37th Voorburg Group Virtual Meeting
Ottawa, Canada, 13th, 15th, 20th and 22sd September 2022

A contrast between indices produced with Booking.com data and direct survey data. Swiss case study for the regions Bern and Lucerne SPPI.

Cross cutting topic - Data gaps and measurement issues with the online intermediary platforms (Air BnB, Booking, Uber, etc.)

Author: Angela Hernandez Santacoloma, Swiss Federal Statistical Office

ABSTRACT

This paper aims to highlight how different price types can cast contrasting indices. First, we set the context; how developing a new index during a Pandemic raises essential questions about the kind of data we used to produce indices. Second, we explore the specificity of the accommodation industry in times of the internet. Finally, we analyze if these results indicate that a price's nature can directly influence the resulting index.

The case study shows at a small scale how the advent of e-commerce introduced complexities to the way we used to understand prices and added levels of differentiation to prices that did not exist before the internet. Finally, we observed how the nature of a price could affect an index, especially during crisis periods. These results are not final and will require further investigation, leaving probably more questions than answers.

INTRODUCTION

This paper illustrates how different price types can cast contrasting indices. We believe there is a gap between the image transaction prices and listing prices can show. Therefore, depending on which type of price is used to produce the index, the resulting index can display a slightly or, in some cases, a divergent global evolution of prices of a given branch.

Transaction and listing prices used to have no further divisions. However, the establishment of the internet and the latter creation and widespread use of e-commerce introduced a subdivision within the transaction and listing prices. The comprehension of the subdivision of each transaction and listing prices in situ and online has yet to advance. In this paper, we will refer to this subdivision as in-store prices (in situ), referring hotel prices (hotel reception walk-in, telephone), and online prices (OTA's prices), as specified in figure 1, down below.

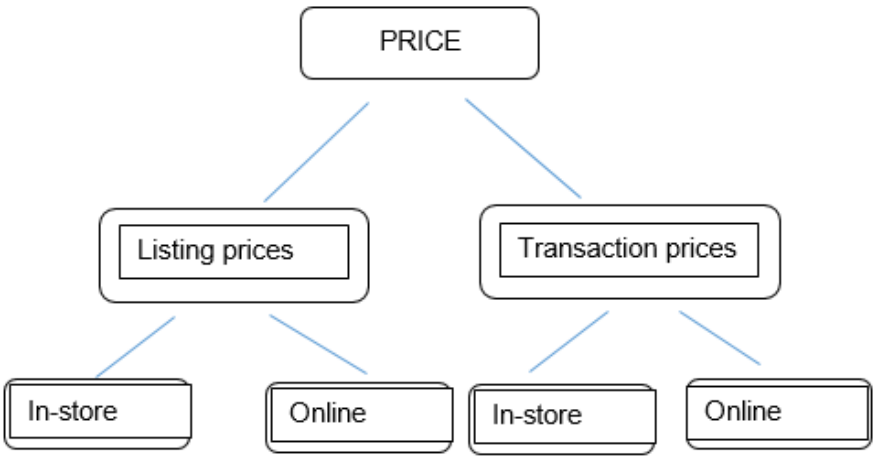


Fig 1. Price subdivisions by Listing and transaction

In some branches, the different price options can be used as close proxies to produce indices. However, we have observed that, in the case of the accommodation sector, online listing prices from Booking.com and the in-store transaction prices directly collected from hotels do not behave in the same way. While the gap in some industries can be insignificant, it could be considerable in others, as is the case we will analyze in this study.

Given the attractive opportunity offered by online listing prices, which are readily available, accessible at a low cost, and abundant, we should be considered the implications of these prices choice for index production. Mainly we should understand their functioning and differences before selecting these as a data source.

In the case of some statistical offices from countries like the United States, Germany, and the Netherlands, among many others who have explored the internet as a source of prices for index purposes, internet prices represent an innovative way of handling and finding price sampling data. Inspired by these experiences, in Switzerland, where the law stipulates that whenever possible, the Federal Statistical Office should not burden enterprises or natural persons with data demands, the consideration of the internet as a rich and relatively easy accessible source becomes apparent.

Nonetheless, as we gain experience with internet data, we realize that abundant data is not always better. Since an increase in quantity does not imply an improvement in the data representativeness, therefore the capacity of this data to capture the branch's global price evolution may have not improve as a result in the increased quantity. Hence, an index's main objective is to capture an industry's global price changes over time it should be assured that the price sample contains representative prices that can measure the global change over time.

Note first that the scope of this case study is small since the project was born out of an internal need to explore innovative channels for price collection. Second, the evaluation period of the analysis is highly atypical (Covid-19 Pandemic). Third, we remain aware of the restricted implications for other branches since price behavior can vary depending on the goods or services to be studied.

Although this case study is small and its implications for other countries and branches may be restricted, this paper offers a reflection overview on the importance of proceeding meticulously when choosing a particular type of price for index purposes, especially when using internet listing prices as a proxy for in-store transaction prices.

1. The Swiss Accommodation Producer Price Index

THE CONTEXT

In 2019, the SPPI (Services Producer Price Index) team began working on expanding its indices' coverage to the area of accommodation by including the NACE 55.10. Hotels and motels with (or without) restaurant[1]. For this matter, it was first necessary to understand the behavior of our target group, the business client. We designed a poll to inquire hotels, in regions defined as business-relevant, about the behavior of their business customers.

From the outcomes of this polling, we concluded that the average business client is the user of a standard double or single hotel room for single use during weekdays.

[1] We make a retake of the CPI index for the B2C part, which has been in production for a longer time.

Fig 2. Definition of business clients

Although this assumption about the business client, on the one hand, limits the scope of measurement, on the other hand, it ensures that we can have a relatively robust standard for measurement over time while assuring that we are capturing a representative image of the B2B typing. Furthermore, we chose to leave out other services included in the NACE 55.10, such as seminars, conference halls, enterprise events and the other different types of consumption referred to as additional services[2]. The choice of this sampling design is a pragmatic decision to avoid having a highly heterogeneous sample with price variations that cannot be compared or followed continuously over time and due to the risk of overlapping with other NACE industries[3].

The resulting hypothesis from the poll served as a base to create a survey, which was launched in December 2019 when we began the data collection of the base year, which would have extended through 2020. Nonetheless, in March 2020, the Swiss Federal Government had to implement the first measures to combat the Pandemic caused by the Covid – 19 Sars virus. One of these measures was the implementation of a lockdown. Therefore, people in Switzerland were advised not to travel, to reduce contact with others, and stay home. Restaurants and non-essential stores were closed during the first wave of the Pandemic. Equally, other factors exacerbating the situation for hotels were the risks associated with hospitality workers getting ill, the massive reduction of international travel flow, and the cancellation of conferences, spectacles, and events in general. The mandatory implementation of home office decreased business clients' traffic, thus, the demand for accommodation. Accordingly, hotel occupancy fell, and some establishments closed for extended or intermittent periods. Consequently, how hotels and clients alike used to function changed.

In Switzerland, the first lockdown was particularly strict; as for most other industries, the hotel industry got intensely affected when restrictions were implemented. The changing daily functioning of business flipped, and most enterprises depending on consumption in situ, had no idea, at first, how to adapt to the rapidly changing environment.

