Comparing efficiency in all-inclusive and bed and breakfast hotel businesses: a multi-period data envelopment analysis in Turkey

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Abstract

Purpose – This paper aims to understand the most efficient hotel system and why efficiency varies across years and between the two differing types of hotel businesses in Turkey.

Design/methodology/approach – A data envelopment analysis (DEA) analysis was used to characterise the efficiency of all-inclusive (AI) and bed and breakfast (B&B) hotel businesses with one output (total revenue) and three inputs (labour, food and capital costs). The Malmquist approach is then used to discern changes in total efficiency (TTE) and intertemporal shifts in the efficiency frontier (technological change (Tch)).

Findings – The results reveal that the AI hotel operates at 100% efficiency in the summer and year-round. The B&B hotel business operates at 89.6% with variable constant returns to scale during the summer and with 100% efficiency. The results of the Malmquist approach indicate that the total factor productivity grew in the years 2015, 2016, 2018 and 2019, while the other years were marked by inefficiency. Such increases were due to technical efficiency change (TEch) and Tch, which means that managerial and allocative efficiency (AE) were barely achieved. Slight differences were noted in the two time periods (all year and summer), suggesting that the scale of hotel businesses is prepared to operate all year round, and this calls for strategies to mitigate seasonality.

Research limitations/implications – As to avenues for future research, the limitations of this study are threefold. First, the hotel businesses are not parallel in terms of the duration of their service offerings. Future research may consider including an AI hotel business that is in operation for the whole year. Second, businesses in Turkey are sceptical about sharing their data as it is considered confidential. However, to better generalise the results and encourage hoteliers to consider the positive outcomes of such analysis, the number of observations could be increased by considering more hotel businesses in both categories. Third, a mixture of data representing businesses operating in various countries may reflect if the efficiency scores vary internationally.

Practical implications – Overall, AI hotel businesses are more attractive but less efficient than B&B. Furthermore, the external crisis impacts the efficiency of hotel businesses meaning that hotel managers could keep on exploring AI, perhaps educating their hosts not to waste or not offer huge quantities. Hotel managers may also need to enlarge their seasonal activities to ensure more efficiency.

Social implications – Despite the intentions of AI hotel businesses to increase their profitability with a lower level of service quality, this study shows that the AI hotel business is very attractive but not so efficient due to the higher propensity of guests to consume food and beverages in excess that compromises the definition of efficiency as zero waste. AI is very attractive for family groups or those seeking the pleasure of relaxation at

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seaside resorts and is also very popular in Turkey. On the other hand, the B&B hotel business is more efficient but less attractive.
Originality/value – The contributions of this paper are threefold. First, the authors analysed the efficiency and inefficiency of hotel businesses within nine years of operations. During this period, Turkey experienced first a tourism boom (2011–2014) followed by stagnation and subsequently a sharp decline due to political instability resulting in an (in)direct impact on tourism (2015–2019). Second, the authors compared the efficiency and inefficiency of AI and B&B hotel businesses. Third, the authors examined the effects of hotel management factors to ensure efficiency.

Keywords Turkey, City hotels, Hotel efficiency, Data envelopment analysis, Resort hotels
Paper type Research paper

Introduction

Over the last two decades, there has been an increasing number of studies evaluating the performance of hotel businesses by applying efficiency measures that are dependent upon the consideration of multiple inputs and multiple outputs (Assaf *et al.*, 2012; Chen, 2019; Chiang *et al.*, 2004; Hwang and Chang, 2003; Tsaur, 2011). Efficiency is critical for the administration of hotel businesses as they compete in an oligopolistic market where prices and costs are the key drivers to succeed (Barros, 2004). Given these calls for efficiency, it is of considerable interest to examine how hotel businesses could respond to the increased pressure. Data envelopment analysis (DEA) allows measuring the variation in efficiency between hotel businesses and in the time frame. Furthermore, this technique allows the identification of the possible sources of inefficiency.

The standard DEA approach has the disadvantage that it cannot distinguish between changes in relative efficiency brought about by movements along or down the efficiency frontier each year (Hadley, 2006). Malmquist indices are computed to capture these two sources of change in efficiency (Maniadakis and Thanassoulis, 2004). Studies about efficiency in hotel businesses rely primarily on stochastic frontiers (Barros, 2004; Chen, 2007; Dapeng *et al.*, 2020), usually only for one year (Oukil *et al.*, 2016) or for several years but using the same types of hotel businesses (e.g. Assaf *et al.*, 2012; Barros and Dieke, 2008; Chiang, 2006; Hsieh and Lin, 2010; Pulina *et al.*, 2010).

