Transaction Data for the Price Index of Package Holidays in Germany

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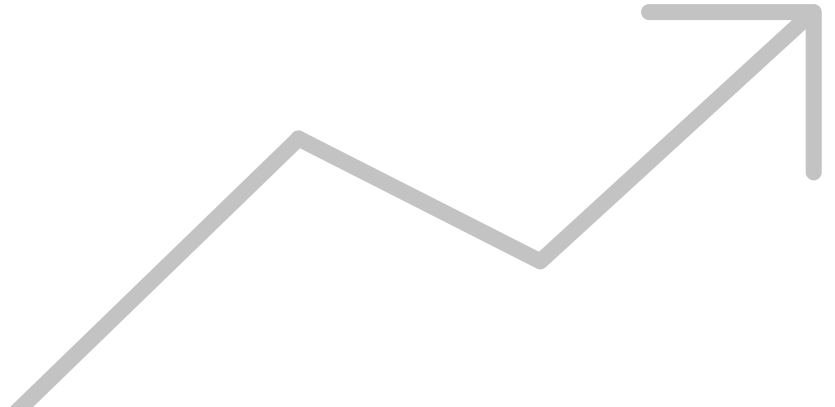


Agenda

1) The German HICP

2) Data

3) Projects on German package holidays

4) Methodology: hedonic double imputation

5) Plausibility checks

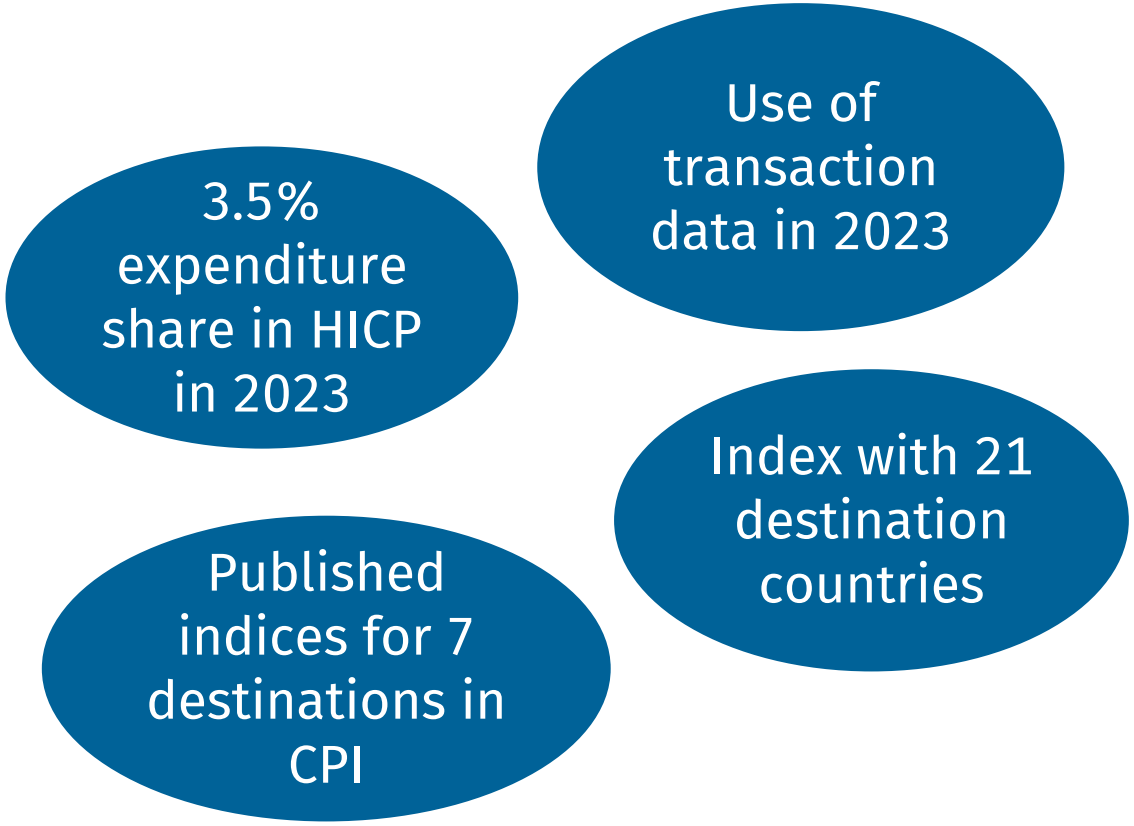
6) Index results

The German HICP and domestic CPI

Update of weights

- HICP: Update of consumption weights every year
- CPI: Update of consumption weights every 5 years
- Methodological changes are integrated with CPI weight updates

