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Introduction

The coronavirus (COVID-19) pandemic is expected to drive global economic growth down to -3% (IMF 2020), which will be similar to the figure (-3.2%) produced by the Iraq War and the SARS outbreak in 2003. The most disruptive hospitality player, Airbnb, was hit hard by this crisis. Airbnb has projected that its revenue in 2020 will fall approximately 54% to approximately $2.2 billion due to the global pandemic (Reuters 2020). Due to lockdown restrictions, Airbnb users have shifted from international travelers to entirely domestic travelers; previously, international Airbnb users constituted 80-90% of all Airbnb users in France, the Netherlands, and Denmark (Chadwick, 2020). Researchers have found that the tourism industry, especially international tourism demand, is vulnerable to external crises or disasters, such as political instability, economic conditions, and natural hazards (Cró and Martins 2017).

Compared to other traditional accommodation providers, Airbnb has emerged as a value co-creation platform to connect tourists with local and authentic experiences at a destination (Guttentag 2015). Prior research has found that a close proximity to leisure and hospitality suppliers may influence Airbnb business positively (Lee, Jang, and Kim 2020) or negatively (Zervas, Proserpio, and Byers 2017). The colocation of complementary tourism businesses, so-called tourism clusters (Michael, 2003), creates an overall tourism experience (Gutiérrez et al. 2017). Research also indicates that small tourism businesses such as Airbnb listings are more vulnerable to crisis shocks due to their limited capacities to reduce risk (Zeng, Carter, and De Lacy 2005). Hence, Airbnb's nature of community-based value co-creation suggests the importance of the community's capacity to respond to a crisis/disaster (i.e., community resilience) in terms of the extent to which the community has learned from prior crisis/disaster experiences and has adapted accordingly (Mair, Ritchie, and Walters 2016).

Although abundant research has studied tourism clusters and crisis management, researchers have not considered the pandemic factor when measuring the effect of tourism clusters on Airbnb business performance (Lee et al. 2020) and have focused mainly on crisis management and tourism development for large tourism businesses such as hotels, airlines, and tour companies (Cioccio and Michael 2007). No evidence can be applied to peer-to-peer accommodation markets that have been disrupted by the COVID-19 pandemic. From the Airbnb demand perspective, some travelers may voluntarily implement personal precautionary measures (e.g., social distancing) (Aledort, Lurie, Wasserman, and Bozzette 2007) and further use Airbnb listings during their trip. It is of paramount importance to understand whether and how local resources—tourism clusters and community resilience—play a role in improving Airbnb performance during the pandemic. Furthermore, a combined view of tourism clusters and community resilience must be adopted when measuring the effect of COVID-19 on Airbnb performance. During the ongoing pandemic situation, a focus on the preliminary stage will be essential to help Airbnb listings and local governments not only take short-term remedying actions during this crisis but also build long-term localized resource development planning in advance of future crises.

By going beyond the hypothesized impacts of COVID-19 on the future Airbnb supply and demand (Dolnicar and Zare 2020), this study attempts to empirically examine the spatially heterogeneous (i.e., location-specific) impacts of COVID-19 on Airbnb performance and to offer localized

strategies for managing local resources that are critical for Airbnb-based value cocreation. Specifically, this research investigates how the statistical information on COVID-19 cases and deaths affects (harms to a greater or lesser degree) Airbnb operating performance (i.e., revenue and bookings) across communities and how each community can remedy the pandemic crisis through specializing in a particular tourism industry (i.e., tourism clusters) and the capacity to reduce crisis-induced losses (i.e., community resilience). As an empirical setting, we choose the U.S. state of Florida because it has widespread COVID-19 transmission, explosive Airbnb growth in rural areas (Florida Trend 2018), and an array of natural disasters (FDEM 2020), which have formed different levels of tourism specialization and resilience frameworks across Floridian counties. The findings will allow Airbnb business and policymakers to understand that the heterogeneous characteristics of each community lead to different environments for travelers and Airbnb consumers during the pandemic and to manage local resources to boost a crisis-resilient accommodation-sharing economy.

Literature Review

According to service-dominant logic (Vargo and Lusch 2004), peers with common interests exchange time, space, knowledge, experiences, culture, skills and resources or nonproduct assets on accommodation-sharing platforms (Smaliukiene, Chi-Shiun, and Sizovaite 2015). Although initial studies on the service-dominant logic focused on exchange between two parties (e.g., the Airbnb host-guest relationship), researchers have also emphasized that the venue of value creation should be value configurations (e.g., human and physical resources)—that is, economic and social actors within networks interacting and exchanging between networks (Vargo and Lusch 2008). Value co-creation in the accommodation sharing economy takes place within and between network systems in a coordinated way. The coordination mechanisms need to be reinforced to accompany small tourism businesses (e.g., Airbnb listings) whose services depend on local resources prior to and during the COVID-19 pandemic (OECD 2020). In this study, two types of local resources—tourism clusters (Lee et al., 2020) and community resilience (Williams and Vorley 2014)—are assumed to play a significant role in attenuating the negative impact of the pandemic on Airbnb revenue and demand at a certain destination.

