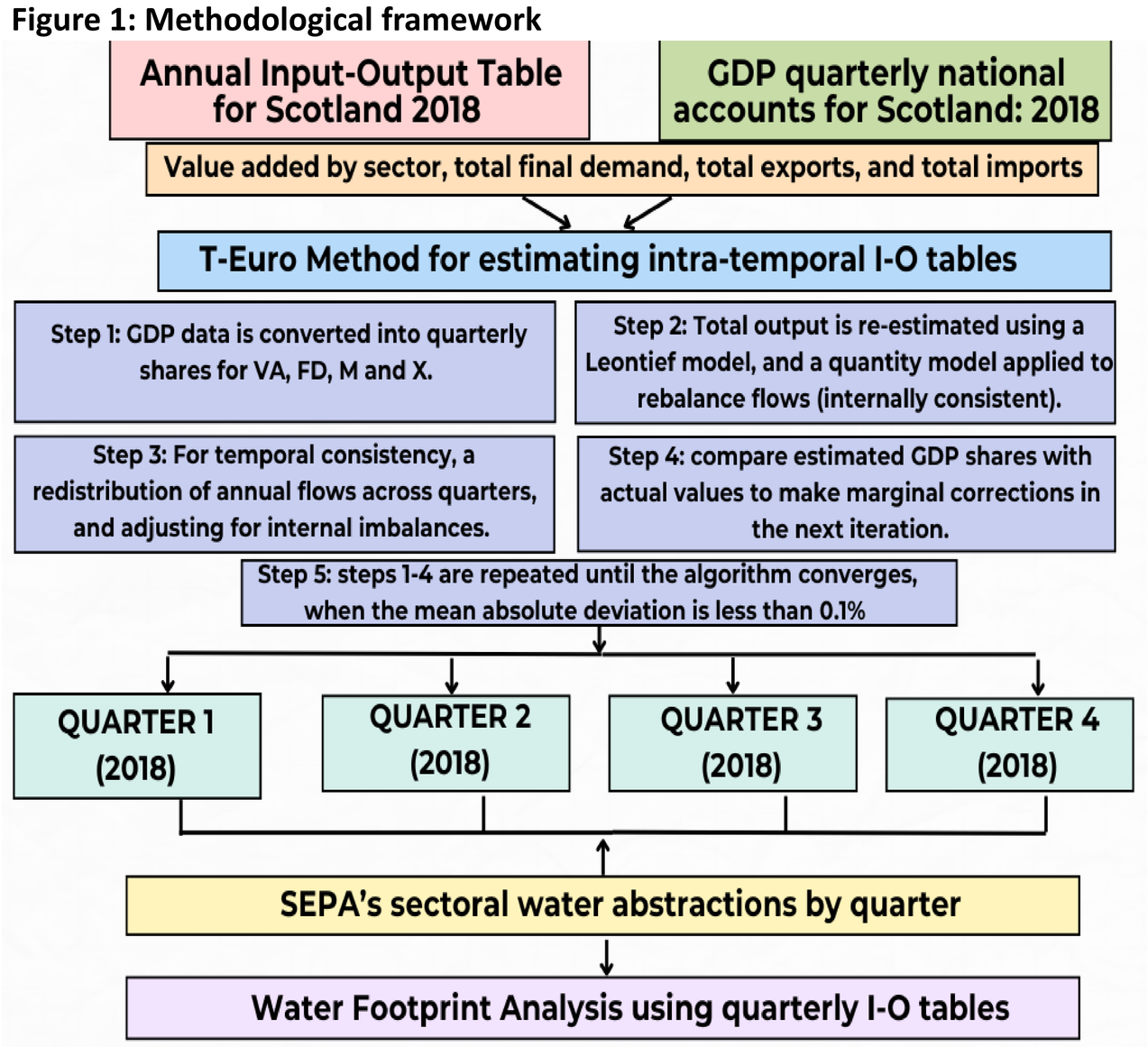
- The input-output model is a useful tool for analysing industry interconnections and resource flows. Combined with sectoral water accounts, it can quantify national or regional water footprints by tracing direct and indirect water use through the supply chains.
- Annual I-O models obscure intra-year seasonality in production processes and smooth out resource-use fluctuations.
- Fluctuations in water availability throughout the year can impact water-intensive sectors like agriculture and energy, but annual data in input-output models fail to capture these variations.
- In 2018, Scotland experienced a prolonged period of dry summer increased water usage for crop irrigation and affected the operation of water-abstracting industries such as whisky production.
- This paper uses quarterly I-O tables to map the water footprints of Scottish sector in 2018 **to analyse the seasonal variations in sectoral water use and output of water abstracting sectors.**

Research Objectives

1. Disaggregate the 2018 annual input-output table into quarterly tables using the T-EURO method.
2. Calculate the direct, indirect, gross water intensity, and sectors' gross water footprint in Scotland using the 4 quarterly input-output tables.

Methodology

Figure 1: Methodological framework



➢ T-Euro Method

- This study employs the T-EURO methodology described by Avelino (2017) for temporally disaggregating input-output (I-O) tables into quarters.
- This disaggregation method was chosen due to its minimal data requirements, using only an annual I-O table and quarterly GDP data as data sources.