The geographical profile of existing studies also represents the hospitality industry in such countries as China (Dapeng *et al.*, 2020), France (Perrigot *et al.*, 2009), Italy (Pulina *et al.*, 2010), Singapore (Ashrafi *et al.*, 2013), Slovenia (Assaf *et al.*, 2012), Portugal (Amado *et al.*, 2017), Taiwan (Chen, 2019; Chiang *et al.*, 2004) and Tunisia (Aissa and Goaied, 2016), among others. Also, the representation of the Turkish hospitality industry and the comparison of different forms of hotel businesses in efficiency studies have been overlooked in the international literature.

Unlike the previous studies carried out with a homogeneous sample of hotel businesses (e.g. Assaf *et al.*, 2012), to our best knowledge, this is among the first studies differentiating all-inclusive (AI) and bed and breakfast (B&B) hotel businesses despite the comparison of city/chain and resort/AI hotel businesses previously (Aissa and Goaied, 2016; Yu and Lee, 2009). This study also aims to examine trends in efficiency over time with the main causal factors, dismantling the efficiency differences in AI and B&B hotel businesses for 2011–2019. The first research question is R1, and the second research question is R2:

R1. Whether hotel efficiency was impaired by the exceptional downturn in tourist arrivals.

R2. Whether AI hotel businesses are less or more efficient than their B&B counterparts.

Efficiency in hotel businesses

The microeconomic theory states that producers aim to maximise their profits. They have to choose the most efficient combination of resources (allocative efficiency (AE)) that defines the optimal level of production (technical efficiency (TE)) with minimal costs. The DEA model measures technical and AE (Varian, 2014). As such, TE is the maximum production that the organisation can reach considering its production function, whereas AE is the best combination of resources which the organisation can reach, given the prices of the inputs (Varian, 2014). Therefore, the total efficiency (TTE) is the product of allocative and TE. A DEA estimate based on outputs allows an understanding of how marginal increases in outputs (or quantity produced) is a source of inefficiency. Although it is possible to estimate DEA through an input orientation that measures technical inefficiency as the marginal decrease in input usage, this study adopts an output orientation to consider the shifts that the tourism demand has suffered over the last decade.

Traditionally, the production functions of hotel businesses are considered a Cobb Douglas function; this configuration allows constant or variable returns to scale. Return to scale refers to the rate of increase in output with the increase in inputs. In other words, returns to scale measure how much the output will increase if the utilisation of inputs increases. Constant returns to scale mean that the output increases by the same proportion of the increase of the inputs used. In contrast, variable returns to scale mean that output could increase by less (decreasing returns to scale) or by more (increasing returns to scale) than the proportion of the increase of utilisation of the inputs. Returns to scale are mainly related to TE (Varian, 2014).

To better utilise how the inputs are effectively used to produce outcomes, understanding the efficiency of operations in various aspects is critical to defining business strategies and enhancing competitiveness (Honma and Hu, 2012; Qi and Junhai, 2011). At the competitive level, efficiency is measured to compare competitors, and at the business strategy level, efficiency is measured to control performance (Chen, 2006). The primary purpose of any business is to maximise the number of revenues subject to constraints on quantities and prices. Efficiency happens when businesses reach the maximum level of revenues while maintaining minimal costs or an optimal combination of inputs (Lovell, 1993). As a result, cost control has become an essential dimension of efficiency for hotel businesses (Qi and Junhai, 2011).

From the perspective of a hotel business, efficiency models have been used to identify efficiency as well as sources of inefficiency that may contribute to defining strategies to reduce cost inefficiencies through a benchmarking assessment (Anderson *et al.*, 1999; Barros, 2004; Chen, 2006; Morey and Dittman, 1995). Businesses are inefficient when they fail to allocate resources most efficiently, AE, or when they fail to utilise resources efficiently, technical inefficiency (Anderson *et al.*, 2000).