Tourism clusters, which are defined as the specialization of tourism businesses within a particular region, are crucial for the Airbnb business because they provide Airbnb guests with localized tourism experiences (Lee et al. 2020). Research has found that Airbnb hosts offer limited services, so they must rely on other tourism and hospitality services that can be served by a number of different firms (Gutiérrez et al. 2017). Tourism clusters can be classified into two types of tourism industries: leisure businesses (e.g., museums and golf courses) and hospitality businesses (e.g., hotels and restaurants) (Dredge 1999; Lee et al. 2020). Research has indicated that hotels co-located with other tourism businesses perform better than hotels that are less co-located with tourism businesses (Peiró-Signes et al. 2015). Although Lee et al. (2020) studied the importance of tourism clusters on Airbnb performance, whether and how this relationship still holds during the pandemic has not been examined.

Community resilience is defined as "the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis 2010, p. 402). Enhanced resilience enables communities to mitigate vulnerability by reducing losses from unexpected crises or disruptions (Cutter et al. 2008). Empirical research has identified various dimensions of resilience, such as

ecological, social, economic, institutional, infrastructure, and environmental (e.g., Cutter et al. 2008). Among these studies, Cutter, Ash, and Emrich (2014) defined six dimensions of community resilience indicators that adequately capture the multi-attribute nature of inherent disaster resilience. Specifically, social resilience captures the demographic qualities of a community's population (e.g., physical and mental wellness), economic resilience represents community economic vitality, diversity, and equality in compensation, community capital resilience refers to the good will of local citizens to assist their neighbors and fellow citizens during emergencies, housing/infrastructure resilience is the quality of housing construction and disaster-relevant infrastructural capacities, institutional resilience is meant to capture programs, policies, and governance related to disaster resilience, and environmental resilience relates to qualities of the environment that enhance the absorptive capacity of natural disasters. Hence, a resilient community allows small tourism businesses (e.g., Airbnb listings) both to recover from crises and disasters and to show adaptive capacity because they are more flexible, adaptable and innovative than large businesses (Williams and Vorley 2014).

Given that the value co-creation resources within a local Airbnb destination collectively form guests' decisions about Airbnb consumption, it is imperative to investigate whether and how two types of local resources (i.e., tourism clusters and community resilience) play a role in moderating the negative impact of COVID-19 on Airbnb operating performance.

The major lessons learned from the COVID-19 crisis in tourism haven been the importance of community, social connections, and society, which considers the empowerment and well-being of local communities, the so-called community-centered tourism framework suggested by Higgins-Desbiolles et al. (2019). Hence, the impact of COVID-19, tourism clusters, and community resilience on Airbnb performance is expected to vary across communities due to geographic and socioeconomic features. First, regarding the impact of COVID-19, each community requires collective, unified action, such as social distancing. In some communities (e.g., urban areas), social distancing is simply impossible for people who need to move around for work or grocery shopping, and daily travel patterns may be different in other communities (e.g., rural areas) where residents are spread out. According to a recent report (Sharkey 2020), U.S. counties with higher income, more education, and lower rates of unemployment show more social distancing, whereas communities with lower social capital and a greater share of disagreement with global warming show less social distancing. During the SARS crisis, it was found that Chinese rural communities were more significantly impacted because their local households relied on employment in tourism-related businesses or on physical labor efforts in urban areas (Zeng et al. 2005). Therefore, it is important to explore a community-specific impact of COVID-19 on Airbnb performance due to the uneven geography of social distancing, viral infection, and socioeconomic status.

Second, researchers have identified how tourism clusters may shape regional economy and hospitality performance. Traditional accommodation providers (e.g., hotels) co-located with tourism firms outperform those with fewer tourism firms (Peiró-Signes et al. 2015). In the accommodation-sharing economy, a region's tourism business structure and environment support the growth of tourism-related activities and Airbnb listings in that region (Gutiérrez et al. 2017). Recently, it has been found that while the clustering of hospitality businesses (e.g., hotels and restaurants) has a positive impact on Airbnb performance, the relationship between tourism clusters and Airbnb performance has spatial variations across locations (Lee et al. 2020). However, these studies have not considered the outbreak of a crisis/disaster, such as the COVID-19 pandemic.

