

Lessons Learned from the COVID-19 Pandemic

36th Voorburg Group Meeting

September 20, 2021



Overview

- Response rates
- Variance estimates
- Seasonal adjustment
- Index weights
- Data collection



Response rates

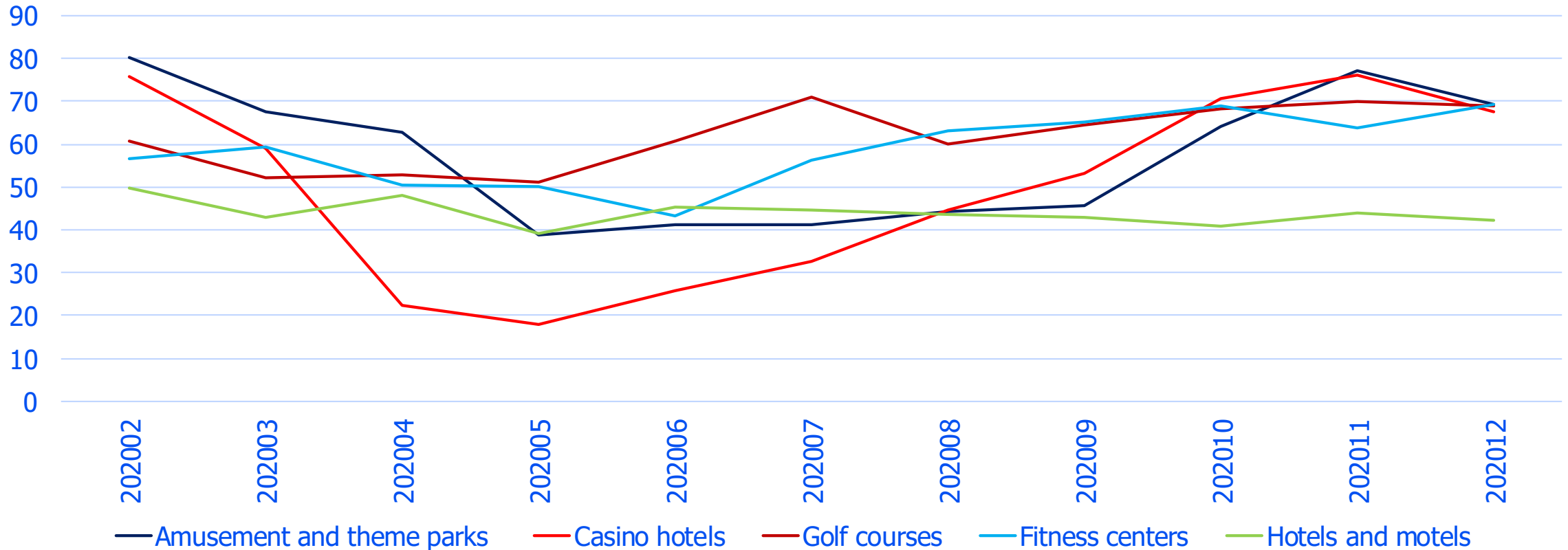
- Monthly repricing response rate=
 - ▶ $(\text{number of prices received for a month}) / (\text{number of prices requested for a month}) * 100$
- PPI was unsure how the pandemic would affect repricing response rates

PPI repricing response rates by industry sector

Industry sectors	Average Mar 2019 to Feb 2020	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Average Mar 2020 to Mar 2021
All industrial sectors	69	72	76	72	72	73	72	73	73	73	72	73	73	74	73
Agriculture, forestry, fishing and hunting	47	49	44	44	48	47	47	50	51	51	46	50	49	46	48
Mining, utilities, and construction	66	69	71	70	66	70	72	71	72	71	69	74	71	73	71
Manufacturing	74	75	78	73	74	75	75	75	75	74	73	74	74	76	75
Wholesale trade	62	60	65	61	64	63	61	63	63	64	60	65	64	64	63
Retail trade	75	75	74	75	70	76	74	76	75	75	74	75	76	79	75
Transportation and warehousing	80	81	81	83	84	79	77	77	80	77	78	84	79	79	80
Finance, real estate, and other information services	79	76	79	78	77	77	76	79	76	78	78	76	78	80	78
Health care services	59	54	62	60	57	62	60	57	62	63	63	60	66	61	61
Entertainment, accommodation and food services	66	52	47	38	43	46	46	47	54	53	54	56	52	46	49
Other services, except public administration	80	84	96	95	95	95	100	100	91	87	83	92	90	90	92



