



STATISTICS

Accommodations Research – Unit Values and Transaction Prices

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Disclaimer

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Goal of the project

- Compare large private data set of hotel prices to official PPIs for hotel lodging services
- Research questions:
 - Do price indexes based on the much larger sample size of properties and transactions produce different trends than official PPIs?
 - If so, is there a consistent pattern of trend differences across countries?
 - Would real output growth for lodging services look different if the price indexes based on the large data set were in place in the past?
 - Can the differences provide any insights for measuring the benefits of sample size expansion against the costs of introducing unit value bias?

The basics – matched models and unit values (1)

- General best practice for PPIs – matched models
 - Select a sample of well-specified goods and services, monitor their prices in future periods when they are sold under similar transaction terms.
 - Update sample periodically, perform QA when necessary.
- Alternative approach – unit values
 - Collect the price for a good or service as the total sales value generated from all transactions divided by the number of units (quantity) sold.
 - Subject to unit value bias – likely to be affected by changes in the mix of types of transactions that are included each period.
 - Advantage – low-cost method to increase number of sample observations

The basics – matched models and unit values (2)

- If data collection resources were unlimited and response burden unconstrained, we'd always advise matched model approach since it is not subject to unit value bias
- In real world, decision may be based on assessment of increased precision of larger sample weighed against loss of accuracy due to unit value bias
 - This is difficult to measure (any ideas?)
 - This study produces only anecdotal information about this tradeoff

STR historical data

- For this study, the IMF purchased historical monthly accommodations data for Canada, UK, and Japan from STR.
- STR maintains Census of all properties with 10 or more rooms in these countries
- 40-70% of these properties report supply of available rooms, room nights booked, and accommodation revenue each month. $\text{Price} = \text{revenue} / \text{room nights booked}$.
- Information for non-reporting properties is estimated based on reported data for similar properties
- No property-specific information is provided, only aggregations across all Census properties at the national level.

Benefits of increasing sample for accommodation services

- A large hotel with 1,000 rooms may make as many as 30,000 distinct room night transactions in a month
- NSOs typically collect only 2-6 accommodation transaction prices from a property
- Dynamic pricing compounds problem – algorithmic models that continually estimate profit-maximizing price for each room night based on evolving supply and demand signals

Channel shifting

- Hotels may also discount through channel-shifting. When demand is low, offer rooms at lower price through OTAs (booking.com, etc.) while keeping website price the same. This price dynamic is missed with strict matched model pricing.
- Example – In month 2, Hotel A determines that to maintain 100% occupancy in their non-suite rooms, they will make them available at a discounted rate to a third party, while keeping their own rates the same.

	Rooms revenue	Occupied room nights	Total lodging unit value price
	number of rooms * price per night * monthly nights * occupancy rate	number of rooms * monthly nights * occupancy rate	rooms revenue / occupied room nights
Month 1 Suites	$20 * \$100 * 28 * .5$ \$28,000	$20 * 28 * .5$ 280	
Month 1 Non-suites	$100 * \$50 * 28 * 1$ \$140,000	$100 * 28 * 1$ 2,800	
Month 1 Total	\$168,000	3,080	\$54.55
Month 2 Suites	$20 * \$100 * 28 * .5$ \$28,000	$20 * 28 * .5$ 280	
Month 2 Non-suites	$(75 * \$50 * 28) + (25 * \$35 * 28)$ \$129,500	$100 * 28 * 1$ 2,800	
Month 2 Total	\$157,500	3,080	\$51.14

Cost of unit value bias for accommodation services

- Erroneous price changes shown if the occupancy rates of different types of rooms vary from month to month
- Unit value may reflect change, even though all prices remain the same. This is really a volume change, as Hotel A is selling more suite nights in Month 2.
- Ideally suites would always be separated from non-suites, but other distinctions may also be significant