It is imperative to examine whether and how tourism clusters in the leisure and hospitality industries play a vital role in attenuating COVID-19 disruptions to Airbnb across communities.

Finally, in addition to COVID-19 infection, actions to cope with the virus may impact communities in a disproportionate fashion (Evelyn 2020). It has been noted that more resilient communities are less vulnerable to crises and disasters than less resilient communities (Cutter et al. 2014). Regarding the components of resilience, overall resilience in urban communities is mainly influenced by economic capital, while resilience in rural communities is driven by community capital with a considerable spatial variability (Cutter, Ash, and Emrich 2016). In rural areas, although bonded relationships among small tourism firms may present a rigid outlook when facing various social groups (O'Brien et al. 2005), they tend to provide the rural community with a common identity and increase trust in rural tourism business networks (Kelliher, Reinl, Johnson, and Joppe 2018). However, it is not clear whether crisis-resilient communities enable Airbnb listings to be less disrupted by the pandemic.

These arguments indicate that a one-size-fits-all approach is not appropriate for boosting Airbnb businesses due to the multidimensional nature of community configurations (Cutter et al. 2016). To explore the spatially heterogeneous effects of COVID-19 and local resources (i.e., tourism clusters and community resilience) on Airbnb performance, we employ two approaches—intracommunity effects (within a community) and intercommunity effects (between communities)—because service-dominant logic emphasizes the venue configurations of Airbnb-driven value cocreation (Vargo and Lusch 2008). Specifically, intracommunity effects are explained by a combination of COVID-19 and local resources in one community, which may affect Airbnb performance within the community. For instance, rural areas with fewer COVID-19 cases and deaths, more restaurant businesses, and medium resilience may have fewer cancellations for Airbnb bookings. Intercommunity effects are formed by spatial interactions among neighboring communities in terms of COVID-19 (e.g., virus spread), tourism businesses (e.g., supply and demand spillovers), and crisis resilience (e.g., coordinated resilience programs). Hence, we argue that such spatial spillovers across communities may affect Airbnb performance in a clustered way.

Methodology

The state of Florida was chosen as the empirical study area due to several reasons. First, Florida, as one of the most popular tourism destinations, has shown rapid growth in Airbnb development and performance. More than 60,000 Airbnb listings in Florida received $1.2 billion in rent from 6.6 million guests in 2019 compared to figures in 2018 (45,000 listings, $0.81 billion in rent, 4.5 million guests) and 2017 (40,000 listings, $0.45 billion in rent, 2.7 million guests). Second, the growth rate of Airbnb guests in rural Florida counties has nearly doubled beyond the growth rate in urban counties, indicating that an increasing number of Airbnb users intend to experience rural tourist attractions, not just urban destinations (Florida Trend 2018). Third, Florida has an array of natural disasters (e.g., sea level rise, hurricane, flooding) that regularly affect local residents and visitors (FDEM 2020). Finally, on March 1, 2020, Florida became the 7th U.S. state with a documented COVID-19 case, and within two weeks, public schools and resorts had been closed throughout Florida. Such empirical setting enabled us to examine the intricate relationship between COVID-19 cases and deaths and Airbnb operating performance while considering tourism clusters and community resilience across communities, especially urban and rural areas.

To measure the operating performance of Airbnb listings, revenue and booking data in the last two months (March-April 2020) were used in the empirical model because they are commonly used in Airbnb research (Dogru, Mody, Suess, Line, and Bonn 2020; Lee et al. 2020). Because the focus of this study was on how the extent of the COVID-19 spread in March 2020 affected the growth rate of Airbnb operating performance in April 2020, we calculated the growth rate of Airbnb performance in April 2020 compared with March 2020. Because three datasets (COVID-19, tourism clusters, and community resilience) were collected on a county basis, performance data of individual Airbnb listings acquired from AirDNA were merged into a county level. Finally, the growth rates of the average Airbnb revenue-per-available-listing (RevPAL) and average Airbnb occupancy rate (OCR) for each county were defined as the dependent variables.

Concerning COVID-19, the total number of confirmed cases and deaths in March 2020 for each county was measured, and related data were collected from the Florida Division of Emergency Management (FDEM 2020). One variable (i.e., the total number of cases and deaths) was used instead of two variables (i.e., the number of deaths and the number of cases) because the two variables were highly correlated and future travelers will be affected by the aggregated COVID-19 statistics.