---

[2] *"A range of additional services may be provided such as food and beverage services, parking, laundry services, swimming pools and exercise rooms, recreational facilities as well as conference and convention facilities."* https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

[3] The pragmatic decision was taken based on the difficulty to stablish a coherent periodicity for events and seminar rooms, the problems to access weighting data, the complexity of differentiating and weighting hotels with and without seminar and conference rooms.

Consequently, in 2020, HotellerieSuisse and the HESTA survey registered a loss of 7.9 million in overnight stays for the big Swiss cities, or a reduction in overnight stays of 65% among the major Swiss cities Geneva, Zürich, and Basel. Geneva is the city with the most significant loss, with a decrease of 67% in overnight stays in 2020, closely followed by Zurich and Basel Regions. Switzerland-wide, the reduction was a staggering 40%, while arrivals worldwide fell by 74%. Nevertheless, this meant a loss of 15.8 million in overnight stays for the Swiss hotel industry. Worldwide, the situation looked severe, and the losses in overnight stays amounted to 1.1 billion for 2020. The consequences of this loss have been strongly felt in Switzerland since tourism plays a significant role in the country's GDP. In 2019 (last available data), the Swiss Federal Statistical Office reported that the contribution of the accommodation branch amounted to 0.72% of the national GDP[4].

Switzerland benefits from robust domestic demand for accommodation. Due to this fact, the reduction in overnight stays during the Pandemic was not as devastating as in the case of other countries, which heavily rely on international demand. This fact helped to mitigate, in part, the effects of the decrease in foreign demand.

In contrast to the domestic demand, Swiss tourist are eager international travelers; nonetheless, we did not observe an effect of substitution of outbound demand to local demand. The figures for domestic demand in overnight stays remained relatively stable.

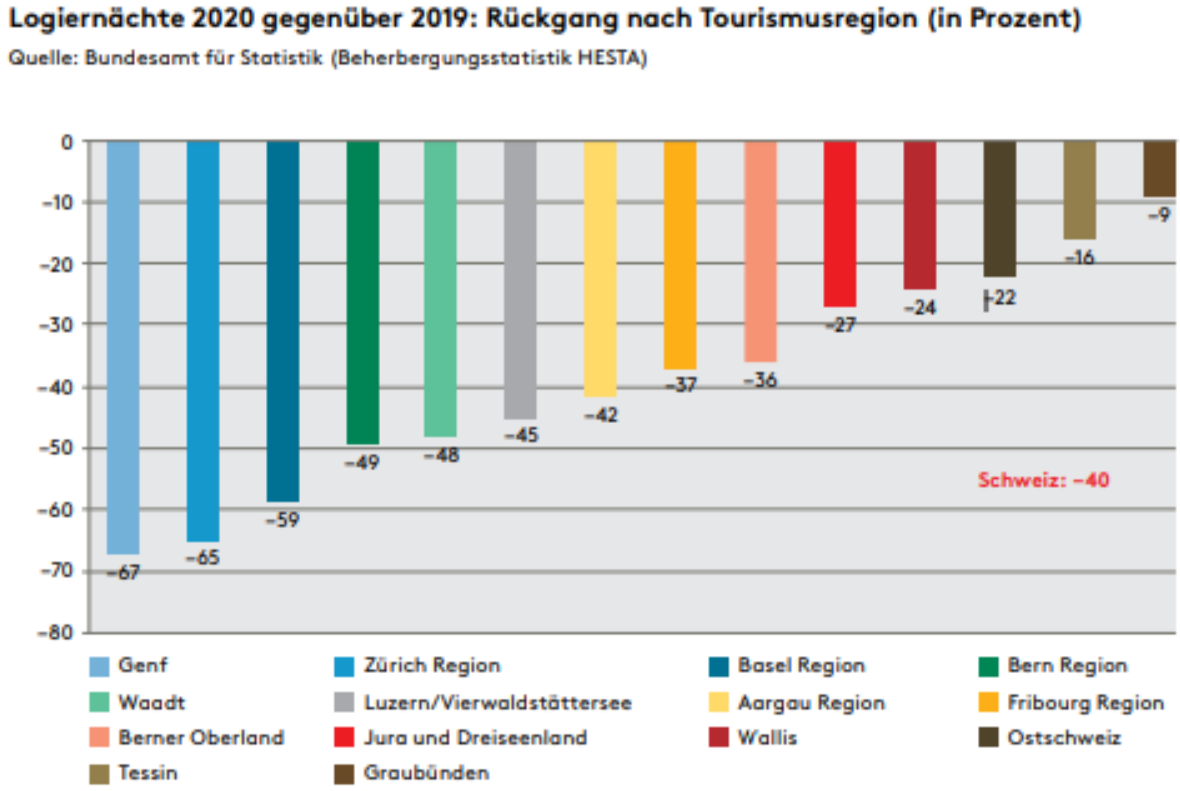


Fig 3. HotellerieSuisse Report The hotel industry in Switzerland - facts and figures 2020[5]

The crisis induced by the Covid-19 virus has extended, and two and a half years have passed since the outbreak. The landscape looks different today from two years ago for the accommodation industry and the world. However slowly, we have adapted and created new dynamics in this rapidly transforming environment. The present global economic and sociopolitical landscape remains fragile and plagued by high inflation not seen in over forty

[4] Compte de production par branches OFS 2022, status 2019
[5] https://www.hotelleriesuisse.ch/de/branche-und-politik/kennzahlen/wirtschaftskennzahlen

years at a global level, war, and the logistic crisis induced by the economic slowdown as a side effect of the Covid-19 crisis.

Initiating an index series with an atypical base year could give a false image of the development of the branch, which deterred us from publishing at the beginning of 2021. Unfortunately, the Covid-19 Pandemic crisis has extended, and travel restrictions, although lower after the development of a vaccine, remained high during 2021. Although most travel restrictions have been lifted in most countries, the situation remains brittle. The index will be evaluated at the end of 2022 to decide if we can publish it in 2023. Thus, this project remains for now in its exploratory and testing phase.

Even though we do not publish our index yet, we have been able to do particularly exhaustive work and gained valuable knowledge about this industry. We continue studying the branch to prepare a robust index.

THE INDEX

The final published index has nine business regions. In contrast, for this analysis, we will only consider two major business regions, Bern and Luzern[6]. We assume business-related trips most often occur in cities; hence, business regions are where cities are geographically present.

For this study, we have two almost identical samples; the difference is due to some hotels not participating on the platform Booking.com. Sample one for the hotel survey entails 29 participant hotels, 13 from the city of Bern, and 16 from the city of Luzern, while sample two for Booking.com entails 27 hotels, 12 from Bern and 15 from Luzern.

The final index will be calculated from the 300 prices collected from 150 hotels. Here we calculated the index for each region with 58 prices from the 29 hotels for the Survey indices and 27 hotels and 54 prices for the Booking.com indices.

The methodology for both samples was kept as close as possible to make them somehow comparable. We are aware that different types of prices could require different methodologies. Yet the main priority was to compare if the prices would produce the same indices, thus we use the closely similar samples (as close as we could match) and the same methodology. We use a simple comparison of the prices in T and T-1 then we aggregate with a geometrical mean. There is no weighted total aggregation for the purpose of this analysis but in the final index, each business-region will be weighted using the branch revenue of each region.

We selected Booking.com as candidate alternative source because the platform is the most visited website for hotel room bookings. It ranks at position 27, as for April 2022, from all internet searches in Switzerland[7] according to the classification of Similarweb.com. Further, Booking.com has a high hotel participation rate: 4257 of the 4539 registered hotels in Switzerland are present on the platform (as for 26.06.2022).