096 Package holidays



Projects on German package holidays

- Henn et al. (2019) tested transaction data for German package holidays for 2013-2018
  - Calculation methods performed well, none was clearly superior
  - Indices using transaction data differ from indices using offer pricesMissing variables: meal type and room category
- Feasibility study in 2021 of Destatis
  - Data source: tour operators or Amadeus?
  - Transaction data of 2015-2021
  - Variable handling, choice of index method, plausibility checks, imputation

Data

- Transaction data obtained by the global distribution system (GDS) Amadeus Germany
- Very high market share in Germany
- 21 destinations cover ~90% of bookings through Amadeus
- Bookings are heterogeneous in properties

Booking date	Travel date	Duration	Travelers	Depart. airport	Dest. airport	Hotel-name	City	Country	Hotel stars	Meal type	Room category	Price
01.03.2023	11.04.2023	10	2	HAM	AYT	Eftalia Hotel	Alanya - Türkler	Turkey	4	All Inclusive	DOUBLE-ROOM	662.90
06.02.2023	15.10.2023	8	4	CGN	FUE	allsun Hotel	Playa de Esquinzo	Canary Islands	5	All Inclusive	FAMILY-ROOM	2215.00

Methodology: hedonic double imputation

- Estimation of coefficients in current period t and base period b

$$(1)\ \ln(price_t) = \alpha_t + \beta_{1,t} * \ln(travellers_t) + \beta_{2,t} * \ln(duration_t) + \beta_{3,t} * star3_t + \ldots + \varepsilon$$

$$(2)\ \ln(price_b) = \alpha_b + \beta_{1,b} * \ln(travellers_b) + \beta_{2,b} * \ln(duration_b) + \beta_{3,b} * star3_b + \ldots + \varepsilon$$

- Prices are imputed by inserting bookings of both periods into equation (1)
- Price index is calculated via geometric mean

Methodology: hedonic double imputation

- Reliable indices in months with few bookings
- Takes into account many price-determining characteristics
- Method controls for omitted variable bias
- For each destination, month and over time, importance of variables differs
  - (forward) stepwise variable selection

Possible variables

- log no of travellers
- log duration
- booking time

Binary variables

- school holidays
- online/offline booking
- travel service included
- number of children
- hotel stars (2-5)
- meal types (5 categories)
- clusters of room category
- clusters of room features

Plausibility checks

Deletion of erroneous and implausible bookings

- Cancellations, duplicates, bookings with missing values
- Duration, Price, Number of travellers, booking time ≤ 0
- Cruises
- Bookings including a rental car
- Booking time > 366

Plausibility checks

Clearing of outliers by destination country

0.5% of bookings are cut from the upper (and lower) end of the spectrum

- price per day and person
- duration
- number of:
  - travellers
  - adults
  - children