Entertainment, accommodation, and food services: response rates by industry



Response rates: lessons

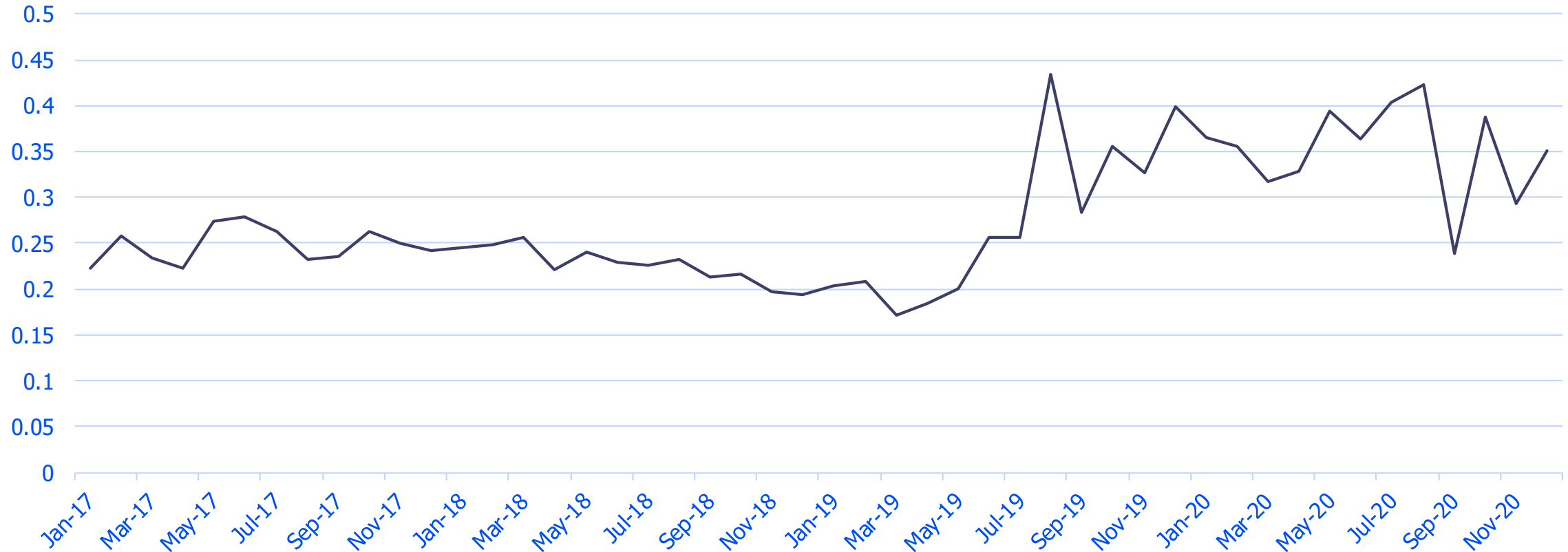
- Although the U.S PPI survey is voluntary, respondents generally continued to participate in spite of the pandemic
- The exceptions were industries that were deeply affected by shutdowns