For the analysis, we use the Booking.com data to create four different indices scenarios and compare them to the survey index:

---

[6] Zürich and Geneva are mostly visited by international business client's destinations while Bern and Luzern are visited by domestic business clients.

[7] Die besten Travel And Tourism Websites in Schweiz | Similarweb Meistbesuchte Websites in Schweiz - Mai 2022 | Similarweb https://www.similarweb.com/de/top-websites/switzerland/category/travel-and-tourism/

- Scenario 1. Booking: last five months geometrical mean.
- Scenario 2. Booking First Price: first available price, collected five months in advance.
- Scenario 3. Booking Last Price: last available price.
- Scenario 4. Booking Short Term: last three months
- Scenario 5. Survey_PPI: The survey prices for rooms directly collected from the hotels.

Example: if the set date is the 1st of September: 1) average price April to August, 2) price April, 3) price August, 4) average price June to August

The prices are for the 1st (same as in the survey) and 3rd Wednesday of the month, so that the last price is within two weeks before check-in, as well, the prices are non-refundable and include breakfast. The rooms of hotels present in both samples are matched to have the same type of rooms for both samples. The difference between the samples is only the timing of data collection respectively the treatment of the prices collected at different moments in time.

As mentioned before, the data for each index was separately collected, on the one hand directly from hotels by means of a paper and e-mail survey. On the other hand, the Booking.com data is scraped using the open source software R. For the analysis of the survey data, we use the PRESTA3 software for index calculation whereas for the web scraped data we use R and a script developed by the section Price of the Swiss Federal Office of Statistics.

As mentioned, the periodicity established for the survey data was set to the first Wednesday of the month for two standard rooms double and single for single use, for an overnight stay (one night length of stay). For the Booking.com scraping takes place twice a month for two standard rooms double and single for single use, yet we retrieve in advance the prices for the same rooms in one month, in two months, iteration until five months in advance of the arrival date. This with the purpose of seeing how prices would vary if advance booking is taking place since we do not know the exact point at which the booking takes place. As well, we retrieve information about number of guests, breakfast, refund policy, and number of beds.

2. The accommodation branch particularities in the age of the internet

Until the beginning of the year 2000, hotel distribution channels were restricted to a few options, such as walk-ins, phone calls, and local travel agencies. Yet, the consolidation of the internet as a marketplace and the surge of Online Travel Agencies[8] (OTA's) (at the end of 1990's) open diverse channels for hotel rooms reservation, management and global distribution (Sanchez-Lozano et al., 2020).

Nowadays, the hotel booking landscape includes many types of actors which play different roles, such as Global Distribution Channels like Amadeus, Travelport, Sabre, etc., as well as Online Travel Aggregators like Kayak.com, Google.com or Tripadvisor, and Online Travel Agencies such as Booking.com, Hotels.com, etc.

[8] Paper about the development of the OTAs or website or both

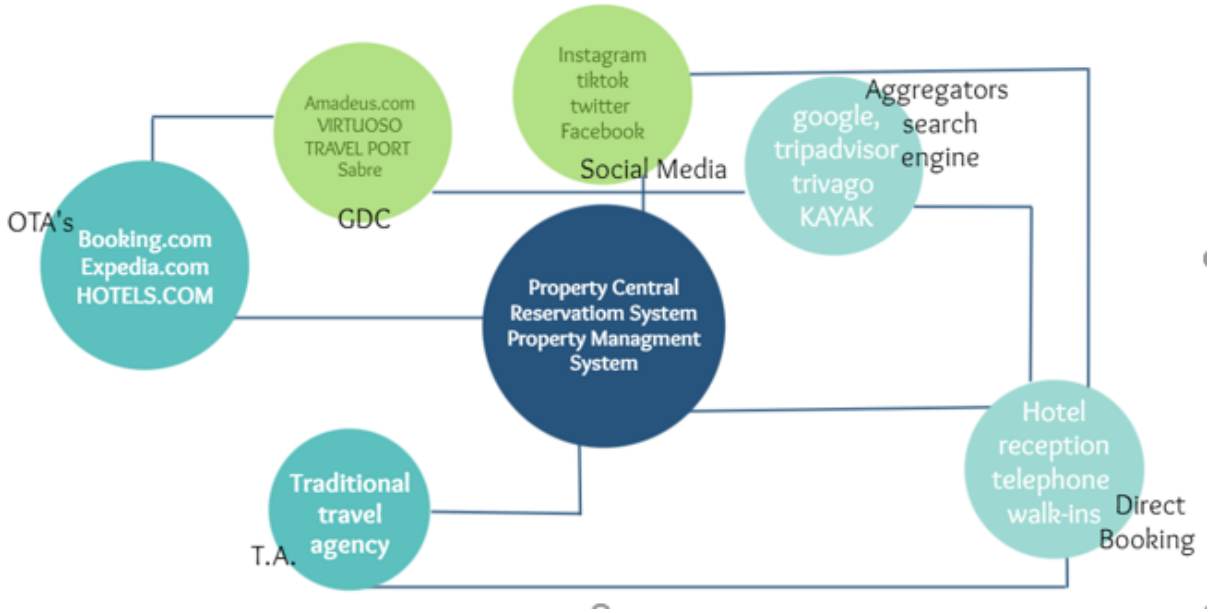


Fig 4. Hotel overnight stay reservation landscape

The establishment of an online-offline booking system has increased the complexity of measuring the global evolution of prices, given the following aspects:

First, hotels are interested in managing their revenue over time, which implies maximizing the price for each room (Moro et al., 2018; Feng & Xiao, 2000; Ivanov & Zhechev, 2011).

Second, as mentioned by Gorodnichenko and Talavera in 2016, “Online markets have unusual characteristics, such as low search costs, the irrelevance of physical locations of buyers and sellers, and negligible physical costs of price changes.” the internet then allows for real-time variations and observations of the variables that play a role in the definition of prices.

Therefore, since the purpose of the hotel is to set the price close to the maximum willingness to pay of its customer’s, for which the hotel takes into account various factors available in real-time and then set the final price at the point of reservation. All the process takes place in real-time through digital systems, according to the relevant literature, some of the factors that seem continuously and consistently to affect online prices are (Zahng et al., 2019; Moro, Rita, Oliveira, 2018; Masiero, Nicolau, & Law, 2015; Abrate et al., 2012; Schütze, 2008; Schwartz, 2008):

- Date of arrival
- Time of booking
- Advanced booking (beforehand between six months and a week before arrival)
- Availability and demand for a type of room
- Hotel location
- Length of stay
- Number of hotel stars
- Quality of the hotel (review)
- Channel used to book the room (OTA’s, online aggregator, hotel website, distribution system)

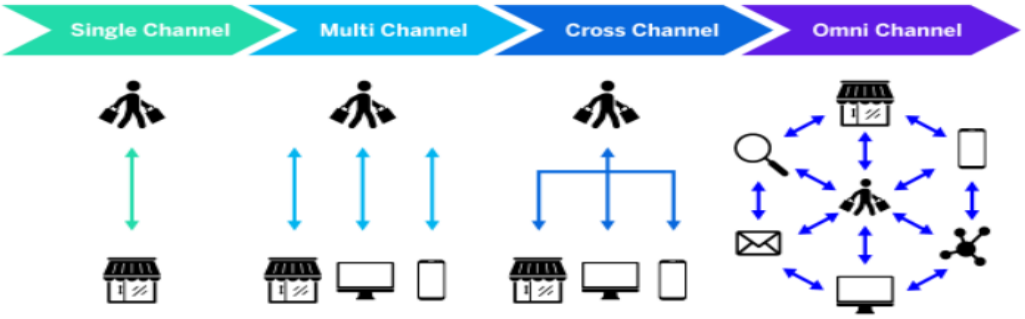


Fig 5. Reservation Channels[9]

Furthermore, the combination of the particular characteristics of the internet, with the establishment of e-commerce and the multiplicity of distribution and management channels has produced online prices that may change rapidly in a dynamic scenario of omnichannel pricing over time (Bigne et al., 2021). Thus, the same room could be priced differently over different channels simultaneously, creating price dispersion (Kim, Cho, Kim, Shin, 2014; Yang et al., 2019). It is open to study how in diverse branches the difference between the online and offline prices manifest.