Number of booking after outlier clearing

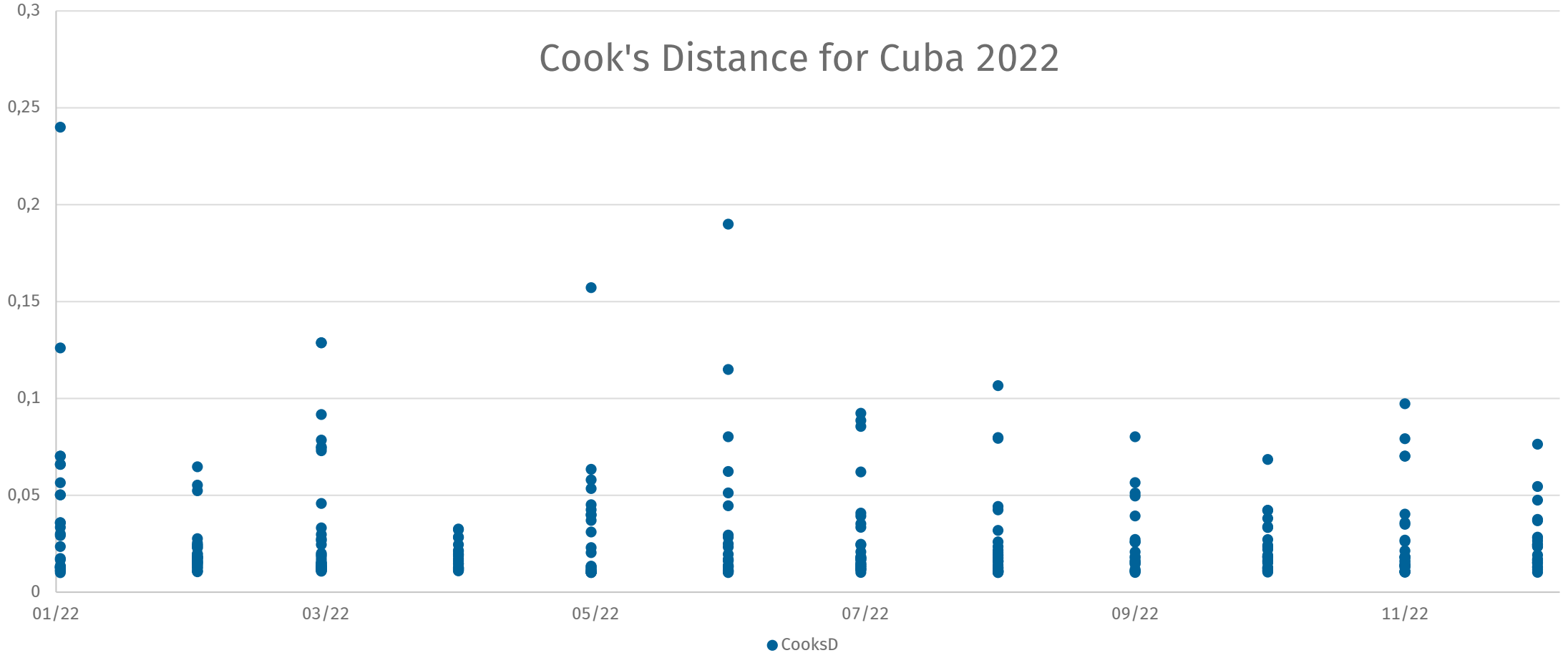
Dataset	Bookings 2019	Bookings 2020	Bookings 2021	Bookings 2022
Without erroneous bookings	1,656,985	1,029,711	740,073	1,349,654
Without 0.5%- and 99.5%-quantils	1,630,078	1,006,402	720,424	1,312,000
Difference	1.62 %	2.26 %	2.66 %	2.89 %

Plausibility checks

Influential bookings

- Cook‘s Distance: Indicator for the influence of a data point
- Cutoff value for outliers?
  - Commonly used rules of thumb ($D > 1$ or $D > 4/N$ and others) do not apply well
  - Little insight through analysis of values of single bookings
  - Graphical analysis seems best applicable

Plausibility checks



Plausibility checks

Minimum number of observations

Framework derived from own robustness checks:

- More than 140 bookings: Index is robust
- Less than 140 bookings: common rule of thumb

$$min\ N\ = N\ explanatory\ variables\ *\ 10$$

- Insufficient number of bookings: Index is compensated

Plausibility checks

Test of multicollinearity

Multicollinearity: two explanatory variables correlate

Ex.: most bookings to 5-star-hotels in Egypt include all-inclusive meals

- Biased index
- Indicator: variance inflation factor (VIF)
- Model improvement by deleting selected variables