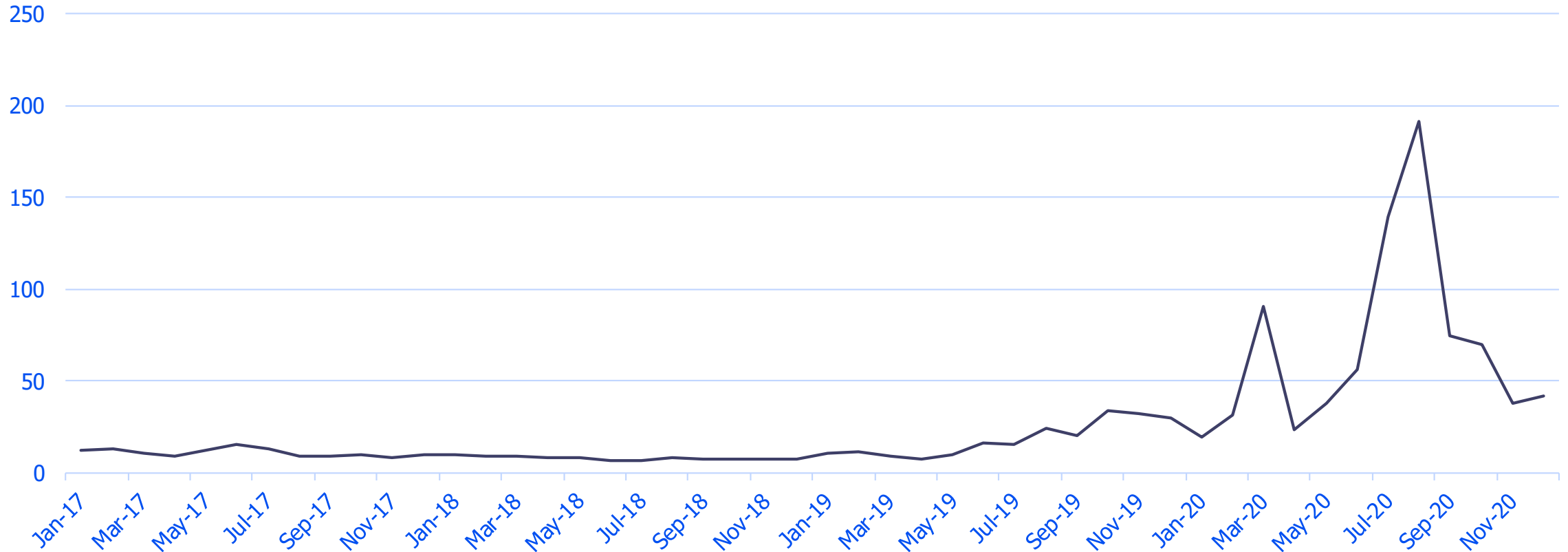
Variations estimates

- Variance estimates
 - ▶ Measure of the uncertainty caused by the use of a sample of prices instead of the complete universe of prices
- Standard error
 - ▶ Square root of the variance
 - ▶ Used to calculate a confidence interval around the sample percent change estimate

SE 12-month percent change in final demand



Relative SE 12-month percent change in final demand



RSE by commodity type in FD

Index	12-month median RSE			
	2020	2019	2018	2017
Final demand	50.7	14.9	8.0	10.5
Final demand goods	11.6	21.9	5.7	5.3
Final demand foods	48.8	16.2	32.7	20.3
Final demand energy	6.2	8.7	7.0	7.8
Final demand goods less foods and energy	25.0	13.8	10.0	6.0
Final demand services	50.5	16.7	12.4	19.9
Final demand trade services	110.3	44.4	51.1	65.2
Final demand transportation and warehousing services	18.7	20.1	8.6	23.2
Final demand services, other	28.5	11.3	10.2	12.6



Variations estimates: Lessons

- Variations, on average, increased during the pandemic
- Pandemic led to more price volatility, which seemed to increase the variability of price changes within PPIs
- Increases in standard errors were relatively broad based across categories but some areas, such as foods, were more affected

