Hotel Revenue Convergence: Evidence Across Star Hotels in Chinese Provinces

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Abstract This paper analyses, for the first time, potential convergence patterns of hotel revenues across provinces in China. Through the club clustering methodology, the analysis uses a unique dataset of all hotels across all Chinese provinces. The findings document that these hotel revenues follow a diverging pattern on a national level, while a converging pattern is identified across certain provinces, thus forming specific clubs. When the analysis is extended to identify potential drivers for such diverging or converging behavior, the new results illustrate the role of productivity trends, management strategies and tax policies as those factors that drive such patterns. The results could be of substantial value, primarily for tourism policymakers to further improve the current framework of the Chinese hotel industry to introduce practices and policies that will allow the industry to catch up with the global market.

Keywords Hotel revenues · Convergence · Club clustering · Chinese provinces

JEL Z30 · C33

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Introduction

Firms’ revenues and profitability usually reflect investors’ expectations regarding potential growth patterns for these firms. Hence, to value such trends, researchers and practitioners must forecast them. This empirical paper explores how hotel revenues evolve and converge over time in the case of the Chinese star hotels across all the country’s provinces. This study touches on a main strand in the literature, the hypothesis of diminishing returns, according to which capital investment flows in the industry lead revenues and profit rates towards their average for the entire sector. Hence, sectors move towards an equilibrium, although the degree of dispersion may not be zero, provided that within a dynamic context, shocks keep hitting firms causing them to diverge.

There are usually macro or micro shocks, which may be industry- or firm-specific and have a substantial impact on revenues, such as research and innovation activities (Görzig & Gornig, 2013), heterogeneity in managerial capacity (Bloom et al., 2012), or industry- and firm-specific taxes (Dosi et al., 2015). Such shocks generate divergence away from a uniform equilibrium. The paper directly explores potential convergence within the Chinese hotel industry. The previous literature has mainly focused on the manufacturing (Nell & Thirlwall, 2017, 2018) and banking (Carbo & Fernandez, 2007; Weill, 2007, 2008) industries, with studies in the hotel industry being comparatively absent.

Moreover, the analysis is associated with the tourism market segmentation literature focusing on micro-level customer segmentation studies, based on individuals’ social demographic and behavioral features (Ernst & Dolnicar, 2018). The analysis is also related to macro-level segmentation studies that analyzed country-level segmentation patterns (Bijmolt et al., 2004), based on macro-level indicators, such as socio-economic, political, cultural, and geographic variables (Hassan & Craft, 2005).

The paper is also associated with the literature of market convergence (Polo Pena et al., 2013). According to this literature, there exist three major conceptual approaches for market segmentation: natural, reproducible, and constructive segmentation (Ernst & Dolnicar, 2018). In general, analysis of the tourism market appears to be an emerging topic in the tourism economics literature (Kourtzidis et al., 2018; Valadkhani & O’Mahony, 2018; Xie et al., 2018).

Over the last 15 years, China has extensively expanded the hotel industry through higher investments and stronger management skills (Gu et al., 2012). The country’s membership in the World Trade Organization, as well as the organization of certain mega events, such as the Beijing Olympics in 2008, the Shanghai World Expo in 2010, and the 16th Asian Games in Guangzhou in 2010, gave a substantial boost to the country’s hotel industry (Li et al., 2011). Along with the substantial increase in national income levels and the mobility of Chinese domestic tourists across Chinese provinces, multinational hotel group interests in investing in China have been substantially stimulated. Furthermore, the literature clearly indicates that China has great tourism potential, especially with respect to the hotel industry (Gross et al., 2013). Currently, star hotels number over 30,000.
across all Chinese provinces and offer many services to stimulate domestic and international tourism mobility. After the previously mentioned mega events ended, current international and domestic investors substantially expanded hotel investments to all provinces across the country.

The empirical analysis is important primarily because potential convergence for revenues to their steady state will offer information content for certain stakeholders, such as investors in the hotel industry, hotel managers, workers, tourism local policymakers, and those agencies monitoring competition and tourism market integration. Any convergence patterns clearly illustrate that variation in hotel revenues across provinces can be attributed to certain factors and policies, apart from those such as geographical positioning and economic drivers, and potentially those associated with productivity, tax policies, and management strategies. Prior research provides no studies of convergence in revenue patterns in the Chinese hotel industry.