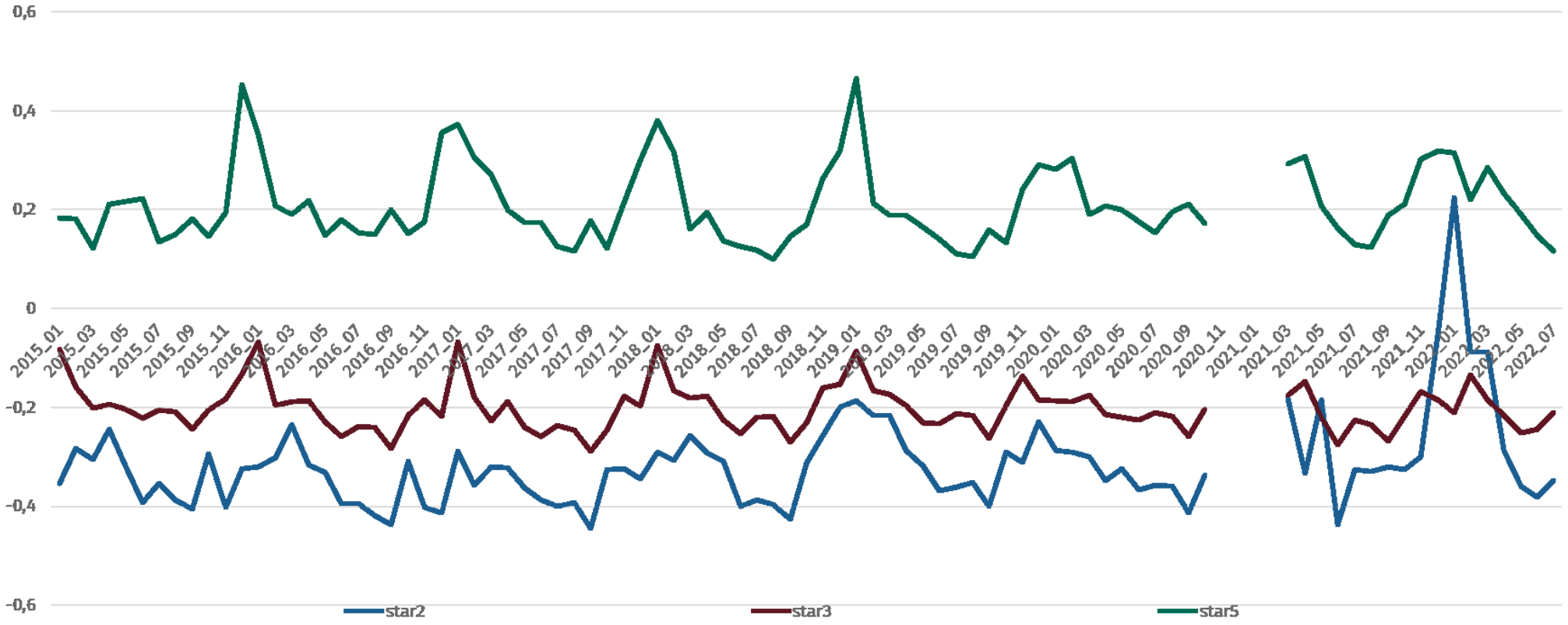
Plausibility checks

Further model examination

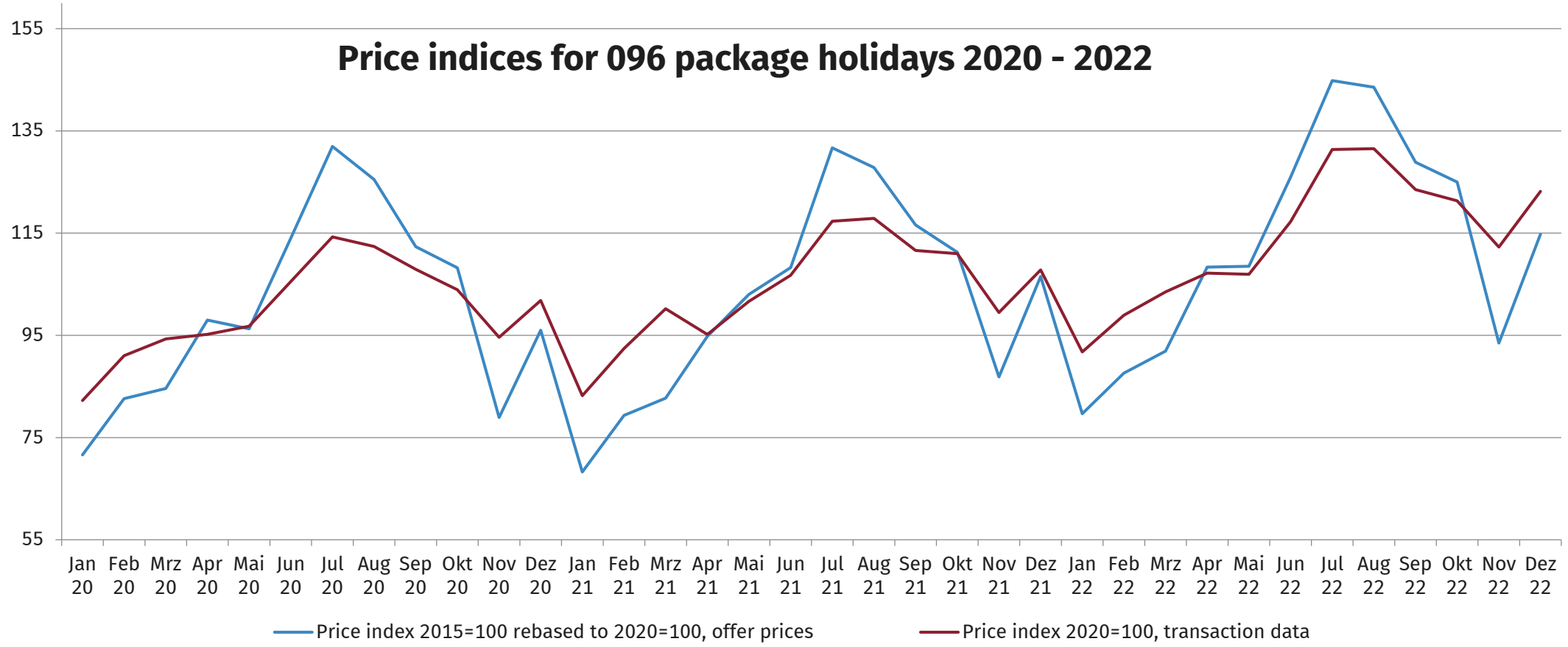
- Graphical analysis of β-coefficients and adjusted R^2
- Regular pattern over time
- Some coefficients display a seasonal pattern
- Significant inconsistencies point to a problem in the model
- Appear for dummy variables with little variation
- Bookings might have to be deleted