Debreu (1951), Koopmans (1951) and Leibenstein (1966) were the first researchers to define inefficiency as the curve difference between the potential and the actual utilisation of resources. The curve of the potential use of resources that maximises the output or the revenue is defined as the efficiency frontier. This frontier has been estimated through different methods, the most usual being the stochastic frontiers approach (SFA) (Assaf, 2012; Chen, 2007; Barros, 2004) or DEA (Hwang and Chang, 2003; Barros, 2006). Furthermore, Honma and Hu (2012) analyse hotel efficiencies using SFA and DEA to conclude that the results are consistent. Both methods assume that the production function in the most efficient combination of resources is known. Furthermore, Hjalmarsson *et al.* (1996) argue that despite some consistency within the results, DEA and DFA are less demanding as these models do not require distribution assumptions about efficiency. Further, DEA generates a range of optimal scales; SFA relies on a constant level of optimal scales and yields a constant return to scale.

Also, SFA is based on econometric models and is much more demanding in terms of data. DEA involves mathematical programming but is less demanding in terms of data (Barros and Santos, 2006). On top of that, DEA allows several inputs and outputs to be introduced without functional data restrictions or distributional assumptions for inefficiency (Barros and Santos, 2006). It also allows the efficient frontier to be estimated from the sample data, as is the case in this study.

There are several studies in the hotel industry adopting DEA to measure the efficiency of hotel businesses (Tsaur, 2001; Chiang *et al.*, 2004; Hwang and Chang, 2003). A quick overview of the existing literature indicates a long list of variables used as inputs and outputs: input variables include annual revenues, number of customers, number of nights and occupancy rates. The input variables are represented by the number of beds, number of rooms, number of employees, labour costs (Assaf *et al.*, 2012; Chiang *et al.*, 2004), marketing and/or advertising costs (e.g. Huang *et al.*, 2014; Polemis *et al.*, 2020), and management styles (Yu and Lee, 2009), star rating and location (Oliveira *et al.*, 2013) and destination characteristics (Benito *et al.*, 2014; Sellers-Rubio and Casado-Díaz, 2018).

Furthermore, there has been a growing interest in comparing efficiency across hotel businesses in different categories such as franchised, managed-contract or independently operated (e.g. Assaf, 2012; Chiang *et al.*, 2004; Perrigot *et al.*, 2009). DEA has been primarily used to make a bilateral comparison across two units of hotel businesses, such as chains and independent operations (Botti *et al.*, 2009). The results of such studies suggest a better efficiency of franchised, managed-contract or chains than those independently operated by the owners (e.g. Aissa and Goaied, 2016; Chen, 2019; Chiang *et al.*, 2004) due to the advantage of economies of scale, professionalism in good managerial practices, strong brand recognition and know-how skills (Perrigot *et al.*, 2009).

Despite several exceptions in environmental performance (e.g. Assaf *et al.*, 2012; Chen, 2019) or regional performance (e.g. Assaf, 2012; Pulina *et al.*, 2010) and the influence of privatisation (e.g. Amado *et al.*, 2017), the existing body of research has been dominant in measuring the efficiency of hotel businesses with the calculation of their inputs (costs) and outputs (revenues), as indicated above. As a result, the current study is also a continuation of using a similar approach but in a different context of locations (city-resort) and service concepts (B&B-AI). Furthermore, the previous literature estimates efficiency indirectly as most variables relate to the market performance rather than the optimal allocation of resources. Because this is the case of labour and capital, this study also recovers the original concept of efficiency.

The output variable was sales in line with the models previously used (e.g. Chiang *et al.*, 2004). In contrast, the three inputs include labour costs, food and beverage costs, and capital costs, given the prices of the inputs considered. *Annual revenues* refer to all income sources generated within the hotel facility (Huang *et al.*, 2012; Neves and Lourenço, 2009; Pulina *et al.*, 2010). *Labour costs* indicate what has been paid as the salary, insurance, food and housing (Brida *et al.*, 2012; Detotto *et al.*, 2014). *Food and beverage costs* are calculated by the amount of all expenses required to serve food and beverage at the hotel facilities (Assaf and Agbola, 2011). *Capital costs* represent the cost of technology, equipment and infrastructure (Guccio *et al.*, 2017; Solana-Ibáñez *et al.*, 2016). The models estimated TE and AE efficiency. Labour and capital are the most traditional and standard variables to define the frontier of efficiency in any hotel business; food costs in a hotel context are not as usual but are critical, particularly in the context of AI resort hotel businesses.