This paper extends the literature on convergence of corporate revenues and profits using the Phillips and Sul (2007) approach to examine the convergence behavior of hotel revenues across 31 Chinese provinces. Drawing upon the early works on positioning theory by Christaller (1955) and bid rent theory by Alonso (1960) with respect to the role of common factors in hotel revenues and profits, the Phillips and Sul (2007) method demonstrated that a time-varying multiple common factor structure can be embedded within a time-varying single common factor structure. Specific to hotel revenues, the Phillips and Sul (2007) approach captures the evolution of provincial hotel revenues in relation to their common component and an idiosyncratic component, both of which are time varying.

Although the literature offers alternative methods to test for convergence, such as the beta- and sigma-convergence and unit root methodologies, the analysis in this paper stays with the Phillips and Sul (2007) club modelling approach which offers several advantages. First, the beta-convergence methodological approach was negatively criticized by Pesaran (2006) who provided econometric evidence that these convergence methods refer to a homogeneous type of convergence, in the sense that convergence occurs only within an economy, area or region and not in a cross pattern. In contrast, the Phillips and Sul (2007) approach allows for different time paths, as well as individual heterogeneity, unlike the traditional convergence approaches that assume homogeneous characteristics. Moreover, according to Azariadis and Drazen (1990) and Hobijn and Frances (2000), if the variables under consideration converge, but the available data come from a time period of transitional dynamics, the unit-root tests may not catch the convergence pattern.

Second, this approach allows for the endogenous determination of convergence clubs. Third, unlike conventional unit root and cointegration tests, the Phillips and Sul (2007) approach does not impose any assumption concerning trend stationarity or stochastic non-stationarity, since this method is robust to heterogeneity and the stationarity properties of the variable in question.

In addition to exploring overall panel convergence, the analysis implements the convergence clustering algorithm to identify the presence of convergence clubs within the 31 provincial hotel revenues. Next, the analysis investigates the extent to which certain economic drivers can explain convergence clubs. The only published study similar to the current paper is the paper by Lin et al. (2019) who adopted...
the panel club convergence approach to analyzing global tourism market segmentation. More specifically, they empirically explored the convergence process of Turkish global tourism source markets over the period of 2001–2015, covering 81 markets. Their findings documented the presence of convergence clubs or segments, highlighting the importance of Asian source markets, and identified important implications for tourism organizations seeking to develop global marketing strategies.

The results of the current study reveal the absence of overall panel convergence across the revenues of 31 provincial star hotels. Instead, they show seven distinct convergence clubs. Similar to the hotel revenue evidence, the convergence findings document evidence for the number of stars characterizing each hotel, hotel size proxied by the number of rooms, revenues coming from room services (but not from restaurant services), the taxes they pay, and the room occupancy rate. In contrast, a different pattern was identified with the mechanism of labor productivity.

Methodology

Given that the goal of the paper is to explore the presence of different regional hotel revenue clubs converging to the steady state, the empirical analysis makes use of the Phillips and Sul (2007, 2009) club convergence procedure. Unlike other convergence tests which rely on unit root and cointegration tests, this particular method offers certain advantages versus other convergence methodological approaches, such as that no specific assumptions regarding the stationarity of the variables or the presence of common factors are required. Given the heterogeneity of the time series in the panel, the method identifies clubs (i.e., groups of regional hotels), each potentially converging towards a common club trend. The full panel is formed by $N = 31 \times 23,416$ (Chinese provinces) and $T = 9$. The method uses a time-varying common factor, $cp_{it}$, where:

$$cp_{it} = \delta_{it} \mu_{it}.$$  

(1)

cp_{it} denotes the logarithm of hotel revenues of region i at time t and $\mu_{it}$ is a common hotel revenue factor (i.e., common trend component in the panel). $\delta_{it}$ describes a time-varying idiosyncratic component that captures both time and individual specific effects, implying the distance between $cp_{it}$ and the common factor, while $\mu_{t}$ determines the common stochastic trend in the panel. To test the null hypothesis of convergence, Phillips and Sul (2007) propose the following semiparametric form for the loading coefficient $\delta_{it}$, where:

$$\delta_{it} = \delta_{i} + \sigma_{i} \xi_{it} L(t) t^{-\alpha}.$$  

(2)