Regarding tourism clusters, two fields—leisure and hospitality—were considered to examine any independent and/or cooperative roles of the leisure and hospitality fields across communities (Hobson and Teaff 1994). The former represents the attraction-related businesses, and the latter represents the service-related businesses (Dredge 1999; Lee et el. 2020). To measure the degree of specialization for a specific leisure or hospitality industry in a community, the location quotient (LQ) was used because it represents the relative agglomeration of the industry in a county in relation to the entire population (Lazzeretti and Capone 2006). The North American Industry Classification System (NAICS) classifies the industries of arts, entertainments, and recreation as NAICS 71 and accommodation and food services as NAICS 72. While NAICS 71 belongs to the leisure industry, NAICS 72 belongs to the hospitality industry (Lee et al. 2020). Finally, due to the absence of LQ in 2020 and the seasonality of tourism employment (Brown and Connelly 1986), the leisure and hospitality LQs for March 2019 were collected and used in the model.

To measure community resilience, the Baseline Resilience Indicators for Communities (BRIC) index was used because other resilience measurements focus mainly on place-specific approaches (e.g., urban or rural) or dimension-specific approaches (e.g., infrastructure sector) (Cutter and Derakhshan 2020). However, the BRIC measurement regards a community as an integrated system that influences crisis/disaster recovery and that consists of six different capitals: social, economic, community, institutional, housing/infrastructural, and environmental capital (Cutter et al. 2014). Finally, the most recent BRIC indexes measured in 2015 were used as the variable of community resilience (Hazards & Vulnerability Research Institute 2019). Although the 2015 data are not matched with the other variables' time period (2020), the BRIC indexes in Florida showed relatively high stability over the 5-year time period (from 2010 to 2015) (Cutter and Derakhshan 2020).

This study controlled three variables of Airbnb density and past Airbnb performance that may influence current Airbnb performance. Airbnb density—the number of Airbnb listings for a given county—has been found to have a positive agglomeration effect on individual Airbnb listings (Xie, Kwok, and Heo 2020). It is worthwhile to identify whether the agglomeration effect can play a critical role in attenuating the negative effect of COVID-19 on Airbnb performance. In addition, two metrics of past Airbnb performance were employed as controls. Research suggests that other

Airbnb users' purchase actions provide an informative signal of quality that encourages potential users to follow the purchase actions of their predecessors, so-called herding behavior (Banerjee 1992). Although herding behavior (i.e., past Airbnb performance) may influence the future demand of Airbnb listings, whether this relationship is still significant during the COVID-19 crisis remains unclear. Table 1 presents the operational definitions and spatial distribution of all variables used in the model.

Table 1. Operationalization of variables and data sources.

Variable	Operational definition	Source
Airbnb RevPAL growth	Monthly percentage change of average Airbnb RevPAL for each county	AirDNA
Airbnb OCR growth	Monthly percentage change of average Airbnb occupancy rate for each county	
Covid-19	Number (in thousands) of Covid-19 cases and deaths for each county	Florida Division of Emergency Management
Leisure clusters	Location quotient of leisure industries (Arts, Entertainment, and Recreation) for each county	U.S. Bureau of Labor Statistics
Hospitality clusters	Location quotient of hospitality industries (Accommodation and Food Services) for each county	
Community resilience	Baseline resilience indicators for communities (BRIC) index for each county	Hazards & Vulnerability Research Institute
Airbnb density	Number (in thousands) of Airbnb listings for each county	AirDNA
Past Airbnb RevPAL	Average Airbnb RevPAL (in thousand dollars) in past month for each county	
Past Airbnb OCR	Average Airbnb occupancy rate in past month for each county	

Note: RevPAL: Revenue per available listing; OCR: Occupancy rate.

Multiple data analyses were conducted to measure both the aspatial and the spatial effects among variables. First, we ran an ordinary least squares (OLS) regression to examine the global relationships among variables. Second, a geographically weighted regression (GWR) was run using the same set of variables for the OLS regression to examine spatial effects among variables. Unlike OLS methods, GWR considers the spatial variation of the relationships between geo-referenced variables, as well as their spatial dependence (Fotheringham, Brunsdon, and Charlton 2000). GWR has been used as an explorative tool to detect spatial variability over the study area in tourism and hospitality research (e.g., Kim, Jang, Kang, and Kim 2020; Lee et al. 2020). The GWR model is shown in Equation (1):

$$\text{Airbnb growth}_i = \beta_{i0}(u_I, v_i) + \beta_{i1}(u_I, v_i)\text{Covid19}_1 + \beta_{i2}(u_I, v_i)\text{Leisure clusters}_2$$
$$+ \beta_{i3}(u_i, v_i)\text{Hospitality clusters}_3 + \beta_{i4}(u_i, v_i)\text{Commuty resilience}_4$$
$$+ \beta_{i5}(u_i, v_i)\text{Airbnb density}_5 + \beta_{i6}(u_i, v_i)\text{Past Airbnb RevPAL}_6$$
$$+ \beta_{i7}(u_i, v_i)\text{Past Airbnb OCR}_7 + \varepsilon_i , \tag{1}$$

where (u_i, v_i) refers to the longitude and the latitude of the county i's centroid and $\beta_{ik}(u_i, v_i)$ is the coefficient for the variable k (k=1,…,7) that varies in each county i. To maximize the GWR model fit, we used a bisquare kernel to calculate the spatial weights because it determines the specific number of neighbors for each county (Fotheringham, Charlton, and Brunsdon 1998) and employed an iterative optimization approach to minimize the corrected Akaike Information