	Rooms revenue	Occupied room nights	Total lodging unit value price
	number of rooms * price per night * monthly nights * occupancy rate	number of rooms * monthly nights * occupancy rate	rooms revenue / occupied room nights
Month 1 Suites	20 * \$100 * 28 * .5 \$28,000	20 * 28 * .5 280	
Month 1 Non-suites	100 * \$50 * 28 * 1 \$140,000	100 * 28 * 1 2,800	
Month 1 Total	\$168,000	3,080	\$54.55
Month 2 Suites	20 * \$100 * 28 * .75 \$42,000	20 * 28 * .75 420	
Month 2 Non-suites	100 * \$50 * 28 * 1 \$140,000	100 * 28 * 1 2,800	
Month 2 Total	\$182,000	3,220	\$56.52

Sample size comparisons – number of properties

	Canada	UK	Japan
STR	~6,500	~15,000	~4,000
Official PPI	482	124	~400 for CPI, undisclosed for SPPI

- STR collects data for about 4 million rooms in each country each month

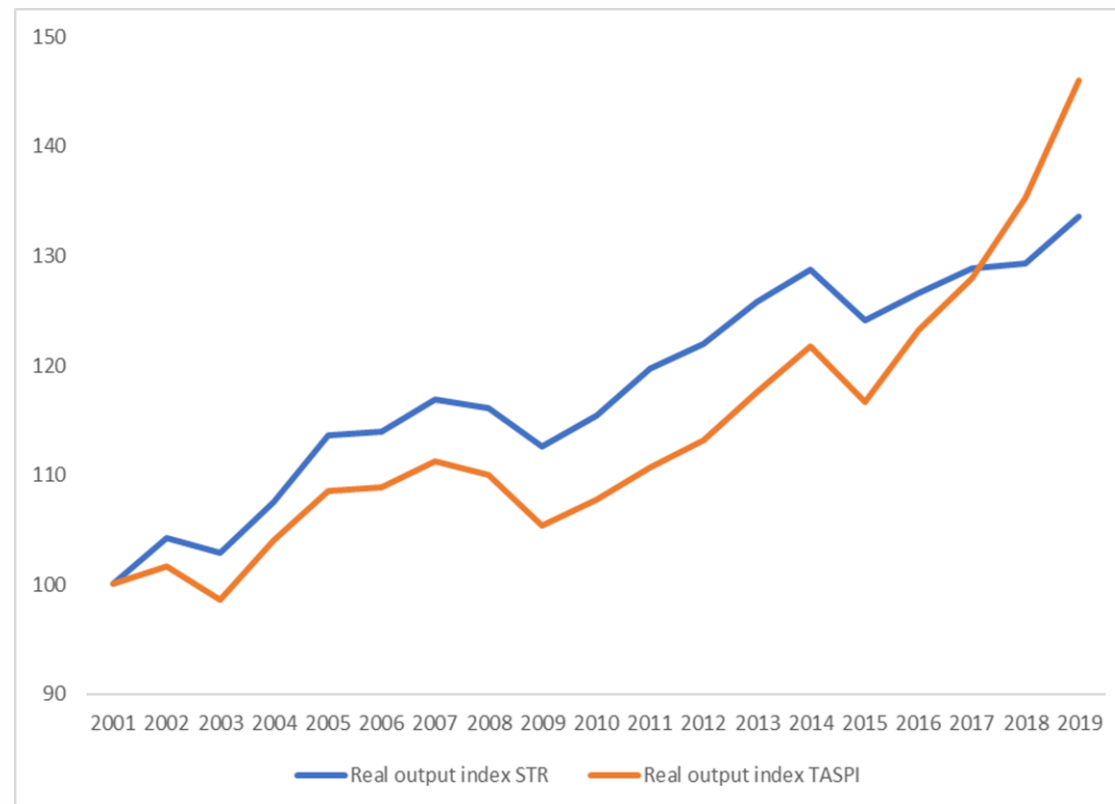
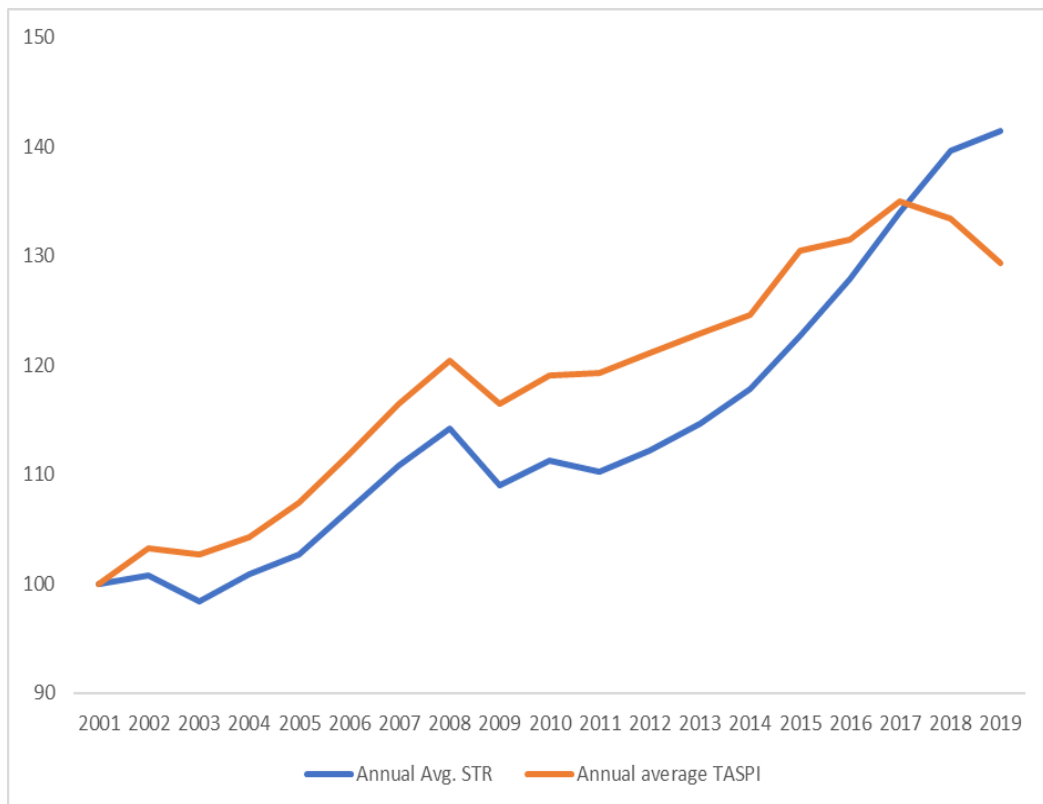
Results of analysis