$\delta_{i}$ is fixed, $\xi_{it} \sim iid(0,1)$ across hotel revenues of provinces $i = 1, 2, \ldots, N$ and which is weakly dependent over time t. $\sigma_{i}$ illustrates an idiosyncratic scale parameter. $L(t)$ displays a slowly-varying function of time, with $L(t) \rightarrow \infty$ and $t \rightarrow \infty$. This representation ensures that $\delta_{it}$ converges to $\delta_{i}$. The null hypothesis of convergence can be written as: $H_0$: $\delta_{i} = \delta$ and $\alpha_{i} \geq 0$, against the alternative hypothesis: $H_1$: $\{\delta_{i} = \delta$ across
all \( i \) and \( \alpha_i < 0 \}, \text{ or } \{ \delta_i \neq \delta \text{ for some } i \text{ and } \alpha_i \geq 0, \text{ or } \alpha_i < 0 \}. \text{ Phillips and Sul (2007) employ the following quadratic distance measure, } H_t, \text{ where }

\[
H_t = N^{-1} \sum ((h_{it} - 1)^2
\]

and \( h_{it} \text{ indicates the transition coefficient, defined as:}

\[
h_{it} = (cp_{it})/(N - 1 \sum cp_{it}) = \delta_{it}/(N - 1 \sum \delta_{it}).
\]

Hotel revenue convergence occurs when \( h_{it} \rightarrow 1 \text{ for all } i \text{ as } t \rightarrow \infty \). Following Phillips and Sul (2007), \( L(t) = \log t \) \text{ in Eq. (2). The null hypothesis } H_0 \text{ above can be tested by estimating the following } \log t \text{ regression: }

\[
\log(H_t/H_i) - 2 \log(\log t) = a + \gamma \log t + \epsilon_t
\]

for \( t = r_T, r_{T+1}, \ldots, T \), where \( r > 0 \) and \( r \) is the initiating sample fraction which usually influences the results from regression (5). Monte Carlo experiments from Phillips and Sul (2007) indicate that \( r \in [0.2, 0.3] \) achieves satisfactory performance. For \( \gamma = 2a \), the null hypothesis was tested through a one-sided test of \( \gamma \geq 0 \), against \( \gamma < 0 \). The estimates of \( \gamma \) are based on heteroskedasticity and autocorrelation consistent standard errors.

To identify convergence clubs in a panel of countries, Phillips and Sul (2007) developed a data-driven algorithm, which has the following five steps. Step 1 is ordering; arranging the panel members according to the last observation. Step 2 is core group formation; identification of a core club of provinces by sequential \( \log t \) regressions, based on the \( k \) highest members (Step 1) with \( 2 \leq k \leq N \). The size of the group is determined by seeking the maximum convergence t-statistic, \( t_k \), with \( t_k > 1.65 \). Step 3 is data sieving for club membership; addition of provinces to the core group (Step 2), one at a time, if the t-statistic associated with each new province is greater than zero. Step 4 is recursion and stopping formation; formation of a second convergence club by application of \( \log t \) regression to the group of provinces not selected in Step 3, if they converge. If not, steps 1 to 3 are repeated to detect sub-convergence clusters. If no core group is found in step 2, these provinces display divergent behavior. Step 5 is club merger; merger of the clubs fulfilling the convergence, according to \( \log t \) regression, of all pairs of subsequent clubs and across formed clubs until no further mergers meet the criteria.

Data

The empirical analysis of the paper makes use of all private star hotel revenue data in 31 Chinese provinces (23,416 hotels): Beijing (1,248), Tianjin (296), Hebei (514), Shaanxi (1,111), Inner Mongolia (305), Liaoning (482), Jilin (210), Heilongjiang (197), Shanghai (1,017), Jiangsu (1,208), Zhejiang (1,651), Anhui (680), Fujian
(1,152), Jiangxi (684), Shandong (1,089), Henan (1,432), Hubei (919), Hunan (1,017), Guangdong (2,815), Guangxi (751), Hainan (327), Chongqing (494), Sichuan (1,344), Guizhou (776), Yunnan (717), Tibet (79), Gansu (388), Qinghai (113), Ningxia (69), and Xinjiang (331) obtained from the Statista (2020) database, with the number in parentheses indicating the number of hotel per province.