Background of the Turkish tourism industry

The historical background of tourism development in Turkey dates back to the 1950s. As the first international chain and five-star hotel business, the Hilton Istanbul started welcoming visitors in 1955. This was followed by other chains and larger capacity hotel businesses in the subsequent decades. Commencing in the 1980s, the government decided to financially support the development of summer tourism by establishing resorts with larger capacities on the Aegean and Mediterranean coasts of Turkey. In the 1990s, the government discontinued subsidising as those facilities reached their saturation point, leading to the diversification of tourism types and the establishment of small-scale facilities being encouraged. As a joint force of both public and private sectors, the Turkish tourism industry has recorded remarkable progress over the last five decades. As a result, with its more powerful position in international tourism, Turkey was among the top 10 destinations until early 2020.

As in all countries, Turkey has also been adversely affected by the spread of the pandemic, leading to a dramatic decrease in the arrival of international visitors by 75% leading to a loss of tourism income by 70%. With its annual base of 31%, the national hospitality industry recorded a much lower occupancy rate in 2020. In terms of its attractiveness and formation of significant tourism products dominated mainly by culture, nature and sports, the Turkish hospitality industry has been formed by a more substantial contribution from its three major destinations: Istanbul, Antalya and Mugla.

As one of the most robust destinations both in domestic and international tourism, Bodrum, a part of Mugla, is located on the Aegean coast of Turkey. Its tourism movements started in the 1970s. With the opening of Bodrum Airport (BJV, 1998), additional flights and tourist movements boomed in Bodrum. In 2015, the best year for the region, one million inbound tourists flew into Bodrum. However, the occupancy rate sharply decreased in the following years due to the consequences of terrorism (1999), the Russian plane crisis (2015), the coup attempt of 15 July (2016) and the Bodrum earthquake (2017). The common point of these crises is that they occurred in Turkey but directly influenced the progress of tourism development, specifically in Bodrum.

Currently, Bodrum has 147,000 permanent residents, but with the arrival of tourists and summer houses, this adds up to 600,000 in the summer season. It accommodates 68 five-star hotel businesses, with a total bed capacity of 110,000. There are 90 hotel businesses offering AI services. The tourism season usually opens in the middle of April and lasts until October. Bodrum welcomes inbound tourists primarily from the UK, Russia, Poland, Ukraine, the Netherlands, Belgium, France, Germany and Denmark. While there was a stable upward trend until 2015, it experienced a sharp decline in 2016 due to the political crisis between Turkey and Russia and the attempted coup on 15 July 2016. It maintained a welcome for 940,000 international tourists in 2019, but a sharp decline to 233,000 was recorded in 2020, arriving only via airlines. The domestic market also makes a significant contribution. Over the last ten years, there has been a similar pattern for Turkey in general and Bodrum specifically (Figure 1).

As a partner destination of this study, the population of Istanbul is over 20 million and houses 134 five-star hotel businesses. They mainly cater for B&B accommodation, and the

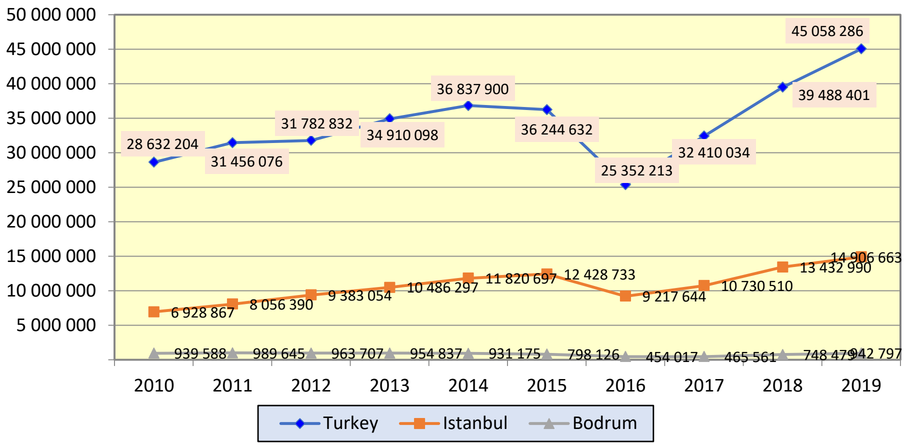

Figure 1.
The number of inbound tourists to Turkey, Istanbul and Bodrum (2010–2019)

duration of stay per visitor is lower than that in Bodrum. Istanbul is also one of the strong brands in attracting visitors to MICE tourism. In 2019, it attracted approximately 15 million inbound tourists, primarily from France, Germany, Iran, the Netherlands, Russia, the UK and the US. As indicated in Figure 1, the pattern of tourist arrivals has also been unstable for Istanbul over the last ten years.

