

# Output compilation during economic shocks

## Revisiting imputation

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ISRAEL  
Voorburg Group  
Meeting  
March 2023

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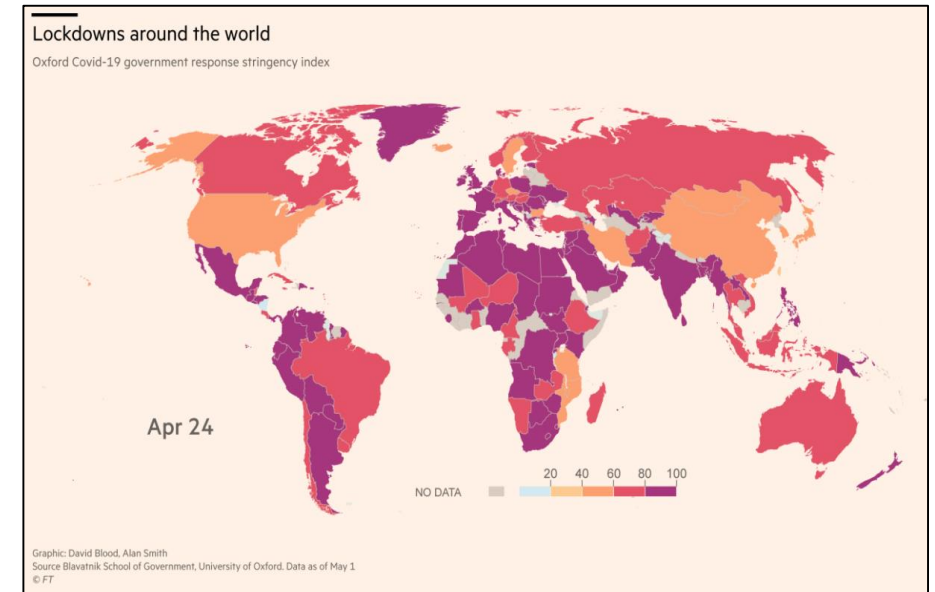
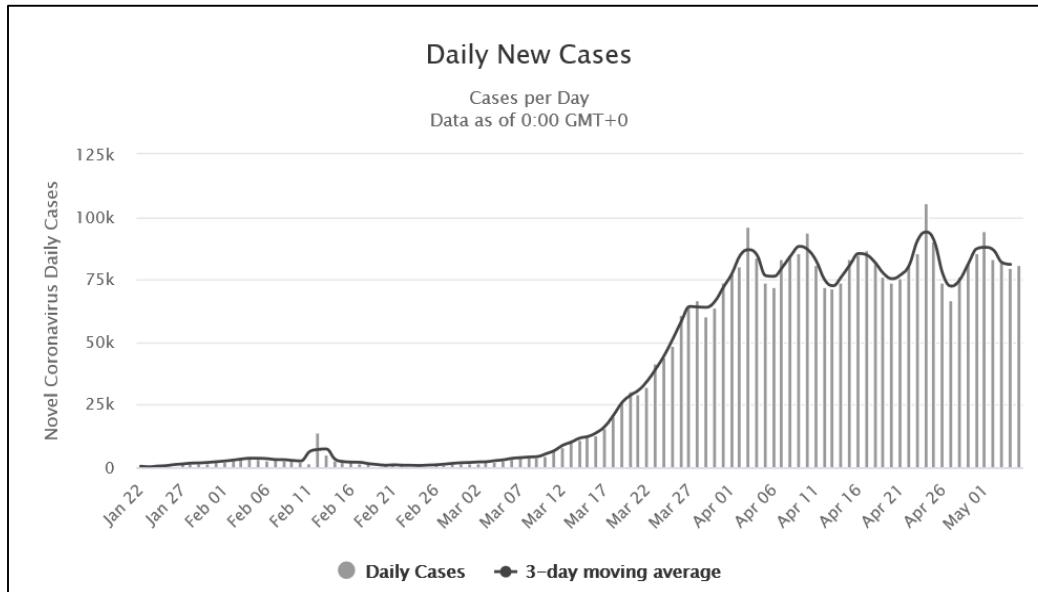
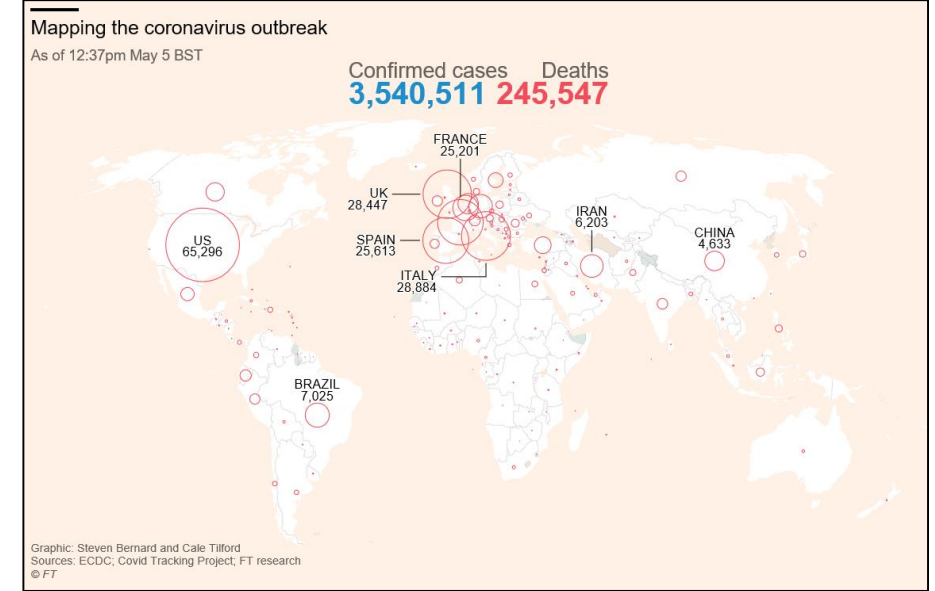
## Introduction