Hotel revenues are annual, spanning the period 2010 to 2018 and were considered only if they remained active over the period under study. Moreover, given that the Chinese provinces varied dramatically in terms of size, the revenue variable was standardized to make suitable comparisons. At the end of the empirical analysis, hotel revenues were also expressed in natural logarithms. Table 1 reports summary statistics. Before the club convergence empirical analysis, the trend component of the star hotel revenues was obtained via the Hodrick and Prescott (1997) filter. Given that the analysis employs annual data, a smoothing parameter of 100 was used.

Empirical Analysis

Baseline Results

After normalizing the trend variables through a standardized z-score procedure, Table 2 presents the convergence results for $r=0.3$. Phillips and Sul (2007) suggested that $r=0.3$ (with $r$ as previously defined) is an efficient choice to provide valid results in terms of both size and power. The first row reports overall convergence, i.e., convergence across all 31 Chinese provinces. The coefficient estimate is $\gamma = -0.184$, with a t-statistic, $t_\gamma = -47.456$, and statistically significant at 1%, indicating rejection of the null hypothesis of overall convergence. Next, the analysis continues to determine whether club clusters can be identified. The new results highlight the presence of seven distinct clubs plus non-converging provinces. More specifically, Club 1 includes the provinces of Heilongjiang, Jilin, and Liaoning, with $\gamma = -1.502$ and $t_\gamma = -0.459$, indicating failure to reject the null hypothesis of convergence.

Club 2 encompasses the provinces of Beijing, Hebei, Tianjin, and Shandong, with $\gamma = -1.609$ and $t_\gamma = -0.448$. Club 3 includes the provinces of Gansu, Ningxia, and Qinghai, with $\gamma = -1.385$ and $t_\gamma = -0.477$. Club 4 includes the provinces of Chongqing, Shanxi, Shaanxi, and Sichuan, with $\gamma = -1.539$ and $t_\gamma = -0.460$. Next, Club 5 includes the provinces of Anhui, Guizhou, Henan, Hubei, Hunan, and Jiangxi, with $\gamma = -1.625$ and $t_\gamma = -0.489$. Club 6 has the provinces of Guangxi and Yunnan, with $\gamma = -1.346$ and $t_\gamma = -0.466$, while Club 7 includes the provinces of Fujian, Guangdong, Hainan, Jiangsu, Shanghai, and Zhejiang, with $\gamma = -1.417$ and $t_\gamma = -0.448$. Finally, the non-converging club rests with the provinces of Inner Mongolia, Tibet, and Xinjiang. Moreover, the information shown on the table provides an examination of the speed of convergence, which highlights that Club 5 (0.813) has the fastest speed of convergence, followed by Club 2 (0.805). These two clubs show the strongest convergence toward hotel industry’s revenues, potentially implying that the hotels in these provinces respond relatively fast to highly intensive competitive conditions (Pervan et al., 2019).
Theoretical Explanations of the Divergence Results

According to the hypothesis of diminishing returns, capital investment flows rely on dynamic firms in the industry to bring revenues and profit rates towards the average for the entire sector. Thus, convergence in hotel revenues was expected. However,