The classification of hospitality facilities in Turkey is officially based on 1–5 stars, first- and 2nd class resorts, and those graded by the local municipalities. This study refers to the performance analysis of two five-star hotel facilities operating in Bodrum and Istanbul. The one in Bodrum started its operations in 2004. It is a five-star establishment with 200 employees, 251 rooms and 550 beds and offers an AI concept. As known, AI is a complete concept offering various services such as food, beverage, pool and animation at a single price. Some hoteliers offer those services from early in the morning until late at night, whereas others are open 24/7. The concept is successful in attracting mainly family groups with kids. The structure of hotel guests is mainly represented by those coming from the UK, Poland, Russia, Ukraine, the Netherlands, Scandinavia and Turkey. The hotel business usually opens its doors for a new season, effective from mid-April to the end of October.

With its first operation in 2007, the hotel in Istanbul is a five-star establishment offering only the B&B concept. B&B offers only accommodation and breakfast at a single price. It has a capacity of 335 rooms and 670 beds with an average of 140 employees. It is open for the whole year. Its target market is those visitors who visit the city primarily for sightseeing, history, art, fashion, shopping, culture and business. This is a common form of city hotel around the world.

Conceptual framework and methods

DEA incorporates multiple input and output variables, leading to a single efficiency index (Assaf *et al.*, 2012). The most efficient units are considered the best practice frontier. The efficiency score ranges between zero (minimum efficiency) and one (maximum efficiency). As this study aims to understand the efficiency of AI and B&B hotel businesses, two DEA models were estimated. The first with variable returns to scale was estimated for the whole year's operations and the second for the summer (May–October). This study departs from a data set obtained from the two hotel businesses in Turkey with different service concepts (AI and B&B) in nine years (18 observations) from 2011 to 2019, with one output and three inputs.

Based on the above arguments, this study considers the annual revenues as the output variable. In contrast, the three inputs include labour costs, food and beverage costs, and capital costs, given the prices of the inputs considered. The models estimated TE and AE efficiency. Labour and capital are the most traditional variables to define the frontier of efficiency; food costs in hotel contexts are not as usual but are critical for the performance of particularly AI resort hotel businesses (see Figure 2).

Furthermore, efficiency was analysed over time to understand how and why productivity changes over the years. Between 2011 and 2012, a significant decline was observed in inefficiency. Accordingly, Örkcü *et al.* (2016) tested productivity and efficiency in airports in Turkey from the period of 2009 to 2014 with the Malmquist index to conclude that whilst productivity increases, efficiency decreases.

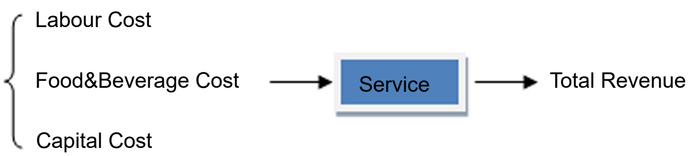

Figure 2.
DEA model used to evaluate the efficiency of AI and B&B hotels

This analysis was performed by calculating the Malmquist productivity index (MPI), which analyses the causes that generate productivity changes over time (Caves *et al.*, 1982). The MPI measures total factor productivity by comparing two time periods with rations of distance functions. This index does not need prior assumptions on the production technology or output data (Coelli, 1996).

This index can be broken down into technical efficiency change (TEch) and technological change (Tch). Technical efficiency is determined by the position of a concrete production relative to (the efficient subset of) and the technological frontier (TEch). It is quantified as a standardised distance between this production and its Pareto–Koopmans optimal possibility marked by the absence of waste in physical terms (Tone, 2004). Furthermore, TEch can be broken down into pure technical efficiency change (PTE) and scale efficiency change (SE). TEch results from improvements in the combination of inputs to achieve output. Technical efficiency is measured along the production possibility frontier, while inefficiency is measured in points below the curve.