- Do price indexes based on the much larger sample size of properties and transactions produce different trends than official PPIs?
- If so, is there a consistent pattern of trend differences across countries?
- Would real output growth for lodging services look different if the price indexes based on the large data set were in place in the past?

There is no clear consistent pattern between countries, and the relationship between the big data indexes and the official PPIs is not consistent over time in the same country

Canada Traveller Accommodation Services Price Index vs. STR

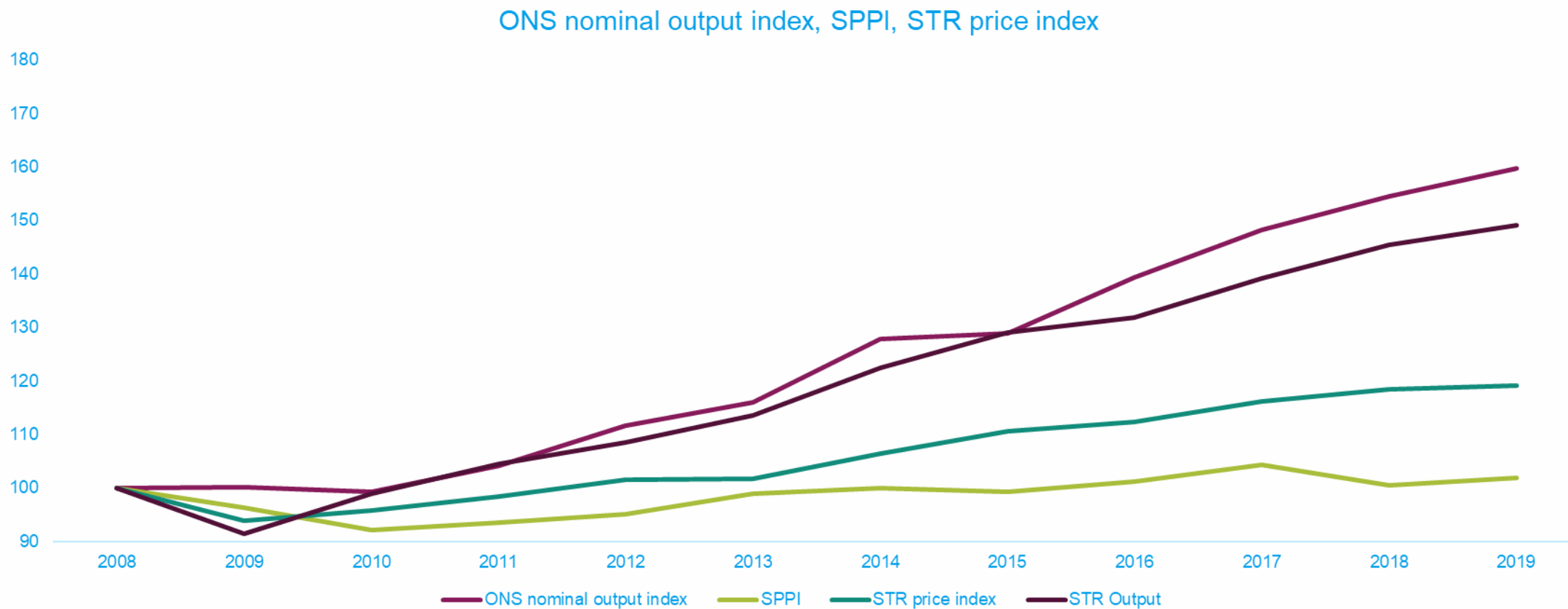
- STR lower than official PPI between 2001-2017 resulting in higher real output, but pattern is reversed in 2018 and 2019