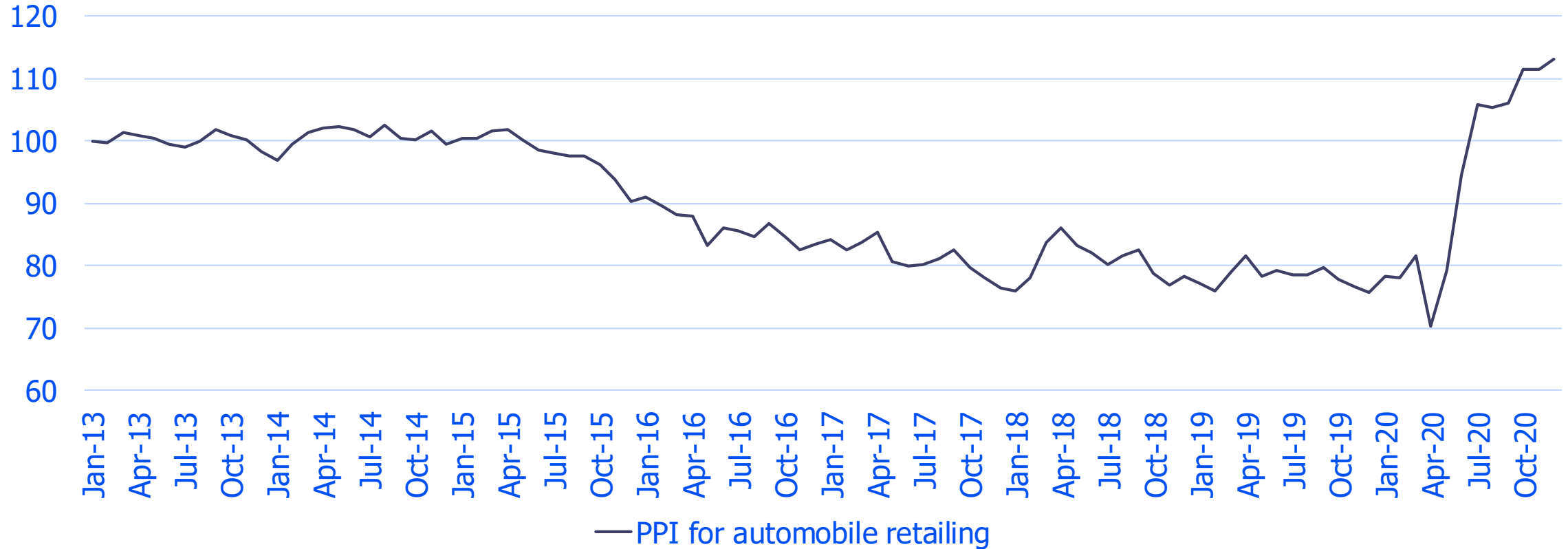


Seasonal adjustment

- Seasonal adjustment removes within-year seasonal patterns from data
- PPI used a filter-based approach that employs moving averages of historical data to estimate the seasonal pattern
- In 2020, a number of PPI index series experienced extreme price movements as a result of the COVID-19 pandemic