Consequently, online prices can be described in nature as something different from a typical transaction or listing price in-store. Since online prices are not only calculated on the base of demand and offer, government and legal regulations and fixed costs but also include a multitude of players and factors that interact in the pricing process in real time, increasing the complexity further. Prices online can be further differentiated at levels of distribution, which we will not be exploring in this paper.

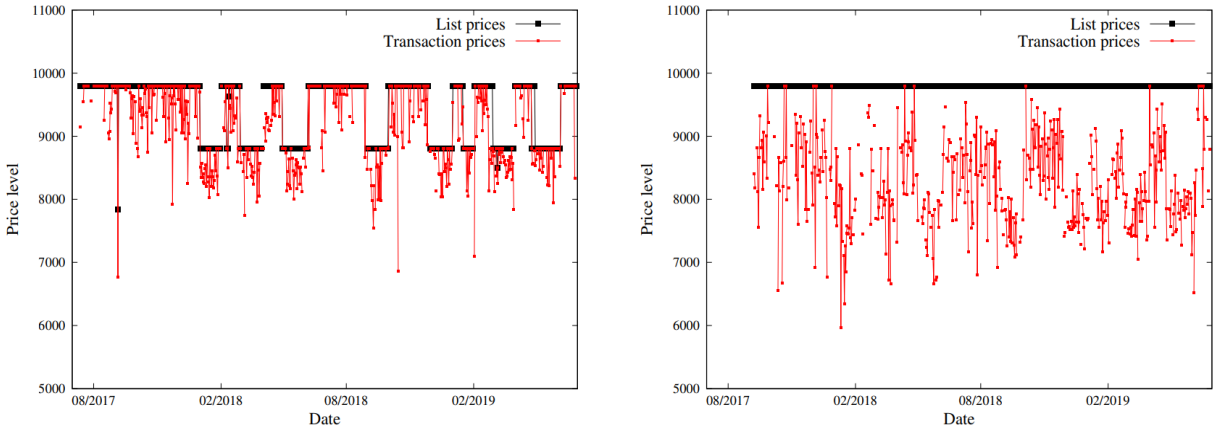
The fact that prices can be determined by real-time feedback involving as many factors, and actors as mentioned beforehand renders the task of measuring their global development over time complex. Considering this evidence, it could be said that internet hotel prices are particular in that they may exhibit a form of real-time dynamic pricing (Bigne et al., 2021) different from in-store prices. Hence we will assume, that survey collected transaction prices (in-store transaction prices) are less flexible and less volatile than Booking.com scraped listing prices (internet listing prices). At a certain extent, the in-store price can vary as the internet prices yet not as fast, this remains an open question that will not be answer in this paper.

In the absence of Booking.com transaction prices, we found a study “Price Setting in Online and Offline Markets: Evidence from Korea” by Ueda et al., 2022 presented at the past spring session of the Ottawa group for consumption prices. Where in-store and internet listing and transaction prices were compared.

Ueda et al., 2022 who had access to an impressive and extensive dataset provided by a South Korean multinational conglomerate with points of sale over the internet and in-store (department stores, supermarkets, drugstores, electronics stores, and convenience stores). In their results, they found, there are clear contrasts between transaction and list prices in-store and the same prices over the internet. Illustrating how internet prices do not always behave as in-store prices. As seen in the concluding graphics bellow, their results are indicating different behaviors of prices online and in-store.

9

https://www.qualtrics.com/de/erlebnismanagement/kunden/omnichannel/?rid=langMatch&prevsite=en&newsite=de&geo=&geomatch=



Note: The left panel shows the price of a particular skincare product sold at a particular offline shop, while the right panel shows the price of the same product sold at an online shop. The black and red lines represent the list and transaction prices.

Fig 6. List price and transaction price comparison in store and online (Ueda et al., 2022)

This specific analysis of a skincare product (which does not exactly resemble the behavior of overnight stays in hotels) is helpful to illustrate further, how in-store and online listing and transaction prices can exhibit alternative behaviors.

The fact that online transaction prices can widely vary due to "personalized discounts" (Ueda et al., 2022) displays concrete evidence that maybe when certain services and goods are sold both in-store and online, we could be in the presence of parallel global price evolutions depending of the price and the channel through which it is sold and offered.

For the purpose of this paper, although, the online transaction price is unknown, there is evidence that Booking.com offers discounts and check-in perks for frequent users through the Genius Loyalty Program; these discounts vary between 10-20%. However, there is no further information in this regard; we can only infer, as in the case of Ueda et al., 2022, that the "personalized discounts" play a role in the end. The magnitude of the impact of these discounts on the online offer and transaction prices is as hitherto unknown.

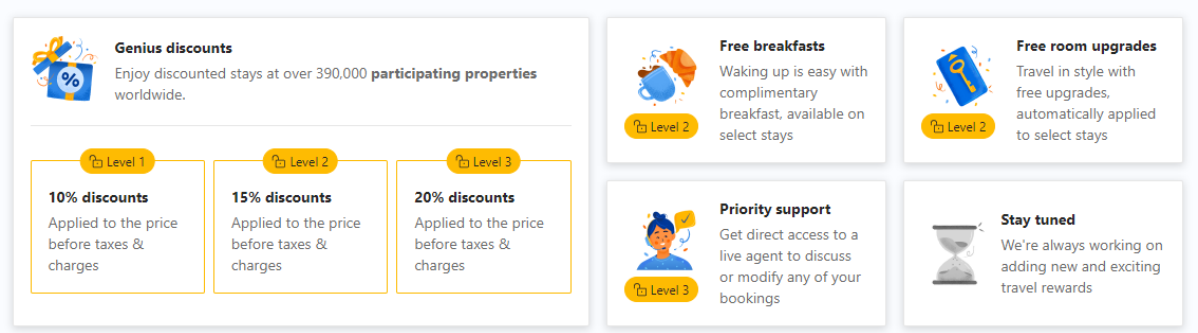


Fig 7. Genius program discount[10]

Another factor influencing Booking.com list price is the Booking fee hotels pay to participate in the OTA. The fee depends on the property's location, ranging from 10% to 25% for each reservation. This fee is high; however, hotels are willing to accept and pay an elevated fee for the increased visibility they obtain from participating on the platform[11]. This is relevant since

[10] Booking.com Genius programme
[11] https://partner.booking.com/en-us/help/working-booking/going-live/what-commission-do-i-pay-bookingcom-and-when-do-i-pay-it

understanding the factors affecting the two prices can help us explore in the future their impact and the magnitude of the impact that affects the price, if at all.