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UK SPPI for Lodging vs. STR

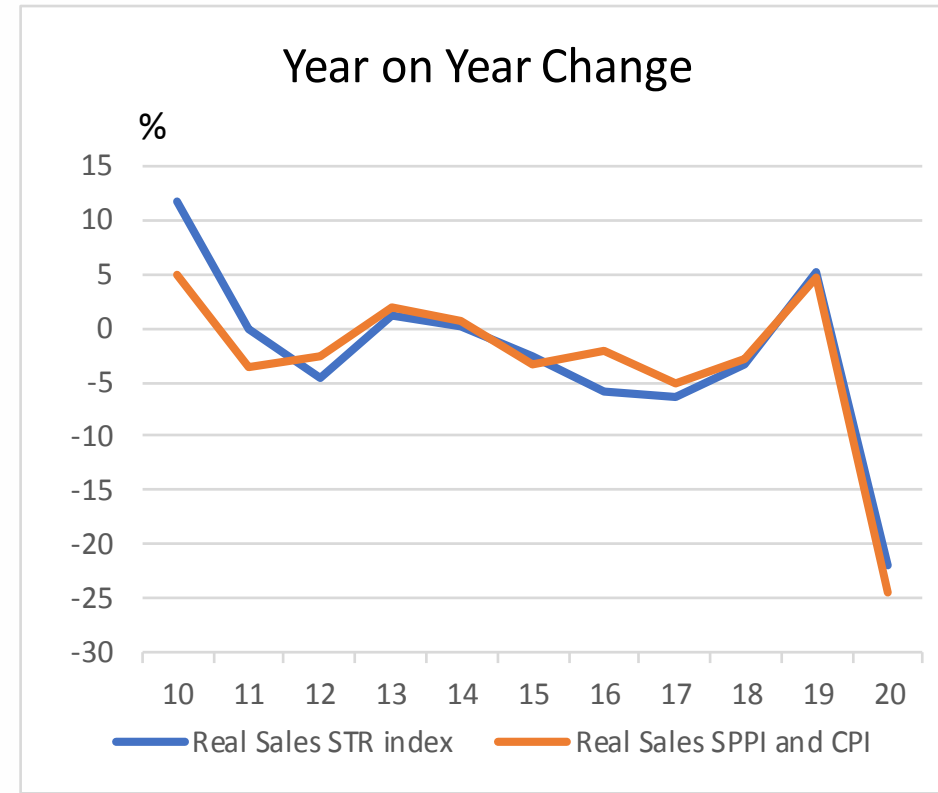
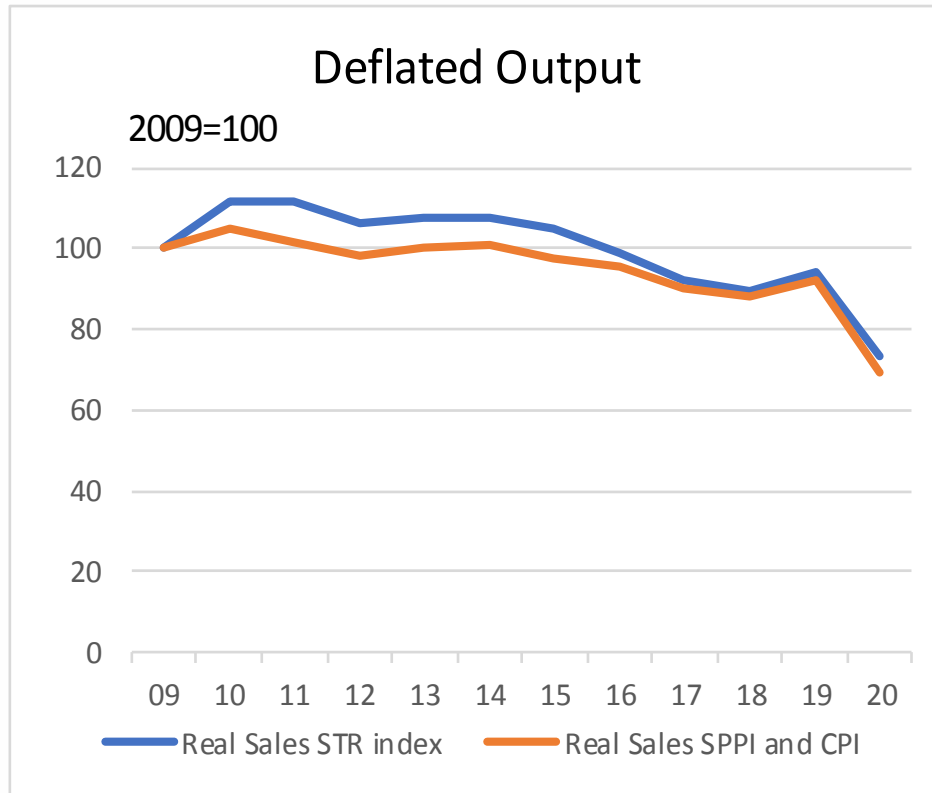
- STR higher than official PPI in most periods, resulting in lower real output, but pattern reverses after 2015



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Japan SPPI and CPI for hotels vs. STR