### Table 1  Summary Statistics of Hotel Revenues Across Chinese Provinces: Time Period: 2010 to 2018

| Provinces          | Mean  | SD    | Min   | Max   | Median | 25%   | 75%   |
|--------------------|-------|-------|-------|-------|--------|-------|-------|
| Beijing            | 0.59  | 0.68  | 0.34  | 0.73  | 0.54   | 0.49  | 0.64  |
| Tianjin            | 0.37  | 0.33  | 0.25  | 0.58  | 0.33   | 0.28  | 0.43  |
| Hebei              | 0.41  | 0.52  | 0.29  | 0.60  | 0.39   | 0.32  | 0.50  |
| Shaanxi            | 0.34  | 0.46  | 0.22  | 0.48  | 0.31   | 0.25  | 0.39  |
| Inner Mongolia     | 0.32  | 0.39  | 0.24  | 0.43  | 0.28   | 0.27  | 0.38  |
| Liaoning           | 0.40  | 0.35  | 0.32  | 0.51  | 0.37   | 0.35  | 0.45  |
| Jilin              | 0.35  | 0.51  | 0.24  | 0.48  | 0.33   | 0.28  | 0.40  |
| Heilongjiang       | 0.31  | 0.28  | 0.22  | 0.46  | 0.29   | 0.25  | 0.39  |
| Shanghai           | 0.54  | 0.63  | 0.39  | 0.70  | 0.53   | 0.44  | 0.62  |
| Jiangsu            | 0.57  | 0.68  | 0.42  | 0.74  | 0.54   | 0.48  | 0.63  |
| Zhejiang           | 0.58  | 0.52  | 0.46  | 0.70  | 0.56   | 0.49  | 0.64  |
| Anhui              | 0.40  | 0.47  | 0.30  | 0.58  | 0.36   | 0.33  | 0.46  |
| Fujian             | 0.55  | 0.51  | 0.46  | 0.72  | 0.50   | 0.49  | 0.61  |
| Jiangxi            | 0.40  | 0.52  | 0.32  | 0.56  | 0.38   | 0.35  | 0.48  |
| Shandong           | 0.49  | 0.40  | 0.35  | 0.64  | 0.45   | 0.38  | 0.55  |
| Henan              | 0.46  | 0.38  | 0.33  | 0.60  | 0.42   | 0.36  | 0.51  |
| Hubei              | 0.48  | 0.42  | 0.39  | 0.63  | 0.45   | 0.42  | 0.55  |
| Hunan              | 0.52  | 0.57  | 0.42  | 0.73  | 0.48   | 0.44  | 0.62  |
| Guangdong          | 0.62  | 0.43  | 0.51  | 0.81  | 0.57   | 0.54  | 0.69  |
| Guangxi            | 0.45  | 0.39  | 0.34  | 0.64  | 0.42   | 0.36  | 0.52  |
| Hainan             | 0.44  | 0.35  | 0.32  | 0.58  | 0.40   | 0.35  | 0.50  |
| Chongqing          | 0.41  | 0.42  | 0.31  | 0.53  | 0.37   | 0.35  | 0.47  |
| Sichuan            | 0.53  | 0.67  | 0.43  | 0.69  | 0.51   | 0.46  | 0.60  |
| Guizhou            | 0.42  | 0.36  | 0.31  | 0.55  | 0.39   | 0.34  | 0.48  |
| Yunnan             | 0.41  | 0.44  | 0.28  | 0.52  | 0.40   | 0.35  | 0.47  |
| Tibet              | 0.22  | 0.31  | 0.12  | 0.39  | 0.19   | 0.15  | 0.30  |
| Shaanxi            | 0.44  | 0.34  | 0.35  | 0.56  | 0.41   | 0.38  | 0.49  |
| Gansu              | 0.37  | 0.30  | 0.26  | 0.54  | 0.35   | 0.28  | 0.47  |
| Qinghai            | 0.21  | 0.17  | 0.14  | 0.39  | 0.18   | 0.16  | 0.29  |
| Ningxia            | 0.20  | 0.15  | 0.12  | 0.36  | 0.17   | 0.14  | 0.30  |
| Xinjiang           | 0.39  | 0.18  | 0.29  | 0.59  | 0.38   | 0.32  | 0.51  |

Figures are in natural logs, while values are in millions of US dollars. 25% and 75% show the lower quartile, or first quartile (Q1), i.e., the value under which 25% of data are found, and the upper quartile, or third quartile (Q3), i.e., the value under which 75% of data found, respectively. Data source: Statista (2020). SD standard deviation

Theoretical Explanations of the Divergence Results

According to the hypothesis of diminishing returns, capital investment flows rely on dynamic firms in the industry to bring revenues and profit rates towards the average for the entire sector. Thus, convergence in hotel revenues was expected. However,
the results signify the absence of such convergence patterns. A potential explanation is found in the argument that although the Chinese hotel industry has experienced significant reforms and attracted substantial private investments, differences still persist across hotels that are in provinces that have attracted foreign hotels, intensifying the competition between the two groups and among provinces where the presence of foreign competition is probably minimal. This results in heterogeneity in terms of performance and in relevance to certain criteria, such as ownership, hotel size, star rating and profits (Li et al., 2006).