Pandemic conditions and constraints.

- Widespread social upheaval with unprecedented constraint on movement
- Widespread shift in ability to consume leading to shifting demand side pressures (or lack thereof) and supply side constraints
- Global broad-based phenomenon impacting all sectors impacting both domestic and international supply chains
- Globalised "just-in-time" economies faced considerable challenges
- Similar to the financial crisis the impact was broad-based in nature

Pandemic challenges for price statistics.

- Widespread missing observations deep in aggregation structures
- Missing observations could be due to inability to collect data; inability for providers to report data; or lack of economic activity
- Substitution occurred outside usual localised bounds
- Pandemic period economic factors unlike historical periods in the near past
- Shrinking levels of total consumption with potential impact on relative transaction shares



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## Imputation and Preservation – Two sides of the same coin

### Imputation (how to impute)

- Making use of the best available information to provide an unbiased estimate of price and price movement (CPI Manual, 2020)
- Localised item level focus, what are we explicitly aiming to estimate at the transaction level
- Built on tried and tested methods with important underlying assumptions

### Preservation (what to preserve)

- “the accuracy of the method relies on the veracity of the assumptions, not the quality of the explicit estimate” (PPI Manual, 2004)
- Holistic reflection on objectives and scope (and fundamentals) and their consistent application over time
- Greater reflection beyond explicit imputation to what implicitly is being impacted
- Breaking down imputation decisions in a structured way that enables the generation of metadata and data-driven solutions

# Output compilation during economic shocks: Revisiting imputation Imputation and Preservation – Navigating a pandemic

## Contextualising our actions through a set of structured parameters (1/2)

- i. Calculate (index formula) – What assumptions and/or mitigating factors exist within the index formula being utilised for calculation?
- ii. Disseminate (level) – Is the key use of the index at the upper most aggregated level (e.g.  $CPI_{Total}$ ) or at finer levels of detail (e.g.  $PPI_{Industry}$ ;  $PPI_{Class}$ )?
- iii. Disseminate (price development) – Is the key purpose of the price index annual, quarterly or monthly price development?
- iv. Disseminate (type) – Is the index published in original terms (unadjusted) or as a seasonally adjusted analytical series?
- v. Review and Validate (transaction occurrence) – Why was price information unable to be collected? Has a transaction occurred but a price was unable to be collected or has there been no economic activity for the item during the comparison period?