In this section, we established that there are many factors influencing internet prices of hotel rooms. As well, we saw how these factors are different than they used to be before e-commerce opened new channels for distribution and management. We further saw that these factors are dynamic and received as real-time feedback by the different actors involved.

Consequently, we found that we can not only distinguish between online prices and in-store prices but we can further differentiate, following the findings of Ueda et al., 2022, online transaction prices from in-store transaction prices, besides we can establish the same difference for in-store listing prices from online listing prices.

As before mentioned the online prices (transaction and offer) behave in certain branches differently due to their intrinsic characteristic endowed by the connectivity and real-time nature of the internet. This would partly explain the observed differences between the two B2B indices for the accommodation industry in Switzerland.

Since the Booking.com list prices represent the desirable price, at which the OTA and the hotel want to sell the room to maximize their revenue over time, and the survey prices, the attained price paid at that given moment. If an index is to be built following but one price source, the resulting picture could be incomplete. Yet and most importantly, both images are accurate, which opens further questions about measuring the total global evolution of markets that operate in-store and online.

Furthermore, it is probable and safe to say that this may not hold true for all industries. In some markets, prices may behave the same way or fairly close in-store and online, which will make them more suitable to be used as close proxies of one another for indices purposes.

In the next section, we will analyze the indices produced with the transaction prices directly collected from hotels and those produced with the harvested listing prices from Booking.com, to illustrate a contrasting global evolution between transaction in-store prices and online listing prices.

3. Differences in resulting indices produced with different data sources

The departure assumption when we began to produce the indices was that even when produced with different price sources, the indices should resemble one another or follow a close pattern showing a similar evolution.

We first analyze both price series to test how close or different they are. As seen in figure 8, which groups all observations independently of period in both cases, Survey PPI prices are generally lower, despite some exceptions for Bern. Disregarding the period, Booking prices are more dispersed (than Survey PPI prices) for Luzern and less for Bern. As seen in figure 9 the dispersion when trying to account for the time period Booking.com prices are more dispersed (than Survey prices) for Luzern and less for Bern.

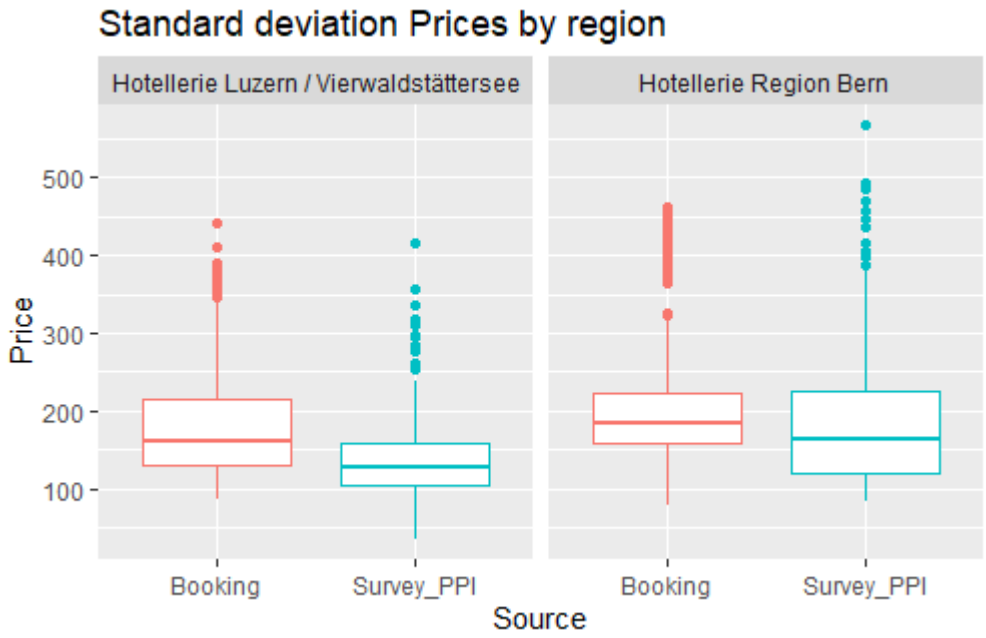


Fig 8. Price distribution for both regions and both samples

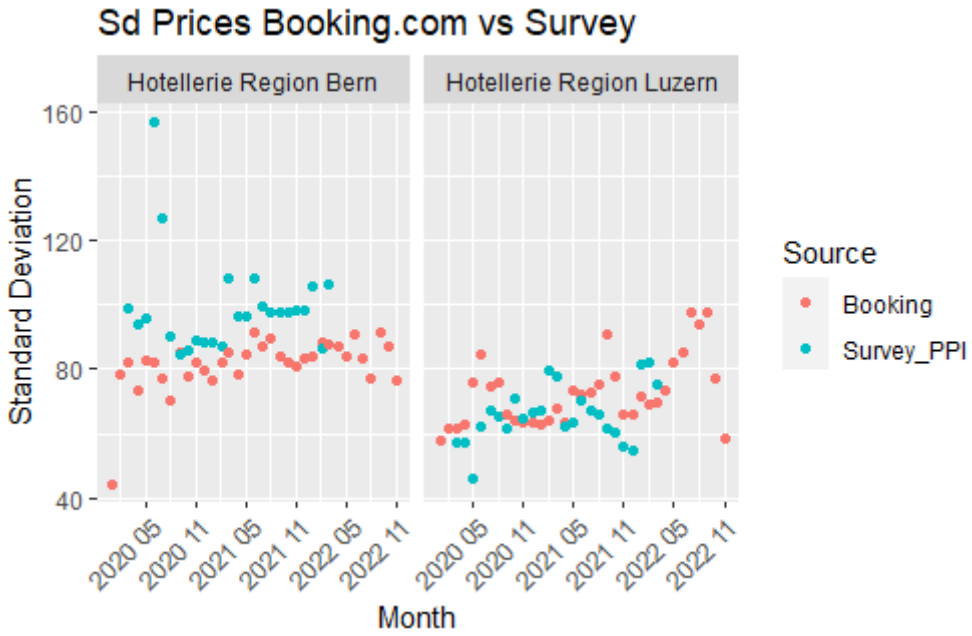


Fig 9. Sd Price for both regions and both samples

This does not comply with current practice that implies that internet list prices should be close proxies for transaction in-store prices. Nevertheless, in this particular case, there appears to exist a clear difference between two price samples representing the same prices. This means we have two different prices for the same service, observed through different sources. Consequently, we could assume they are not close proxies of one another.

When the project began, after six months of observing the indices, we found a strong discrepancy in the results. Considering that this period corresponds to the beginning of the Pandemic, we argued that the context could be heavily influencing the results; in addition, we question if the way the Booking.com data was retrieved and used for calculation was the

cause. The contrast between all the indices is striking in as much as the indices do not follow each other closely and are distant from one another.