However, over time, the level of outputs an organisation can produce will increase, primarily because of Tch that impact the ability to combine inputs to achieve a higher level of outputs. This causes the production possibility frontier to move upward. In other words, TEch accounts for TE gains, and Tch accounts for technological improvements. PTE measures managers' ability to combine inputs in the most efficient way to achieve a certain level of production. SE measures the contribution of scale efficiency to productivity growth (Tone, 2004).

This study calculates DEA frontiers to estimate technical efficiencies and Malmquist TFP indices to estimate total factor productivity changes (TFPch) in AI and B&B hotel businesses between 2011 and 2019. These procedures were adopted with the free software DEAP (DEA (computer) program) developed by the University of Queensland by Coelli (https://economics.uq.edu.au/cepa/software) (Coelli, 1996).

Results

Technical, allocative and economic efficiency for both hotel businesses and the years 2011–2019, with constant and variable returns to scale, are presented in Table 1. With VRS, both hotel businesses presented TE, but AE is above the mean in the B&B hotel business when the operation covers only the summer. This means that the B&B hotel business does not have the best management policies to achieve 100% TE, but in the case of the AI hotel business in Bodrum, the efficiency is 100%. This result suggests that efficiency in B&B hotel businesses is a matter of operating all the year. These results are in accordance with Barros and Santos (2006). Due to the political instability, the Malmquist TFT index was calculated in the time frame under analysis. Five indicators are presented in Table 2, all relative to the previous year: TEch, Tch, PTE, SE and TFPch.

Hotel	TE	AE	EE
B&B Hotel	0.896	1	0.896
AI Hotel	1	1	1
Mean	0.948	1	0.948
Summer			
Hotel	**TE**	**AE**	**EE**
B&B Hotel	1	1	1
AI Hotel	1	1	1
Mean	1	1	1
All the year			

Table 1. Technical, allocative and economic efficiency (2015–2019)

DEA all year round	Technical efficiency change (TEch)	Technological change (Tch)	Pure technical efficiency change (PTE)	Scale efficiency change (SE)	Total factor productivity change (TFPch)
2012/2011					
B&B Hotel	1	0.977	1	1	0.977
AI Hotel	1	0.998	1	1	0.998
Mean	1	0.987	1	1	0.987
2013/2012					
B&B Hotel	1	0.802	1	1	0.802
AI Hotel	1	0.891	1	1	0.891
Mean	1	0.845	1	1	0.845
2014/2013					
B&B Hotel	0.769	1.029	1	0.769	0.791
AI Hotel	1	1.074	1	1	1.074
Mean	0.877	1.051	1	0.877	0.922
2015/2014					
B&B Hotel	1.265	1.105	1	1.265	1.367
AI Hotel	1	1.066	1	1	1.066
Mean	1.125	1.085	1	1.125	1.22
2016/2015					
B&B Hotel	0.933	0.696	1	0.933	0.649
AI Hotel	1	2.035	1	1	2.035
Mean	0.966	1.19	1	0.966	1.149
2017/2016					
B&B Hotel	1.103	1.007	1	1.103	1.11
AI Hotel	1	0.593	1	1	0.593
Mean	1.05	0.772	1	1.05	0.811
2018/2017					
B&B Hotel	1	1.094	1	1	1.094
AI Hotel	1	1.041	1	1	1.041
Mean	1	1.067	1	1	1.067
2019/2018					
B&B Hotel	1	1.115	1	1	1.115
AI Hotel	1	0.926	1	1	0.926
Mean	1	1.016	1	1	1.016

(*continued*)

Table 2.
Malmquist total factor productivity changes

DEA all year round	Technical efficiency change (TEch)	Technological change (Tch)	Pure technical efficiency change (PTE)	Scale efficiency change (SE)	Total factor productivity change (TFPch)
Means by hotel					
B&B Hotel	1	0.966	1	1	0.966
AI Hotel	1	1.021	1	1	1.021
Mean	1	0.993	1	1	0.993

Table 2.