# Output compilation during economic shocks: Revisiting imputation Imputation and Preservation – Navigating a pandemic

## Contextualising our actions through a set of structured parameters (2/2)

- vi. Review and Validate (substitution) – Has substitution occurred within a category; between categories or has production and/or consumption ceased entirely?
- vii. Review and Validate (seasonality) – Is the missing item a highly seasonal product? Does the potential imputation source share the seasonal factor or lack of seasonality of the missing item?
- viii. Review and Validate (macro-economic factors) – Are relevant economic factors (for example: employment, wages, interest rates, inventories, exchange rates, supply and demand, competition, regulatory environment) relatively similar or vastly different than previous collection periods?
- ix. Review and Validate (imputation source) – Is data available to draw an imputation locally in the aggregation structure (for example, substitution and seasonal factors are localised) or is the missing data more widespread? That is, to what extent are transactions available that have similar price determining characteristics and/or price development?

# Output compilation during economic shocks: Revisiting imputation

## Imputation and Preservation – Impact and Suitability

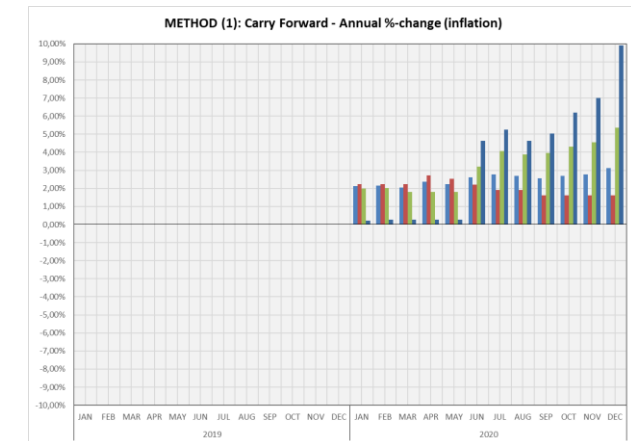
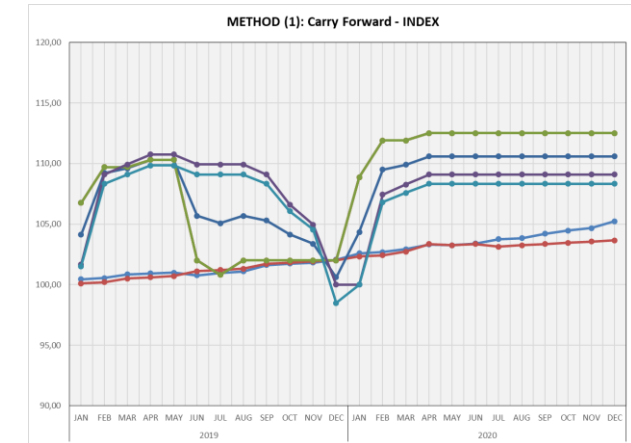
### Contextualising our imputation options through understanding the preservation

#### Suitability scenarios.

- 1) Transaction has occurred but data could not be collected;
- 2) Transaction has not occurred but has shifted to an alternative product/activity;
- 3) Transaction has not occurred and there has been no substitution;
- 4) Missing data broad-based rather than localised and no neighbouring economic activity is available

#### Preservation options.

- 1) Price level
- 2) Historical price behaviour (e.g. seasonal factor)
- 3) Annual or periodic movement
- 4) Elementary Aggregate; Industry Aggregate; Total Aggregate
- 5) Market behaviour (substitution)