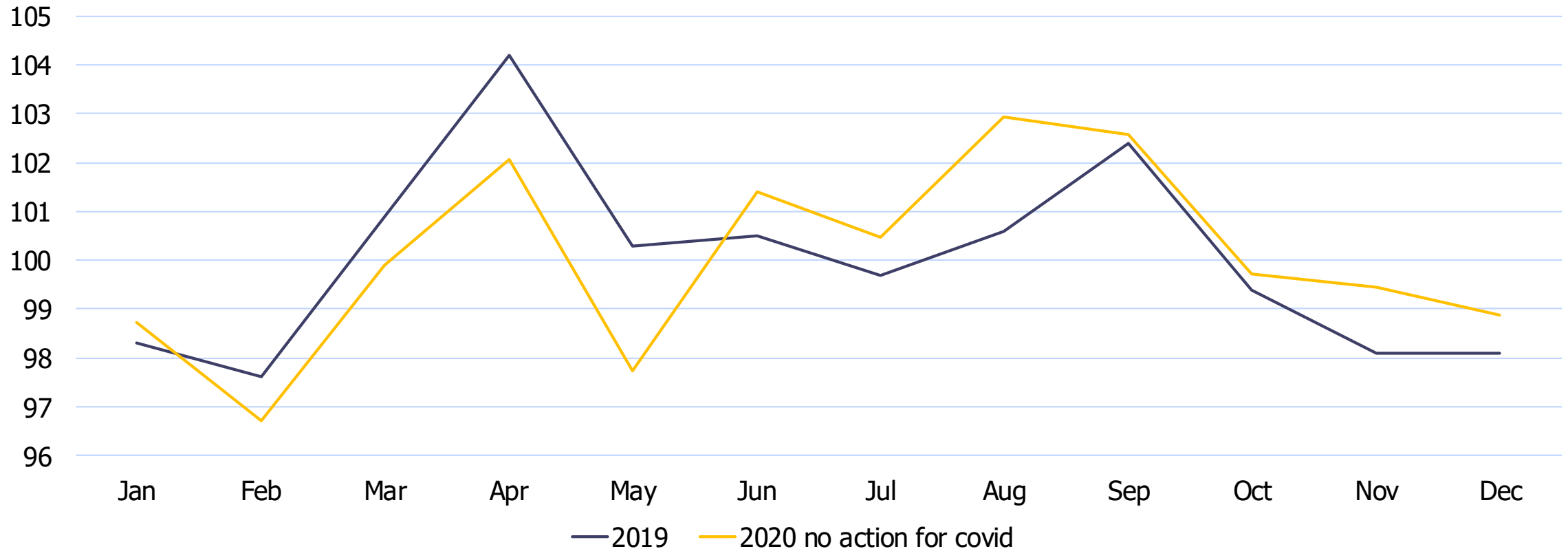
Example- Automobile retailing



Seasonality test- Automobile retailing

Seasonality test	F(s)
2019	9.658
2020	1.73

Seasonal factors- automobile retailing



What can we do?

■ Intervention modeling

- ▶ Estimating and removing the effects of nonseasonal events indexes prior to testing them for seasonality and developing seasonal factors

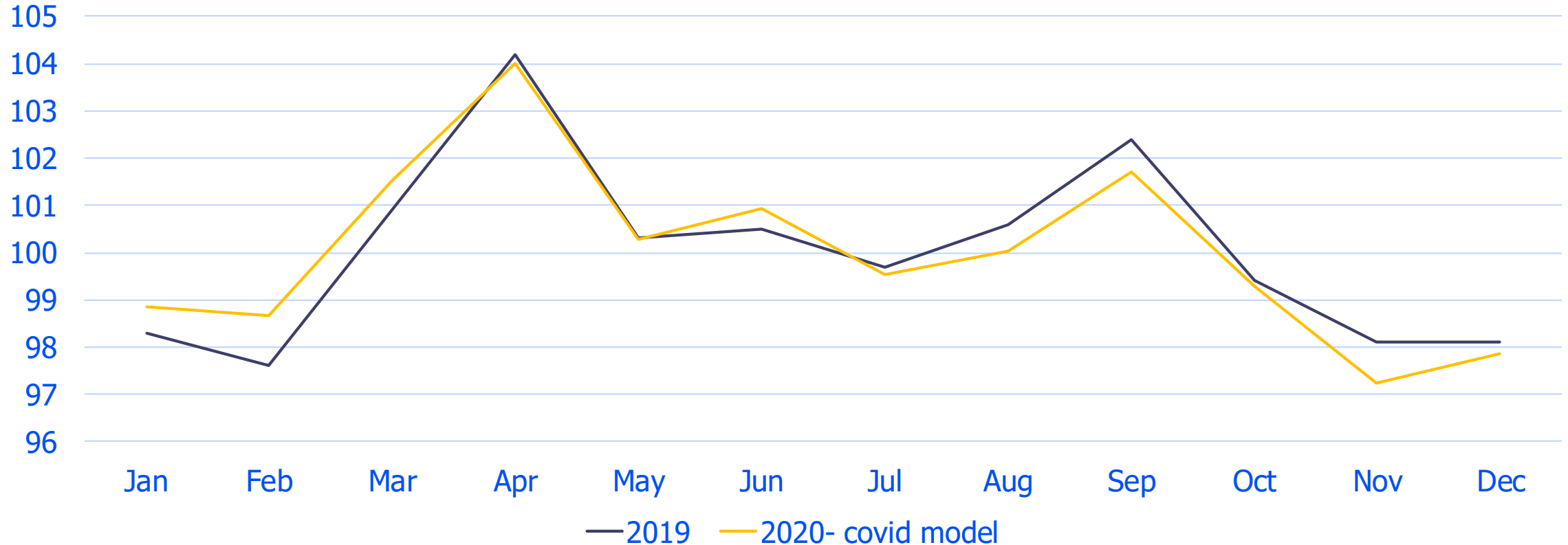
- ▶ ARIMA model with variables to account for nonseasonal events
 - Outlier
 - Level shift
 - Ramp

Seasonality test- automobile retailing– with intervention model

Seasonality test	F(s)
2020 after modeling	9.968



Seasonal factors- PPI automobile retailing- with intervention model



Intervention modeling scope in 2020

- Intervention analysis
 - ▶ 2020: 76 series
 - ▶ 2019: 41 series
- Total interventions
 - ▶ increased 64 percent from 2019 to 2020