Plausibility checks

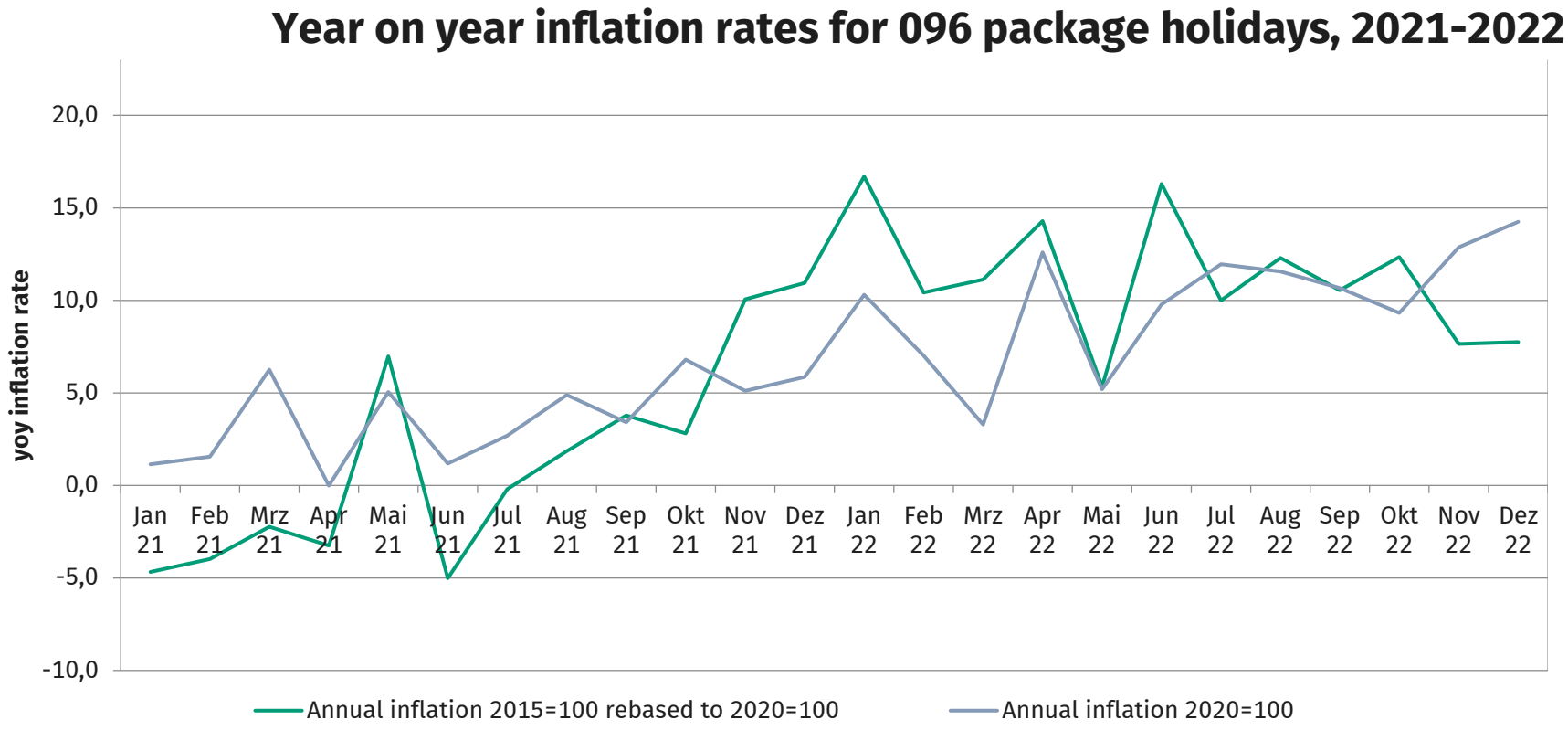
Regression coefficients for Balearic Islands



Index results



Index results



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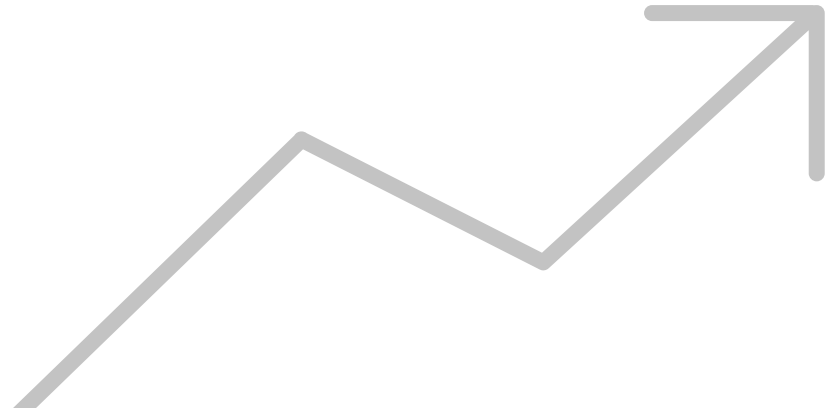

References

Henn, K., Islam, C.-G., Schwind, P., and Wieland, E. (2019). Measuring Price Dynamics of Package Holidays with Transaction Data. EURONA, 2/2019:95–132.

Holiday destinations covered by transaction data

Published indices for domestic CPI

- Balearic islands
- Canary islands
- Egypt
- Greece
- Turkey

Further indices

- Bulgaria
- Cuba
- Cypris
- Dominican Republic
- Italy
- Maledives
- Mauritius
- Mexico
- Portugal
- Spanish mainland
- Thailand
- Tunisia
- United Arab Emirates

- City trips
- Cruises