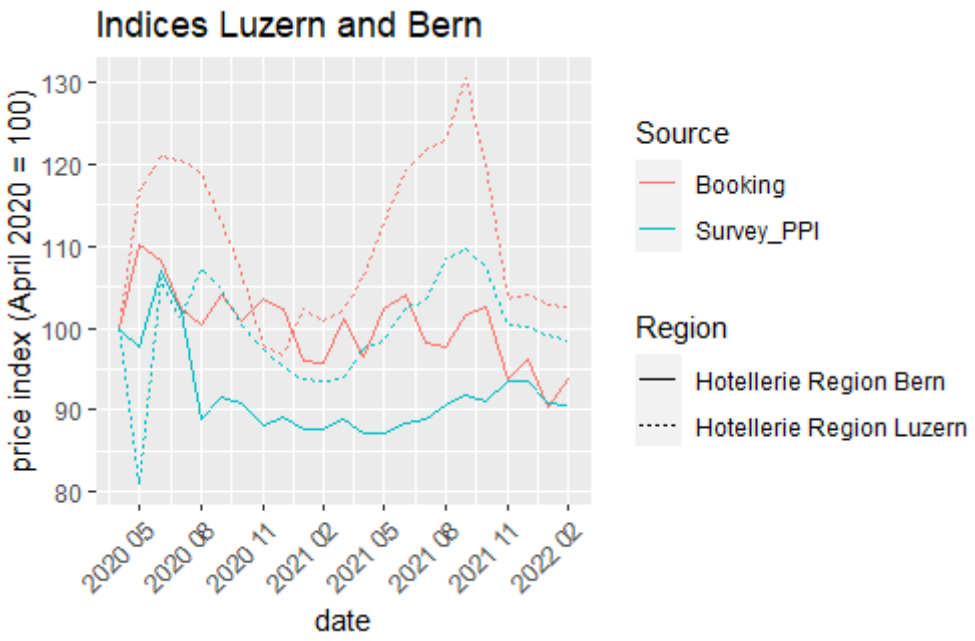


Fig 10. Indices Bern and Luzern both samples

Previously, we had expected the differences to lower as the hotels would adapt to the situation and as the Pandemic was decimated; nevertheless, a noticeable gap and indices trends remain inconclusive until today.

We shall remember that since we collect prices for the Scenario 1 Booking, five months in advance, a big part of the discrepancy we observe could be explained by the contrast between the expected price before Pandemic and the divergent price as the Pandemic effects became obvious. This can be clearly observed between February 2020 and August 2020. Although, the gap has been reduced and the trends have switched following each other slightly, there is a clear need to continue following this branch and conduct further data collection and analysis.

Since the beginning of the study, the observed results seemed not to make sense, given that the indices results from the different samples were developing in opposite direction. To test the validity of our result we then compared our results with the independent survey from the section TOUR, of the Swiss Federal Office of Statistics, on overnight stays between January 2014 and April 2022.

As we can observe in the figure 11, which displays the overnight stays in Switzerland between January 2014 and January 2022, the year 2020 was a highly atypical year for the hotel industry. When we observe the last six years of overnight stays, indeed, a remarkable fall in overnight stays occurs around April - May 2020. This fall in the effective demand is consistent with our price collection and the Survey index. In this case, the fall was the direct effect of the lockdown, which is relevant for this particular branch, because prices are highly sensitive to demand fluctuations, thus, when demand falls strongly, we can assume prices will fall as well.

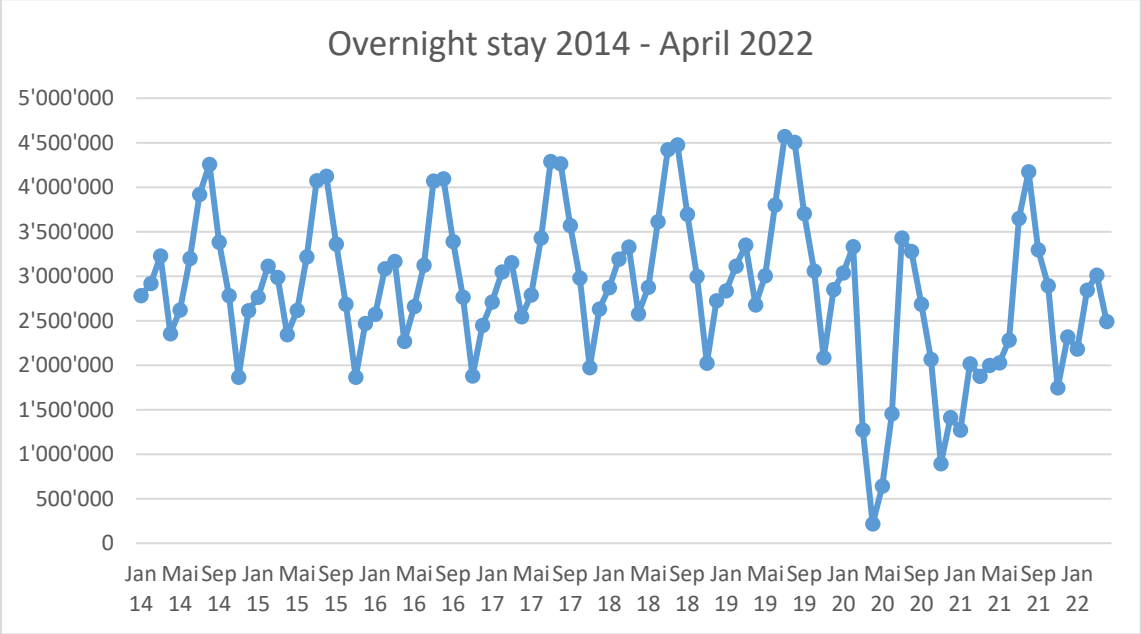


Fig 11. Overnight stays register by FOS 2014-2022 (TOUR)[12]

4. Discussion

After two and a half years, the measures to combat the Pandemic have ended in Switzerland, yet the two indices have not behaved the same. Only recently, in January 2022 they have begun to follow a similar direction, nonetheless it is inconclusive whether this trend will continue. However, how can the difference between the two indices be fully explained?

The best answer would be found in the comparison of an index produced from Booking.com transaction prices, and an index produced with transaction prices in-store. However, we have no access to transaction data from Bookin.com. The second best option is to inquire the data and find similar studies to support our observations.

To understand further our results we calculated four different indices with the Booking.com data and compared it to the Survey data index. For this purpose, we observed how the beforehand mentioned scenarios of analysis were different from each other:

Scenario 1. Booking: **last five months** geometrical mean**.**
Scenario 2. Booking First Price: **first available price,** collected five months in advance.
Scenario 3. Booking Last Price: **last available price**.
Scenario 4. Booking Short Term: **last three months**
Scenario 5. Survey_PPI: The survey prices for rooms directly collected from the hotels.