As indicated in Table 2, both hotel businesses presented inefficiency between 2011 and 2013, mainly because Tchs were not efficient. In 2014, the B&B benefited from a shift in technology, but its TE was not the best (0.769). On the contrary, AI presents a TE of 100% and a Tch of 1.074. In 2015, both presented productivities above 100%, with the B&B being the more efficient (1.367). This gain comes from a shift in the scale of the hotel business and a better allocation of resources. 2016 was the best year for the AI hotel business, which doubled its productivity, whereas the B&B hotel business lost productivity, going down to 0.649, primarily due to a decrease in Tchs. This may be due to out-date operational equipment. In 2017, the AI hotel business lost almost half of its productivity, whereas B&B recovered by 11%. 2018 was a good year for both hotel businesses, even if the B&B business was more efficient. The rapid devaluation of the Turkish Lira against the Euro might have been a significant factor in this respect because the Turkish tourism industry uses Euros for sales but make payments in Turkish Lira, resulting in a decrease in total expenses. In 2019, the AI decreased its productivity, whereas the B&B was kept with efficient patterns. The volatility of the results could be explained by the shifts in the demand and the lack of investments, and more efficient management of the resources.

Overall, the AI hotel business presents a better performance with efficiency gains of 21% due to Tchs. These results may be related to the scale of the hotels. In order to understand the implications of the operating timeline, Malmquist DEA was estimated considering only the summer period from May to October (Table 3). The results are very similar, with a slight loss in productivity primarily noted in the AI hotel business. As gains and losses in productivity are primarily due to Tch, we may assume that the gains are related to experience economies. This means that production increases only due to hotel businesses' expertise over the years. These results suggest that investments to improve productivity remained deficient, while other managerial policies to improve productivity do not change efficiency.

Furthermore, productivity increases very little over the nine years. Perhaps because of the country's political instability or possibly because the hotel businesses under investigation did not change the standards of their operations, it seems that the AI is more efficient than the B&B hotel business. As the summer benefits from a slight increase in productivity, strategies to mitigate the seasonality should be undertaken.

These results also suggest that the productivity of hotel businesses depends on market volatility, and productivity increases could only happen if the hotel business can improve its technical procedures. Managerial efficiency is stable, as it is TE and scale efficiency, which is not surprising as the number of rooms has been fixed over the years. Overall, the results suggest that AI benefits from operating all year with a gain in productivity of 21%. In contrast, the B&B seems to benefit from operating only in the summer, even if its productivity is above 100%.

	Technical efficiency change (TEch)	Technological change (Tch)	Pure technical efficiency change (PTE)	Scale efficiency change (SE)	Total factor productivity change (TFPch)
2012/2011					
B&B Hotel	1.116	0.886	1	1.116	0.989
AI Hotel	1	0.974	1	1	0.974
Mean	1.056	0.929	1	1.056	0.981
2013/2012					
B&B Hotel	0.942	0.833	1	0.942	0.785
AI Hotel	1	0.886	1	1	0.886
Mean	0.971	0.859	1	0.971	0.834
2014/2013					
B&B Hotel	0.722	1.079	1	0.722	0.779
AI Hotel	1	1.061	1	1	1.061
Mean	0.85	1.07	1	0.85	0.909
2015/2014					
B&B Hotel	1.323	1.106	1	1.323	1.463
AI Hotel	1	1.067	1	1	1.067
Mean	1.15	1.087	1	1.15	1.25
2016/2015					
B&B Hotel	0.835	0.692	1	0.835	0.578
AI Hotel	1	1.208	1	1	1.208
Mean	0.914	0.914	1	0.914	0.835
2017/2016					
B&B Hotel	1.331	0.949	1	1.331	1.263
AI Hotel	1	0.918	1	1	0.918
Mean	1.154	0.933	1	1.154	1.077
2018/2017					
B&B Hotel	1	1.172	1	1	1.172
AI Hotel	1	1.046	1	1	1.046
Mean	1	1.107	1	1	1.107
2019/2018					
B&B Hotel	1	1.084	1	1	1.084
AI Hotel	1	0.952	1	1	0.952
Mean	1	1.016	1	1	1.016
Means by hotel					
B&B Hotel	1.014	0.962	1	1.014	0.975
AI Hotel	1	1.01	1	1	1.01
Mean	1.007	0.986	1	1.007	0.992

Table 3.
DEA summer operating period

Conclusion and implications

This paper investigated the efficiency of hotel businesses in two different categories. Specifically, it considered how labour costs, food and beverage and capital had influenced the efficiency of both AI and B&B hotel businesses in terms of the volume of sales, both operating in Turkey. The contributions of this paper are threefold. First, we analysed the efficiency and inefficiency of hotel businesses within nine years of operations. During this period, Turkey experienced first a tourism boom (2011–2014) followed by stagnation and subsequently a sharp decline due to political instability resulting in an (in)direct impact on tourism (2015–2019). Second, we compared the efficiency and inefficiency of AI and B&B hotel businesses. Third, we examined the effects of hotel management factors to ensure efficiency.