Seasonal adjustment: lessons

- A large economic shock, such as the COVID-19 pandemic, requires considerable resources to be reallocated to intervention analysis
- Intervention modeling was effective at mitigating the effects on seasonal adjustment
- Additional resources will be needed until COVID-period data is no longer included in the eight-year estimation window



Index weights

- U.S Producer Price Index
 - ▶ Modified Laspeyres index
 - Fixed weights over a set period of time
 - Weights are based on value of shipments and revenue data from U.S. Economic Census
 - Weights updated every five years

Index weights

- PPI weights
 - ▶ Ideally would reflect the share of revenue for a product or industry relative to the other products or industries included in the index
- Infrequent weight updates
 - ▶ Problematic when revenues are shifting relative to each other over time
- The COVID-19 pandemic
 - ▶ Led to large, non-symmetrical shifts in production patterns
 - ▶ Caused concerns over the accuracy of weights

U.S Bureau of Economic Analysis gross output changes

Industry	Gross output percent change 2018-2019	Gross output percent change 2019-2020
All industries	3.3	-2.9
Private industries	3.3	-3.2
Agriculture, forestry, fishing, and hunting	-0.7	0.4
Mining	-5.0	-29.5
Utilities	-2.5	-3.3
Construction	2.9	4.3
Manufacturing	0.8	-5.5
Wholesale trade	2.4	-3.8
Retail trade	4.1	3.7
Transportation and warehousing	4.9	-15.0
Information	6.2	2.1
Finance, insurance, real estate, rental, and leasing	4.6	2.8
Professional and business services	5.1	-2.1
Educational services, health care, and social assistance	4.0	-2.8
Arts, entertainment, recreation, accommodation, and food services	4.0	-25.6
Government	3.5	0.4



Formula and weighting

- Ideally, under conditions where revenues are shifting relative to each other, weights would be updated every period to accurately reflect shifts across time
 - ▶ Chain weighted Tornqvist
 - ▶ Chain weighted Fisher index
- Not currently feasible for U.S. PPI
 - ▶ Systems and data limitations

Future weights

- Next U.S. PPI weight update
 - ▶ January 2023
 - ▶ 2017 Economic Census data
 - ▶ Hopefully production patterns will return to more historically normal levels and weights will be as accurate as they have been after past weight updates
- Countries with annual weight updates
 - ▶ Typically introduced with a lag
 - 2020 weights introduced in 2021
 - ▶ Using 2020 data seems problematic
 - Delay or estimate weights



Index Weights: lessons

- Laspeyres index formula can be problematic when shocks affect revenue shares disproportionality
- The problem not only occurs during the time period of the shock, but also when data from the shock period is subsequently used for weighting other periods
- The best solution to overcome these problems would be to use a chain weighted superlative formula



Data collection

- Pandemic changed the manner in which PPI initially collects data from respondents
- Pre-pandemic
 - ▶ In person initiation
- Mid-March 2020
 - ▶ In person visits suspended

Steps taken during pandemic

- Steps taken to help facilitate data collection
 - ▶ Initiation by phone
 - ▶ Encrypted video conferencing
 - ▶ Data collection via phone and video supplemented by email
 - Email templates to help better connect with respondents were developed
 - ▶ Resources developed to facilitate the use of video conferencing
 - Guide to create conference calls
 - Industrial prices telephone initiation tips collection aid

Difficulties in collection

- Field economists still encountered difficulties
 - ▶ Businesses that shut down temporarily
 - ▶ Businesses that shut down and were uncertain as to whether they would reopen
 - ▶ Businesses that were unreachable
 - ▶ Businesses on reduced capacity

Data collection results

- Total transmittals - both positive and negative responses
 - ▶ Declined 9 percent in 2020
 - ▶ Generally had been declining prior to the pandemic
 - ▶ Pandemic probably did not cause the entire decline in 2020
- Proportion of positive transmittals
 - ▶ Fell by approximately 8.5 percent in 2020

Data collection: lessons

- Data collection at initiation is more difficult during the pandemic due to the inability to conduct in person visits and business shutdowns
- Efforts instituted to offset these difficulties were somewhat effective at minimizing reduction in data collection
- PPI will generally be less reliant on personal visit data collection in the future



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