[12] Tourist accommodation | Federal Statistical Office (admin.ch)
https://www.bfs.admin.ch/bfs/en/home/statistics/tourism/tourist-accommodation.html

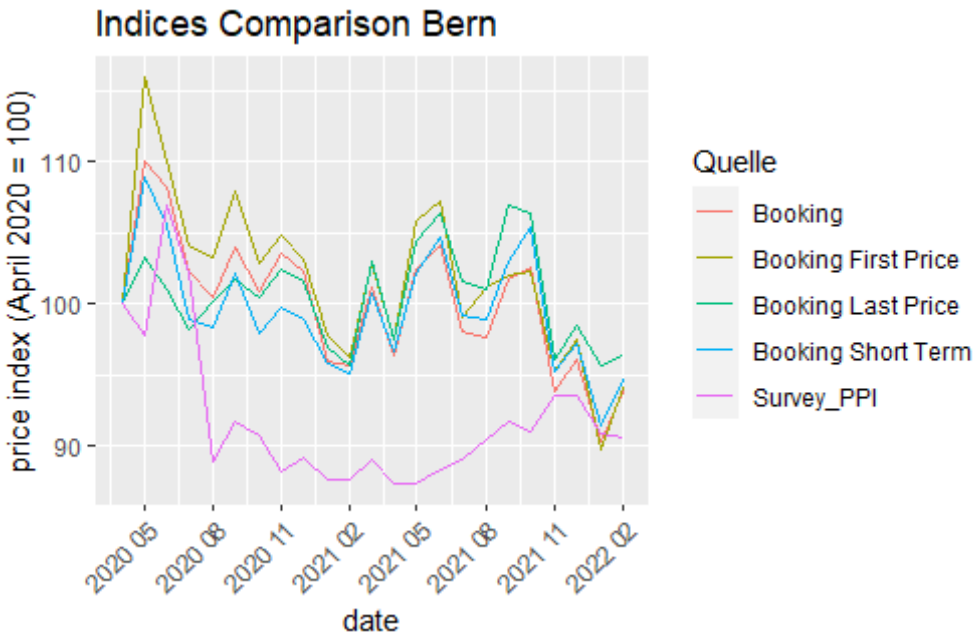


Fig 12. Indices Bern

In the case of Bern, scenarios one to four follow each other closely, yet there is some distance between the first and the last price available, which is consistent with the literature. Since prices may increase slowly as the date of arrival approaches, increasing the most 30 days before arrival and gradually decreasing the week before as the date of arrival approaches when demand is low or inversely when demand is high (Moro, Rita, Oliveira, 2018; Sanchez-Lozano, Nobre, Chavez-Miranda, 2020).

It can also be argued that scenario 3 Last Price and scenario 2 differ the most from one another thus are subject to more variance which can lead to indices that are slightly different. While scenarios 1, 3 and 4 because they use last price could offer a more suitable option for index purposes.

The most substantial differences occur between March 2020 and October 2021. The period during which the strongest measures against the Pandemic were implemented. However, indices produced with online list prices behave unlike indices created with directly collected transaction prices from hotels.

Similarly, the case of Luzern displays an analogous situation. Scenarios one to four follow each other closely, yet there is some distance between the first and the last price available. The transaction price index behaves distinctly from indices produced with listing prices harvested from Booking.com. Nonetheless, the contrast between the two types of indices is less extreme than in the case of Bern. Although, the evolution towards the last quarter of 2021 begins to follow a somehow similar trend, the distance between the two sources is too big to consider them close proxies.

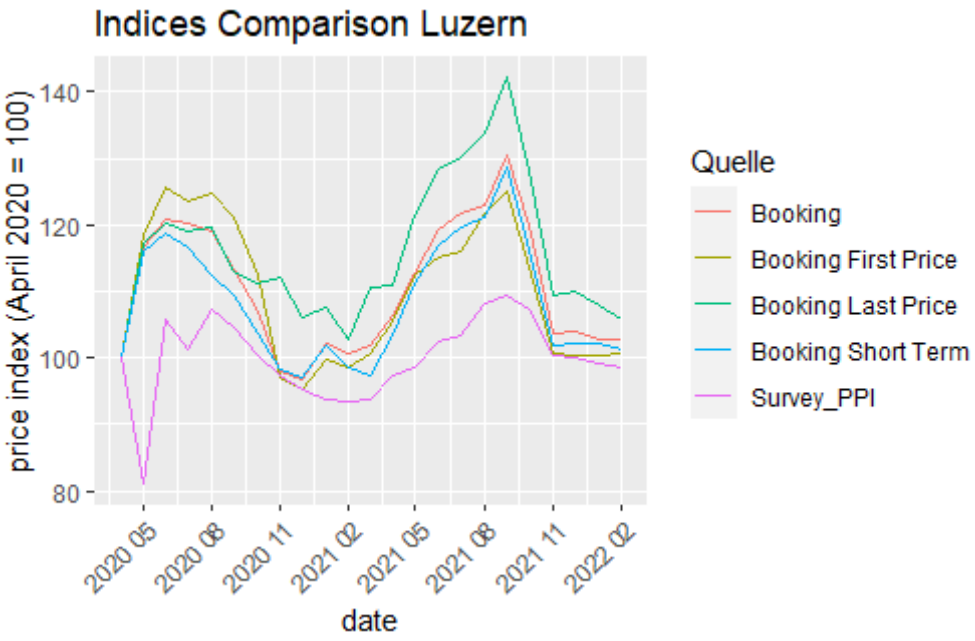


Fig 13. Indices Luzern

As Ueda et al., 2022, highlighted, the fact that internet prices can be subject to greater discounts implies the presence of great price dispersion in online transactions. Which accounts for some of the observed difference between transaction prices in-store and listing prices online. This is coherent with the finds of Ueda et al. listing prices appear higher than transaction prices. This is again logical with the desire of the hotel and OTA's to maximize their revenue by allocating the maximum possible price to each room, for each client (what the client is expected to be ready to pay for this particular room, in this particular hotel).

In the case of the direct survey prices, we are collecting transaction prices. Therefore, we have the actual and most accurate price available to measure the global price evolution of this branch. However, it could be disputed if we can fully rely on the cooperation of the hotels for this purpose. Indeed, we are aware of error margins, human mistakes, and other strategic reporting since there could be mistrust from the part of the hotels towards the collection of data. Yet, the reported price is and will remain the closest to the exact price that was paid, which represents the clearest and nearest price situation in the market, and it is the best we can aim to achieve. As mentioned beforehand, listing online and in-store prices are also part of the price landscape and cannot be simply dismissed, since they too are foretellers of the price evolution in a given market.

Furthermore, it is possible to argue that during crises or strong shocks different types of prices may capture different pictures of the economic state of an industry. Since the strongest divergence is seen during the first part of the crisis. We can assume that first, Booking.com expected the markets to be functioning normally sooner than it actually happened and it adjusted the prices as it became obvious that lockdowns and frontiers will remain closed for longer periods of time than expected. Second, the online listing price representing the desirable price at which a hotel and OTA is willing to book a room may had had a lagging time adjusting since maybe online demand kept high due to the uncertainty of the following months at the beginning of 2020, when authorities were talking about a couple of weeks Lockdowns while hotels were confronted with very low demand and low actual number of guests. Therefore, in the presence of shocks, internet listing prices could be off-target until they catch up with the real situation (in contrast to the expected situation).

If the different types of prices behave differently, this could represent a risk for any organisation that works with this kind of indices, since this data would not capture the actual global evolution of the prices and will misrepresent the economical situation of the branch. Especially and most importantly during crisis when the need for good indicators is mandatory.

5. Preliminary conclusions

Throughout this document, we have established that it is probable for some branches that internet prices and in-store prices do not behave the same. Therefore, using them interchangeably for index production should be considered with caution, especially during crisis periods.

Furthermore, when we study prices we could not only differentiate list prices from transaction prices but also subdivide these in:

1. online list prices
2. online transaction prices
3. in-store list prices
4. in-store transaction prices

Bearing in mind their different characteristics, and considering them in the context of their own complex network.

For this particular case, it is probable that the effects of the Pandemic are showing, expressly at the beginning of 2020 and well into 2021, that we can classify as a crisis effect. Besides, the inconclusive trends of both indices, they have certainly neared each other after the measures to combat the Pandemic were removed, which implies the need to continue following this branch. Furthermore, it became evident that we are observing two different types of prices, which for this particular market behave differently.