Criteria (AICc). Finally, we mapped local GWR coefficients and local R^2 to visualize the spatially heterogeneous effects of COVID-19, leisure clusters, hospitality clusters, community resilience, and other control variables on Airbnb performance growth. To analyze the spatial data, we employed advanced software programs, such as ArcGIS Pro and GWR (version 4.09).

Results

Tables 2 and 3 present the results of two OLS regression models: Model 1 (DV: Airbnb RevPAL growth) and Model 3 (DV: Airbnb OCR growth). The results reveal that the number of COVID-19 cases and deaths was negatively related to both metrics of Airbnb operating performance, indicating that COVID-19 has disrupted Airbnb revenue and demand. Among the two types of tourism clusters, leisure clusters had a negative impact on the two Airbnb performance metrics, whereas hospitality clusters had no impact. This result implies that a higher dependence on leisure-related businesses and their employment caused more serious damage to Airbnb performance during the COVID-19 crisis than lower dependence. Interestingly, community resilience had a strong positive impact on Airbnb revenue and demand, indicating the importance of community resilience during the pandemic. In addition, the agglomeration of Airbnb listings had a positive impact on Airbnb revenue performance but had no significant impact on Airbnb booking performance. Finally, past Airbnb performance had no impact on future performance. These findings indicate that although, overall, Airbnb business experienced losses from the COVID-19 outbreak, more dependence on leisure businesses accelerated the losses, but greater community resilience attenuated the negative impact of COVID-19.

Table 2. Estimation of OLS and GWR models (DV: Airbnb RevPAL growth).

Variable	OLS (Model 1)	GWR (Model 2)		
		Min	Mean	Max
Covid-19	-0.174**	-0.193	-0.181	-0.170
Leisure clusters	-0.035*	-0.039	-0.034	-0.029
Hospitality clusters	0.029	0.019	0.034	0.045
Community resilience	0.535**	0.468	0.499	0.603
Airbnb density	0.004*	0.003	0.004	0.005
Past Airbnb RevPAL	-0.020	-0.029	-0.024	-0.011
Past Airbnb OCR	-0.087	-0.124	-0.077	-0.052
Intercept	-1.778**	-1.957	-1.685	-1.605
R^2	0.286	0.288	0.297	0.312
Condition Number		6.231	11.365	23.486

Table 3. Estimation of OLS and GWR models (DV: Airbnb OCR growth).

Variable	OLS (Model 3)	GWR (Model 4)		
		Min	Mean	Max
Covid-19	-0.132**	-0.156	-0.136	-0.118
Leisure clusters	-0.042**	-0.047	-0.040	-0.033
Hospitality clusters	-0.009	-0.016	-0.008	-0.002
Community resilience	0.579**	0.499	0.554	0.631
Airbnb density	0.002	0.002	0.002	0.002

Past Airbnb RevPAL	-0.020	-0.031	-0.024	-0.012
Past Airbnb OCR	-0.107	-0.227	-0.086	0.052
Intercept	-1.721**	-1.810	-1.661	-1.574
R^2	0.235	0.235	0.247	0.256
Condition Number		5.547	10.216	21.975