Moreover, heterogeneity could be also attributed to the experience the hotels have on the basis of pricing and marketing. Given that the majority of the hotels under consideration are state-dependent firms, their low-price policy leads to low profits, and thus, to the widening performance gap across them (Hsu et al., 2004; Yu & Gu, 2005). Furthermore, convergence cannot occur because the heterogeneity across the hotel industry is intensified by the presence of poor employee service quality (i.e., poor English language ability, poor communication skills) (Kim et al., 2006; Lu & Zhu, 2006).

Finally, another potential explanation for the lack of full convergence comes from the perspective of human resources management, such as difficulties in recruiting the best talents in this sectoral competitive environment (Heffernan et al., 2010; Yang et al., 2015). Then next analysis makes use of specific determinants from the hotel revenue literature to identify potential factors that substantially contributed to the lack of full convergence.

### Table 2  Club Convergence of Hotel Revenues Across Chinese Provinces: 2010 to 2018

| Club             | No. of provinces | $\gamma$   | $t_\gamma$ | speed of convergence: $\frac{\gamma}{2}$ |
|------------------|------------------|------------|------------|-------------------------------------|
| Full Sample      | 31               | -0.184***  | -47.456    | 0.751                               |
| Club 1           | 3                | -1.502     | -0.459     | 0.805                               |
| Club 2           | 4                | -1.609     | -0.448     | 0.693                               |
| Club 3           | 3                | -1.385     | -0.477     | 0.770                               |
| Club 4           | 4                | -1.539     | -0.460     | 0.813                               |
| Club 5           | 6                | -1.625     | -0.489     | 0.673                               |
| Club 6           | 2                | -1.346     | -0.466     | 0.709                               |
| Club 7           | 6                | -1.417     | -0.448     | 0.791                               |
| Non-converging club | 3            |            |            |                                     |

Provinces: Anhui(5), Beijing(2), Chongqing(4), Fujian(7), Gansu(3), Guangdong(7), Guangxi(6), Guizhou(5), Hainan(7), Hebei(2), Heilongjiang(1), Henan(5), Hubei(5), Hunan(5), Inner Mongolia(N), Jiangsu(7), Jiangxi(5), Jilin(1), Liaoning(1), Ningxia(3), Qinghai(3), Shaanxi(4), Shandong(2), Shanghai(7), Shanxi(4), Sichuan(4), Tianjin(2), Tibet(N), Xinjiang(N), Yunnan(6), Zhejiang(7), with the number in parenthesis indicating the club the province belongs, while N in the parenthesis indicates that the province is in the non-converging club. The method includes fixed effects. The critical value $t_{0.05} = -1.65156$ across all cases. Data source: Statista (2020)

*** $p \leq 0.01$

Fisher exact test for independence: [0.00]
Club-merging Tests

Phillips and Sul (2007, 2009) also point out the presence of overestimated findings with respect to the true number of clubs. Therefore, club-merging tests were conducted to determine whether merging adjacent clubs fall into larger clubs. Table 3 clearly documents that by rejecting the null hypothesis of merging, these tests provide no supporting evidence relevant to the merger of the respective convergence clubs.

Mechanisms of Revenues Convergence

This section attempts to explain the above convergence patterns identified by making use of certain mechanisms or drivers associated with the types of products and services provided by the Chinese hotel industry. The analysis follows the resource-based theoretical approach recommended by Jovanovic (1982) and Wernerfelt (1984). According to this approach, certain fundamental drivers of performance and success (e.g., profitability, revenues) of a certain firm rely on internal and external resources, as well as on unique capabilities, i.e., the size of the firm, quality of the employees, number of rooms, innovative methods of management, labor productivity, and general human resources (Ben Aissa & Goaied, 2016; Tan, 2017). The role of drivers in hotel revenues is similar to the operational and financial efficiency approach, where certain factors seem to drive hotel revenues, such as occupancy rate, operational efficiency based on the type of offered services, and productivity (Chiu & Huang, 2011; Chen & Lin, 2012; Skuflic & Mlinaric, 2015).