➢ Water Footprint Analysis (WFA)

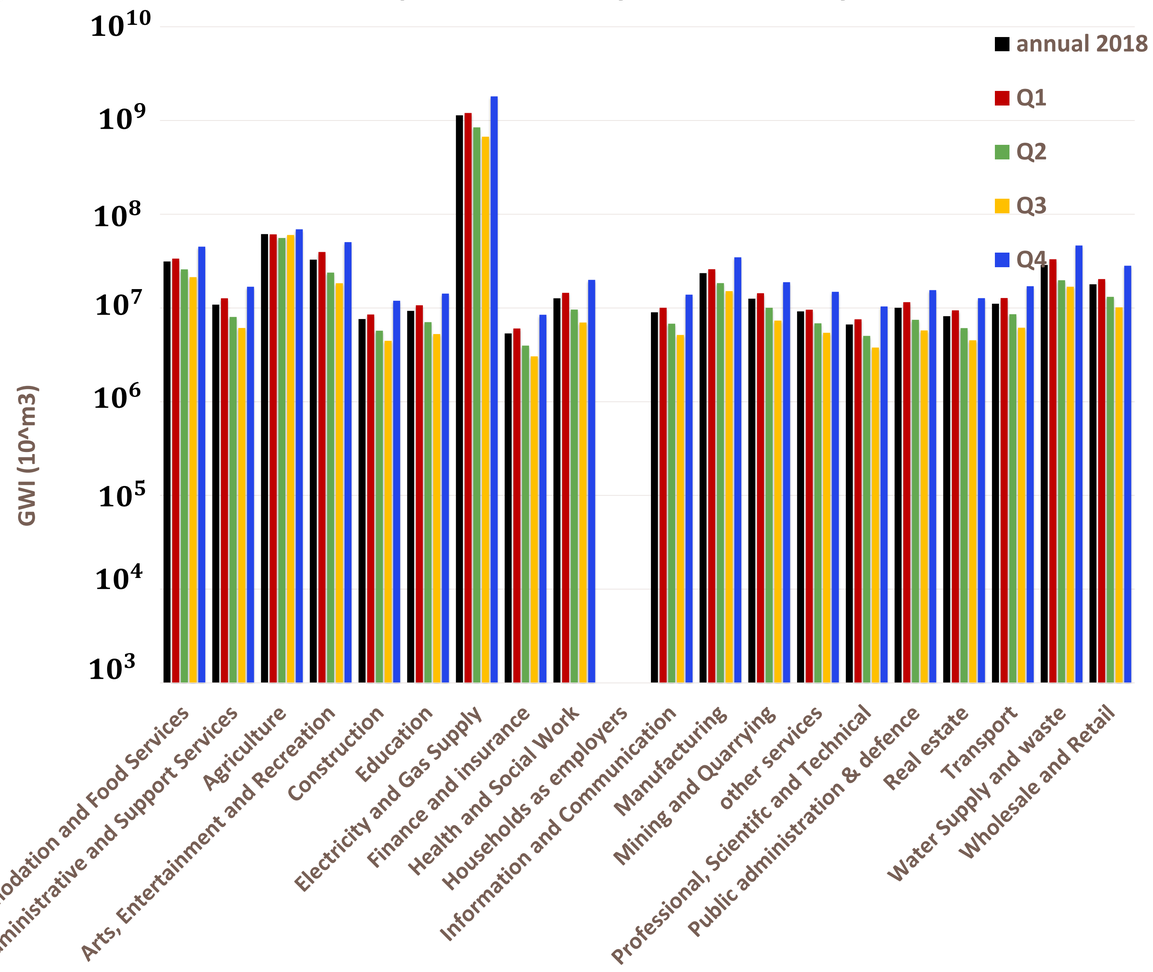
WFA is a method used to assess the total volume of freshwater used directly and indirectly by a sector to produce output. Measures include:

1. Gross water footprint (GWF)
2. Gross water footprint intensity (GWI)
3. Direct water footprint intensity (DWI)
4. Indirect water footprint intensity (IWI)

Water Footprint Analysis Results

- **Which sector/s demonstrates seasonal variations in sectoral water use and output?**

Figure 2: Gross Water Footprint Intensity of Sectors by Quarter



A. Gross Water Footprint Intensity (GWI)

- GWI is the total of DWI and IWI, representing the gross water used to generate one monetary unit of output **(production-based)** for each sector in each quarter.
- There are considerable variations in GWI for all sectors.
- Electricity and Gas Supply (hydropower) sector has the highest GWI, indicating that it is a highly water-intensive sector relative to its economic activity.
  - **Scotland's largest water-intensive sector. The sector produces around 85 per cent of the United Kingdom's hydropower.**
  - **Abstractions are low during summer (quarters 2 and 3) and very high during winter (quarters 1 and 4).**
  - **Climate change will affect the magnitude and seasonality of river flows.**
- Agriculture shows variability in water intensity across quarters.
  - **Agricultural activities' intensity increases in late spring months.**
  - **Dry weather and drought conditions affects the growth of barely and maize (Whisky production)**
  - **The prolonged periods of dry weather in 2018 impacted soil moisture and limited irrigation capacity.**
  - **Spring barley was badly affected in 2018. The yields were about 10% lower than in previous years.**

Conclusions

1. Applying WFA to temporally disaggregated I-O models is crucial for exposing seasonal production patterns and resource use, which are key to addressing climate change.
2. Sectors like Electricity and Agriculture are significantly impacted by seasonality of water availability, altering their output across quarters. The use of annual coefficients creates biases for such sectors.