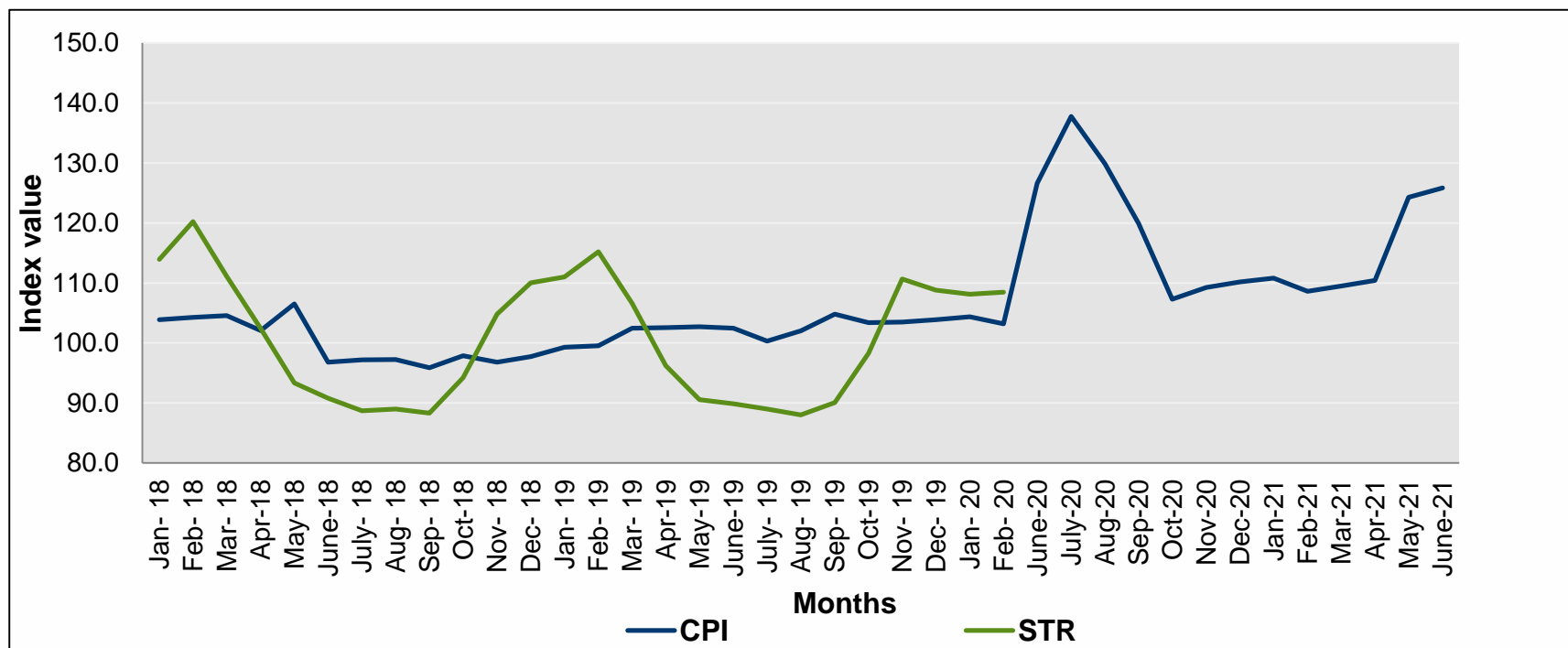
- STR matches Japan official indexes very well in all periods



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India CPI for Lodging vs. STR

- In India, a PPI for hotels is not yet available
- The CPI includes lodging prices for resident households
- Different trends than STR, but hard to compare since scope is very different



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Some additional questions / conclusions

- The big data unit values may do a better job of picking up short-term fluctuations
- No clear evidence that the unbiased matched model indexes are inadequate for measuring long price trends – so maybe no reason to risk unit value bias?
- But there are interesting (and completely contrasting!) differences in the price trends for big data and official PPIs in Canada and the UK
- Other potential areas of study – air transportation?