The GWR results show that local coefficients of independent variables varied across Florida counties. Specifically, Model 2 reports that the number of COVID-19 cases and deaths, on average, was negatively related to Airbnb RevPAL growth ($\beta_{\text{Model 2 Mean}}$= -0.181), but depending on the county, the negative impact was larger ($\beta_{\text{Model 2 Min}}$= -0.193) or smaller ($\beta_{\text{Model 2 Max}}$= -0.170). Similar phenomena existed for the Airbnb OCR growth variable (Model 4), which ranged from -0.156 to -0.118 ($\beta_{\text{Model 4 Mean}}$= -0.136). To provide a better understanding of the coefficient heterogeneity, Figs. 1 and 2 map the spatial distribution of local GWR coefficients for seven variables across counties in the Airbnb RevPAL growth model and the Airbnb OCR growth model, respectively. Specifically, COVID-19 had a more negative impact on the RevPAL and OCR performance of Airbnb businesses located in northwest Floridian (dark-colored) counties than in south Floridian (light-colored) counties.
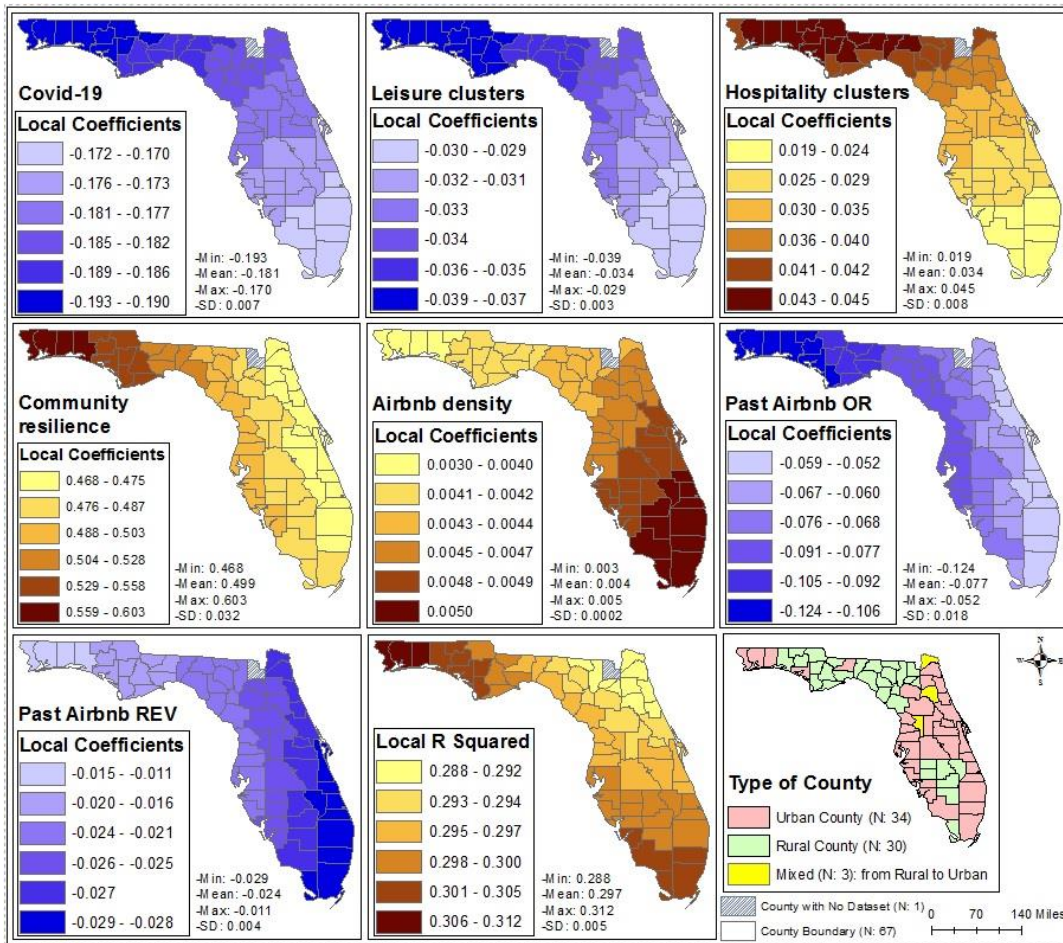
Fig. 1. Spatial distribution of local GWR coefficients in Airbnb RevPAL growth model.
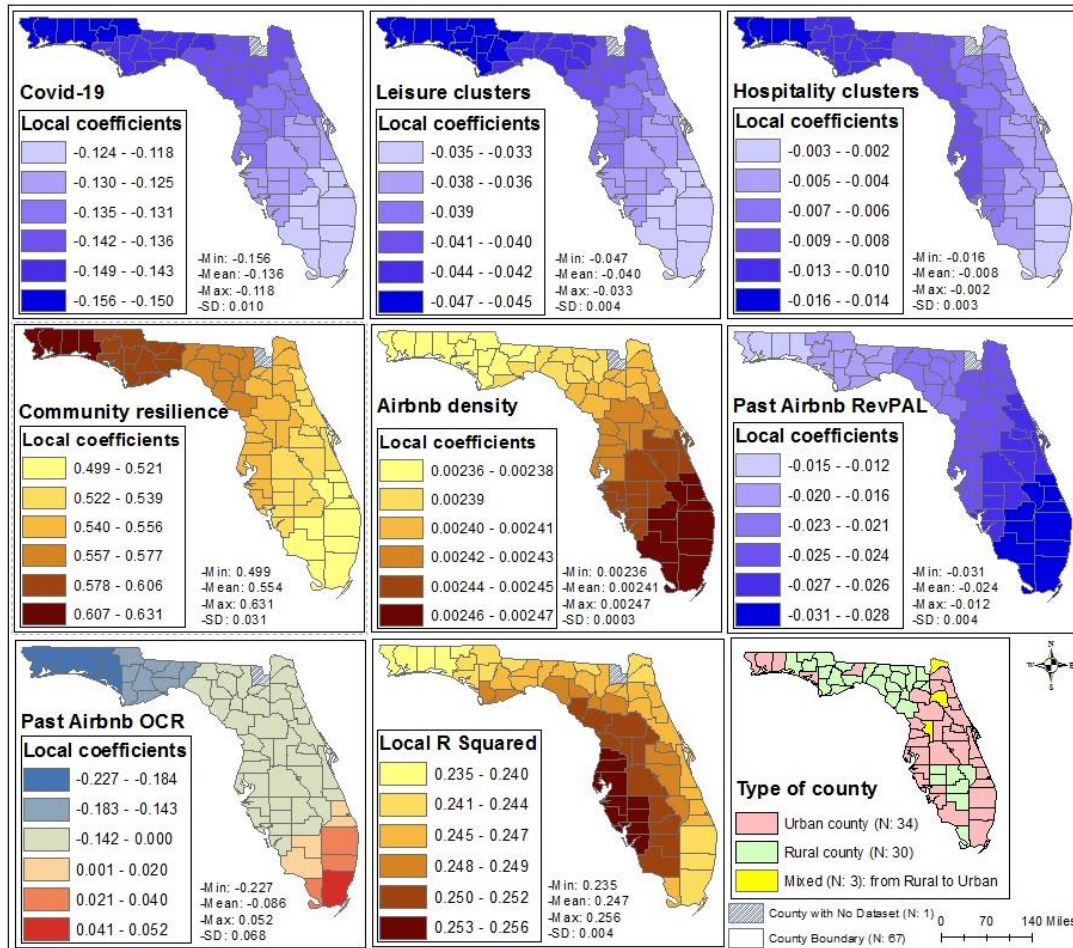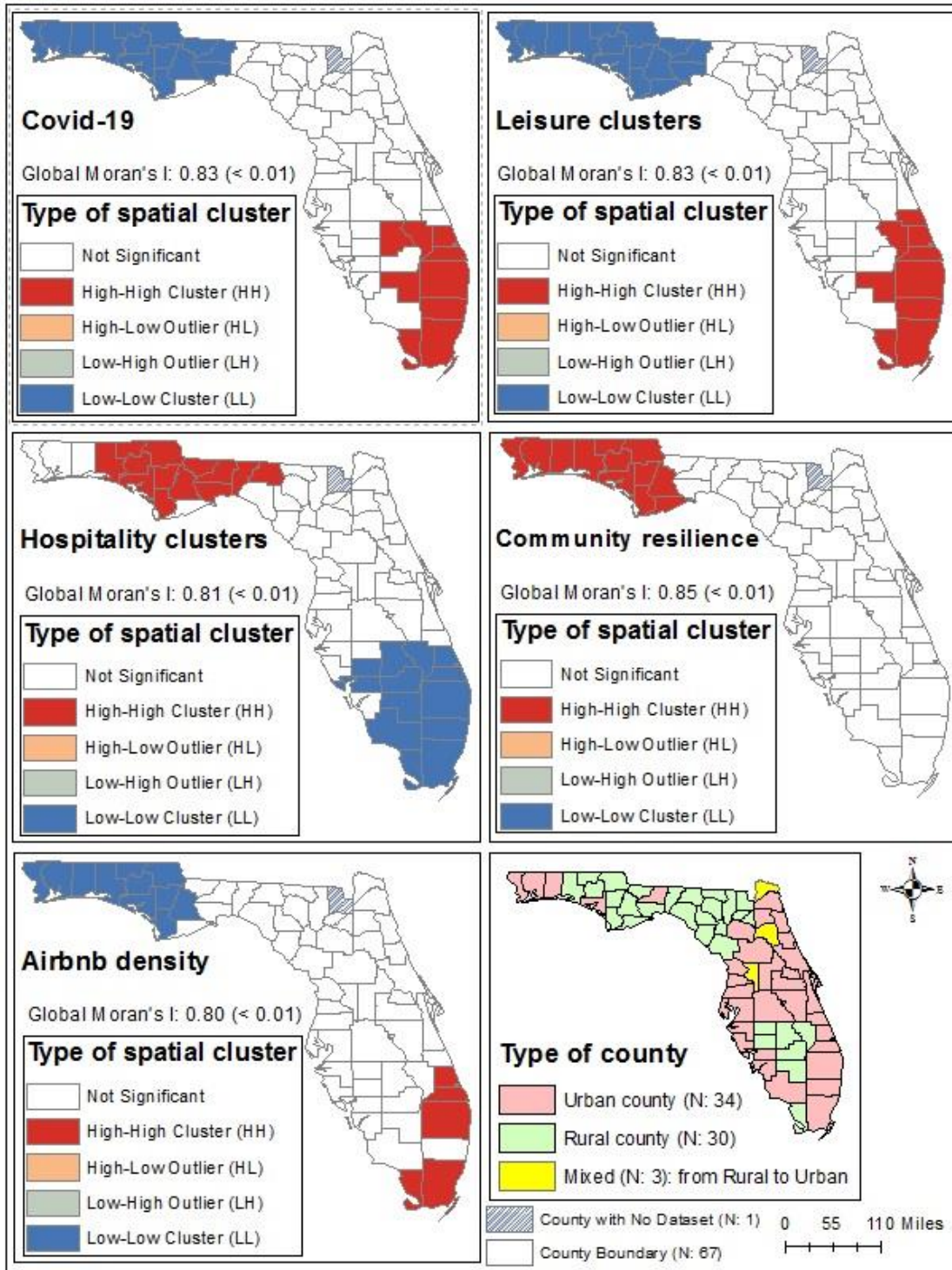
Fig. 2. Spatial distribution of local GWR coefficients in Airbnb OCR growth model.