- CONSUMER PRICE INDEX E.g. Carry Forward.
- International Flight (1) Price level preserved at the cost of the annual movement.
- International Flight (4)
- CPI ALL (excl. Transport)
- International Flight (2)
- INTERNATIONAL FLIGHT
- International Flight (3) Element of unknown data

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## Imputation and Preservation – Impact and Suitability

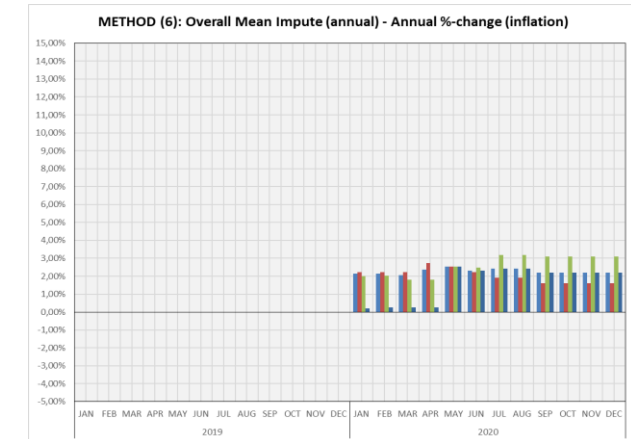
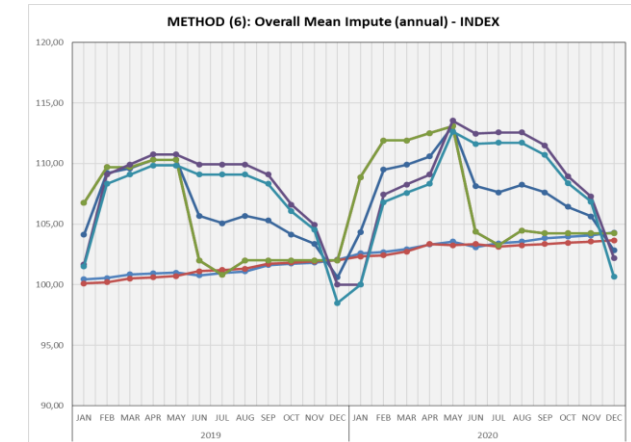
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- 5) Market behaviour (substitution)



- CONSUMER PRICE INDEX E.g. OMI. Annual.
- International Flight (1) Total index and the annual movement preserved.
- International Flight (4)
- CPI ALL (excl. Transport)
- International Flight (2)
- INTERNATIONAL FLIGHT Based off known realised transactions
- International Flight (3)



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## Imputation and Preservation – Questions?

### Conclusion

This thought exercise raises what it considers to be important areas for consideration when imputations are being considered as well as a summary of imputations and what they inherently preserve. This seems especially important in times of economic shocks where fundamental explicit and implicit impacts need to be kept in check and well-communicated. In terms of continued areas for investigation the following are recommended for consideration and discussion:

**Preservation an integral part of imputation.** Imputation seeks to solve missing data issues at the item level under certain assumptions that this will retain representativeness at the item level and resulting in accurate aggregate level indicators. It is suggested that imputation discussed in terms of preservation could enhance understanding and consistent application of imputation in statistical programmes. During an economic crisis type scenario this seems of particular importance.

**Explicit and implicit impacts on the index.** All too often the explicit impacts are considered without due consideration being given to implicit (or hidden) impacts. These implicit impacts and/or qualities are in equal measure important to consider in terms of communication of results and advice to users whilst also holding opportunities to exploit in production system design.

**Structured approach to determining and recording imputation (and quality adjustment).** This thought exercise further proposes that the development of a common language for structuring and recording metadata for imputation and quality adjustment based decisions is a productive and natural progression to take advantage of contemporary technologies. This would support the generation of training datasets useful beyond the bounds of individual statistics offices.

### Contact

Interested in discussing the topic further? Please reach out via email to organise a digital coffee!

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