Based on this discussion, the literature underlines the importance of a number of drivers that dictate the course of hotel revenues, such as the number of stars characterizing each hotel (Danziger et al., 2006; Tarí et al., 2010), the size of the hotel proxied by the number of rooms (Assaf & Cvelbar, 2010; Claver-Cortés et al., 2007, 2010), whether revenues come from rooms or restaurant services (Bertsimas & Shioda, 2003; Kimes, 2005; Kimes & Thompson, 2004), the taxes they pay (Durbarry & Sinclair, 2008; Gooroochum & Sinclair, 2005), labor productivity (Barros, 2005; Sigala, 2004), and the room occupancy rate, which provides the

| Clubs | $\hat{\gamma}$ | $t_\gamma$ |
|-------|----------------|----------|
| Club 1 + Club 2 | -0.068 | -6.69*** |
| Club 2 + Club 3 | -0.072 | -7.14*** |
| Club 3 + Club 4 | -0.059 | -6.58*** |
| Club 4 + Club 5 | -0.073 | -7.69*** |
| Club 5 + Club 6 | -0.060 | -6.82*** |
| Club 6 + Club 7 | -0.075 | -7.86*** |

The critical value $t_{0.05} t_{0.05} = -1.65156$. Data source: Statista (2020)

***$p \leq 0.01$
Homogeneity Tests

Given that the Phillips and Sul convergence method is based on the presence of heterogeneity across the variables under consideration, the presence of heterogeneity through the Pesaran and Yamagata (2008) test was investigated. To explore the presence of heterogeneity before any application of the club clustering method across the potential drivers of hotel revenues, this part follows a two-step strategy. First a simple panel regression of hotel revenues was run against the control variables previously discussed. Next, the residuals from this regression, denoted as $e_{it}$, were used in the second stage to estimate the dynamics of the revenues process within the 31-province group,

$$e_{it} = a_t + \lambda e_{i,t-1} + \sigma_i v_{it}$$

where, within each hotel revenue group, $\lambda$ was assumed to be homogeneous across the different hotel revenues. The goal is to test the validity of the hypothesis that $\lambda = \lambda_i$ for all $i$ in the group. The findings are reported in Table 4. The $p$-values are 0.00, thus, rejecting the null hypothesis of slope homogeneity. In other words, the results clearly document that there is significant heterogeneity across the hotel revenues variables under study.

Online Supplemental Appendix Tables 1 through 7 report the convergence results associated with these potential mechanisms. The findings document patterns similar to those reported in Table 3 with respect to the mechanisms of the number of stars characterizing each hotel, the size of the hotel proxied by the number of rooms, revenues coming from room services (but not from restaurant services), the taxes they pay, and the room occupancy rate which provides the operational dimension of hotel revenues. A different pattern was identified with the mechanism of labor productivity.

Independence Tests

Moreover, the tables provide important information on whether the explored drivers play any role for their convergence into their clubs. This is accomplished through the Fisher’s exact test for independence (Fisher, 1934). Across all tables, the results

| Table 4 | Pesaran and Yamagata Homogeneity Test-Eq. (6): 2010 to 2018 |
|---------|----------------------------------------------------------|
| Statistic: | 28.96 |
| Normal approximation p-value: | [0.00] |
| Bias-corrected bootstrap p-value: | [0.00] |
| $\lambda$ coefficient: | 0.527 |

Data source: Statista (2020)
clearly provide evidence that in all drivers the Fisher exact test for independence is rejected at the 1% significance level, implying that these drivers play a role in the convergence of hotel revenues into the clubs.

Drivers’ Contribution to Convergence: Evidence From Ordered Logit Analysis

To provide further solid evidence about the appropriateness of the drivers used to explain the convergence clubs in hotel revenues, next the clubs were considered as an ordinal variable. More specifically, hotel revenues, the dependent variable, represents the club to which the province belongs. It is possible to order and rank the clubs determined by the Phillips and Sul methodology. To this end, an ordered logit model was used (Fullerton & Xu, 2016) to evaluate the significance of the drivers determining the clubs as previously:

$$y_i^* = X_i b + v_i$$ (7)

where the dependent variable is an ordinal value from 1 to 7 in relevance to the convergence clubs, $X_i$ proxies the set of drivers used previously, and $i = 1, 2, ..., 31$ provinces. The vector $b$ describes the regression coefficients. Table 5 reports the estimated coefficients of the ordered logit model. The findings illustrate that the drivers of the number of stars, number of rooms, revenues from room and restaurant services, room occupancy rate, and labor productivity exert a positive effect on hotel revenues. In contrast, taxes have a negative impact on hotel revenues. The positive estimated coefficients indicate that a one-unit increase in these coefficients increases the likelihood of joining Club 1, moving from Clubs 2, ..., 7, or Club 2 moving from Clubs 3, ..., 7 and so on, with probabilities 0.436, 0.478, 0.413, 0.375, 0.401, and 0.568, respectively.