In the case of Booking.com, we are collecting internet-listing prices. These particular listing prices have a real-time trajectory and respond to a wide range of factors. They represent as well the desirable price at which an OTA and hotel want to sell a room, yet they do not represent the actual price paid for the given room. In the case of the Survey prices it is the final price paid yet given the findings of Ueda et al., we can imagine that compared with online transaction prices slight differences are to be expected. This assumption will remain open because it was not possible to access online transaction data from Booking.com.

At the end of 2022, we will evaluate if and how the new index could be constructed and published. We can ambition, for now, two options. First, a simple transaction prices index is collected directly from the hotels in a traditional manner. Second, a hybrid form of a composed index including both transaction and online listing prices indices since they are both valid. For the latter, we have found examples in the literature from Indices for dynamic pricing in the event ticketing industry. Patel, 2018. Where the author explores the life cycle of a ticket to track the ticket price over time effectively. We will consider other forms and possibilities to mix the data we have at our disposal.

If an index is to be built using only one price source, the resulting measured price development could be incomplete. Yet and most importantly, since both images are accurate, we remain curious about how to measure the total global evolution of markets that operate in-store and online.

The evidence based conclusions hereby presented, represent as said at the beginning a reflection point, known the size of the present sample it is just enough to raise questions, further deep dive into the literature and study of the branch will be required to better understand these observations.

Every National Statistical Office and other statistical organizations alike is faced with important decisions in terms of data sources for the calculations of indices. In this regard, the internet has offered new opportunities that have been explored by different countries and especially by the consumer price indices teams.

Since published indices have a wide range of uses by other organizations and economic actors we consider the importance of the B2B accommodation industry, which is part of the tourism industry in Switzerland, we take into consideration the more than 162.000 employees of the industry, and the fact that tourism represent approximately 0.72% of the country's GDP.

Furthermore, it is probable and safe to say that this may not be true for all industries. In some markets prices may behave alike in-store and online, which will make them suitable to be used as close proxies for indices production. In addition, it can be argued that during normal times prices may behave more homogeneously, whereas, through a crisis, they could exhibit more heterogeneous behavior.

Finally, prima facie not all price data is to be considered equal. The fact that the internet has open the possibility of downloading or scraping does not imply that this data is fitted for analysis.

Bibliography

Abrate, G., Franquelli, G., & Viglia, G. (2012). Dynamic pricing strategies. Evidence from European hotels. International Journal of Hospitality Management. 31 (1), 160 – 168.

Abrate, G., Nicolau, J. L., & Viglia, G. (2016). The impact of dynamic pricing variability on revenue maximization. Tourism Management. 74, 224-233.

Abrate, G., & Viglia, G. (2016). Strategic and tactical price decisions in hotel revenue management. Tourism Management. 55, 123 – 132.

Bigne, E., Nicolau, J. L., & William, E. (2021). Advance booking across channels: The effects on dynamic pricing. Tourism Management, Elsevier. 86 (2021) 104341.

Cavallo, A., & Rigobon, R. (2016). The Billion Prices Project: Using Online Prices for Measurement and Research. Journal of Economic Perspectives—Volume 30, Number 2 - Pages 151–178.

El-Moniem Bayoumi, A., Saleh, M., Atiya, A. F., & Aziz, H. A. (2012). Dynamic pricing for hotel revenue management using price multipliers. University of Cairo.

Feng, Y. & Xiao, B. (2000) Optimal policies of yield management with multiple predetermined prices. Operations Research. 48(2), 332 – 343.

Gorodnichenko, Y., & Talavera, A. (2016). Price setting in online markets: Basic facts, international comparisons, and cross-border integration. March 8th.

Gupta, S., & Kim, H-W. (2010). Value-Driven Internet Shopping: The Mental Accounting Theory Perspective. Published online in Wiley InterScience. Psychology & Marketing, Vol. 27(1): 13–35.

Hamvaine Holocsy, I. & Gatos E. (2019). Prices for short-term accommodation activities. Hungarian Central Statistical Office. 34th Voorburg Group Meeting on Services Statistics. Paris - France.

Hong, H. & Shum, M. (2006). Using price distributions to estimate search costs. RAND Journal of Economics Vol. 37, No. 2, pp. 257–275

Ivanov, S., & Zhechev, V. S. (2011). Hotel Revenue Management – A Critical Literature Review, Zagreb, Croatioa: Institute for Tourism.

Kim, W.G, Cho, M., Kim, D., & Shin, G.C. (2014). The effect of price dispersion on hotel performance. Tourism Economics, 20(6), 1159-1179.

Mantovani, A., Piga, C. A., & Reggiani, C. (2019). Much ado about nothing? Online platform price parity clauses and the EU Booking.com case. University of Manchester.

Montbroussous, A., Freppel, C., & Guillon, O. (2022). Web scraping of a booking platform: exploring new data and methodology for the hotel service consumer price index. Institut National de la Statistique et des Études Économiques (INSEE) French National Institute of Statistics and Economic Studies. Paper for the 17th International Conference of the Ottawa Group Rome.

Moro, S., Rita, P., & Oliviera, C. (2018). Factors influencing Hotels' Online Prices. Journal of Hospitality Marketing and Management. Instituto Universitario de Lisboa (ISCTE-IUL). Lisboa- Portugal.

Nieminen, S. (2010). SPPI for Accommodation and Food Services in Finland. Statistics Finland. 25th Voorburg Group Meeting on Services Statistics. Vienna, Austria.

Patel, R. (2018). Indices for dynamic pricing in the event ticketing industry. Kellogg School of Management.

Roma, P., Panniello, U., Vasi, M., & Lo Nigro, G. (2021). Sharing economy and dynamic pricing: Is the impact of Airbnb on the hotel industry time-dependent. European Journal of Hospitality and Tourism Management. Elsevier Ltd.

Sanchez-Lozano, G., Nobre Pereira, L., & Chavez-Miranda, E. (2020). Exploring online prices with an advance booking horizon on Booking.com. European Journal of Tourism. Varna University of Management.

Schütze, J. (2008). Pricing strategies for perishable products: the case of Vienna and the hotel reservation system hrs.com. Springer-Verlag.

Ueda, K., Watanabe, K., & Watanabe, T. (2022) Price Setting in Online and Offline Markets: Evidence from Korea. Paper for the 17th International Conference of the Ottawa Group Rome.

Yang, Y., Jiang, L., & Schwartz, Z. (2019). Who's hiding? Room rate discounts in opaque distribution channels. International Journal of Hospitality Management, 80, 113 – 122.

Zhang, Z., Liang, S., Li, H., & Zhang, Z. (2019). Boking now or later: Do online peer reviews matter? International Journal of Hospitality Management, 77, 147 – 158.

Websites

https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF
https://www.hotelleriesuisse.ch/de/branche-und-politik/kennzahlen/wirtschaftskennzahlen

https://www.similarweb.com/de/top-websites/switzerland/category/travel-and-tourism/

https://www.qualtrics.com/de/erlebnismanagement/kunden/omnichannel/?rid=langMatch&prevsite=en&newsite=de&geo=&geomatch=

https://partner.booking.com

https://partner.booking.com/en-us/help/working-booking/going-live/what-commission-do-i-pay-bookingcom-and-when-do-i-pay-it

https://www.bfs.admin.ch/bfs/en/home/statistics/tourism/tourist-accommodation.html

STV_STIZ_2020_schweizertourismDE.pdf (admin.ch)