Despite the intentions of AI hotel businesses to increase their profitability with a lower level of service quality (Aissa and Goaied, 2016), this study shows that the AI hotel business is very attractive but not so efficient due to the higher propensity of guests to consume food and beverages in excess that compromises the definition of efficiency as zero waste. This finding corresponds to what has been suggested by Aissa and Goaied (2016). AI is very attractive for family groups or those seeking the pleasure of relaxation at seaside resorts and is also very popular in Turkey. On the other hand, the B&B hotel business is more efficient but less attractive. This finding is in accordance with earlier studies suggesting that the franchised, managed-contract or chain hotel businesses perform better than those independently operated by the owners (e.g. Aissa and Goaied, 2016; Chen, 2019; Chiang *et al.*, 2004; Perrigot *et al.*, 2009) due to the strengths of the former in good management practices and brand reputation.

Today, tourists are more drawn to accommodation with safety and security measures, so AI may constitute tourism's most demanding concept if a new approach to catering is adopted. For instance, radical changes in the design of open buffets by reducing the food items or avoiding self-service are expected to positively influence customers' feelings of trust (Hameed *et al.*, 2020). However, it may increase labour costs and lead to dissatisfaction among hotel guests with limited service offerings. AI hotels are more resistant to crises than BB hotels and more manageable for a recovery. There is a possibility of reducing the number of unsatisfied guests and decreasing the food cost per guest by redesigning cooking plans and recipes.

As to the implications for the industry, first, there can be an elasticity problem for hotel businesses during a crisis due to the strict brand rules that may cost extra. As highlighted above, BB hotels are efficient but less attractive due to low overnight per room 1.3 night/room. This may increase the cost of the room department, such as the daily room cleaning, new linens and staff. AI hotels are not efficient but more attractive due to high overnight stay per room – 9.6 nights/room. Thus, the cost of daily room operations will be less at any level compared to BB hotels.

Second, between 2015 and 2019, the Turkish tourism industry suffered from political instability, with significant drawbacks in tourist arrivals and overnights, ultimately impacting the efficiency of hotel businesses, regardless of their size, location or concept. The number of tourist arrivals was not stable, with a significant drop from 36 million (2015) to 25 million (2016); a restoration was starting with an increase to 39 million (2019). Furthermore, with a loss of international visitors by 73%, the influence of the current pandemic situation on the tourism industry is likely to raise how AI hotel businesses could maintain this concept without compromising business efficiency.

Third, overall, AI hotel businesses are more attractive but less efficient than B&B. Furthermore, the external crisis impacts the efficiency of hotel businesses meaning that hotel managers could keep on exploring AI, perhaps educating their hosts not to waste or not offer enormous quantities. Hotel managers may also need to enlarge their seasonal activities to ensure more efficiency. Food should be produced in smaller portions but with more variety and freshness. Cooking may be demonstrated on the front line so that guests can feel and see the activity. During the off-season periods, AI hotel businesses may reduce the number of paid staff and other operational and fixed costs. These hotels should reach an optimum number of room sales to be profitable due to high costs and busy operations.

As to avenues for future research, the limitations of this study are threefold. First, the hotel businesses are not parallel in terms of the duration of their service offerings. Future research may consider including an AI hotel business that is in operation for the whole year. Second, businesses in Turkey are sceptical about sharing their data as it is considered confidential. However, to better generalise the results and encourage hoteliers to consider the positive outcomes of such analysis, the number of observations could be increased by considering more hotel businesses in both categories. Third, a mixture of data representing businesses operating in various countries may reflect if the efficiency scores vary internationally. Last but not least, the impact of the crisis as it was the pandemic coronavirus disease 2019 (COVID-19) should be analysed in light of efficiency theory.

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