In terms of taxes, the estimated coefficient highlights that a one-unit increase in taxes decreases the likelihood of joining Club 1, moving from Clubs 2, ..., 7, or Club 2 moving from Clubs 3, ..., 7 and so on, with probability -0.352. The findings

Table 5  Order Logit Estimates Across Hotel Revenue Determinants, Eq. (7): 2010 to 2018

| Variables              | Coefficient | $p$-values |
|------------------------|-------------|------------|
| Number of stars        | 0.436***    | 0.00       |
| Number of rooms        | 0.478**     | 0.00       |
| Revenues from rooms    | 0.413***    | 0.01       |
| Revenues from restaurants | 0.375**   | 0.02       |
| Room occupancy rate    | 0.401***    | 0.00       |
| Hotel revenues taxes   | -0.352**    | 0.03       |
| Labor productivity     | 0.568***    | 0.01       |

Pseudo $R^2 = 0.73$

Fixed effects are included. Data source: Statista (2020)

**$p \leq 0.05$; ***$p \leq 0.01$
are expected to provide certain challenges for both national and local Chinese policymakers in terms of tourism policies and strategies. For instance, local policies concerning the coordination of urban development and transportation construction are expected to provide a boost to the hotel industry through converging patterns of income across provinces characterized by strong income inequality.

In addition, national tax policies may also provide substantial assistance to the hotel industry across the country to narrow the gap in terms of net profits and in a sense decrease potential competitive disadvantages hotels experience in certain provinces. The lack of any convergence pattern in terms of labor productivity probably denotes deficiency issues in relation to the efficient management of human resources (Pine & Qi, 2004). This lack of convergence could also potentially indicate the inability of the hotel industry in certain provinces to find skilled human resources (Zhou et al., 2001).

Conclusion

For the first time in the relevant literature, this paper explored potential convergence patterns for hotel revenues across all 31 Chinese provinces through the club-clustering methodological approach and a unique hotel data set from 23,416 hotels. The empirical results highlighted that the Chinese hotel industry was not integrated in terms of revenues, but certain clubs were determined, mainly based on geographical proximity criteria. Furthermore, the analysis identified particular drivers of hotel revenues that could potentially explain divergent patterns, such as tourism management strategies, types of hotels and tax policies.

The results could have substantial policy implications and promote recommendations for certain stakeholders, such as hotel investors, tourists, regulators, local policymakers and mainly national tourism policymakers. Policy actions relevant to tourism strategies and policies appear to be needed to form national strategies and policies that will eventually increase the intensity of competition, measured by a higher speed of convergence towards long-run average revenues. Nevertheless, there is always the danger that the presence of unexpected shocks occurring in a national industry, such as during the recent pandemic crisis, might induce policy makers to adopt certain policy measures to deal with these crisis events by prioritizing other national (or local) goals, such as export activity and other trade issues, over competition, and thus introduce new barriers by insulating certain parts of the industry from competition.

In addition, the Covid-19 pandemic is expected to lead to a significant decline in hotel revenues, because of the contraction in demand caused by an economic downturn and lockdowns. Based on the analysis in this work, certain policies can help the hotel industry rebound, such as lower taxes and improvement of hotel management policies, which will lead to lower operational costs. Nevertheless, the impact of the pandemic, as well as the economic downturn on an individual province depends on the characteristics of the hotel industry in that province. Certain provinces (or even hotels within the same province) are expected to be more vulnerable to such
conditions than others, depending on whether the drivers identified in the empirical analysis section follow or converge with respect to their mean value.

Given that consumer demands and expectations from the hotel industry change rapidly, they can increasingly highlight the need for hotels to develop strategies that are sufficient to be automatically adapted. Regional and national policymakers should explicitly consider strategies that promote the drivers typically responsible for hotel revenues divergence to converge. Designing such tourism strategies is extremely important for provinces whose economic growth is highly dependent upon resources from the tourism sector.

Finally, the results could be further validated either by expanding the set of determinants of profitability convergence or exploring the validity of the findings with datasets for different, mostly tourist, countries. Given that the findings are based entirely on a single methodological approach, robust alternative methodological approaches are needed to confirm the reported results.

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