From the perspective of tourism clusters, the results indicate the existence of spatial variations in local GWR coefficients of two variables, leisure clusters and hospitality clusters. It reveals that the relationship between tourism clusters and Airbnb business performance varies across counties. Specifically, the Airbnb revenue performance of northwest Floridian counties was affected negatively by the clustering of leisure businesses but positively by the clustering of hospitality businesses (Fig. 1), whereas their occupancy rate performance was negatively affected by the clustering of both leisure and hospitality businesses (Fig. 2). This implies that Airbnb listings in rural counties with a high specialization in leisure businesses (e.g., entertainment and recreation) may have been disrupted immediately by the COVID-19-induced lockdown, although the clustering of hospitality (e.g., hotel and restaurant) businesses could attenuate the negative impact of COVID-19 on Airbnb revenue performance in some counties.

In contrast to tourism clusters that had mixed effects, community resilience had a significant positive effect on both the revenue and the occupancy rate performance of Airbnb listings. While community resilience played a moderate role in Airbnb listings located in south (urban) Floridian counties, it also played a significant role in northwest (both urban and rural) counties (Figs. 1-2). These results indicate that, from the perspective of Airbnb performance, some communities that rely heavily on leisure clusters are vulnerable to external shocks, such as the COVID-19 pandemic, but may reduce this disruption with greater community resilience.

Additional results related to the control variables show that Airbnb listings located in south Florida benefitted from the agglomeration of Airbnb listings and the past Airbnb occupancy rate but not from the past Airbnb revenue, whereas the opposite phenomena occurred in the Airbnb listings in northwest Florida. In addition, the results show that compared to the OLS regression, the GWR improved the overall explanatory power of the Airbnb performance model, and the local R^2 values varied across counties. Interestingly, the Airbnb RevPAL growth model performed better in northwest and south Floridian (dark-colored) counties (Fig. 1), but the Airbnb OCR growth model fit better in west Floridian counties (Fig. 2). These results imply that the effect of COVID-19 and local resources on Airbnb performance varies across communities, confirming the existence of intracommunity spatial effects in the model.

Based on the obtained local coefficients, an application study to explore the clustering of large or small local coefficients was performed. Figs. 3-4 illustrate two types of coefficient clusters—hot spots (i.e., the clustering of high-high coefficients) and cold spots (the clustering of low-low coefficients)—across variables. Specifically, COVID-19 and leisure clusters had more disruptive effects on Airbnb performance in northwest (blue-colored) counties that comprise both urban and rural areas but less disruptive effects in southeast (red-colored) counties comprising urban areas (Fig. 3). In contrast, the clustering of hospitality businesses had mixed effects depending on the type of performance and the type of county: a hot spot (red-colored, rural areas) for revenue performance (Fig. 3) and a cold spot (blue-colored, urban and rural areas) for occupancy rate performance (Fig. 4). Interestingly, Airbnb listings located in the clustered region of northwest counties benefitted from greater community resilience, whereas those in the clustered region of southern counties benefitted from greater Airbnb density. These results show the existence of spillovers of similar (high-high vs. low-low) local coefficients across communities, indicating the existence of "intercommunity spatial effects" in the Airbnb performance model.

Fig. 3. Spatial distribution of clustered local GWR coefficients in Airbnb RevPAL model.
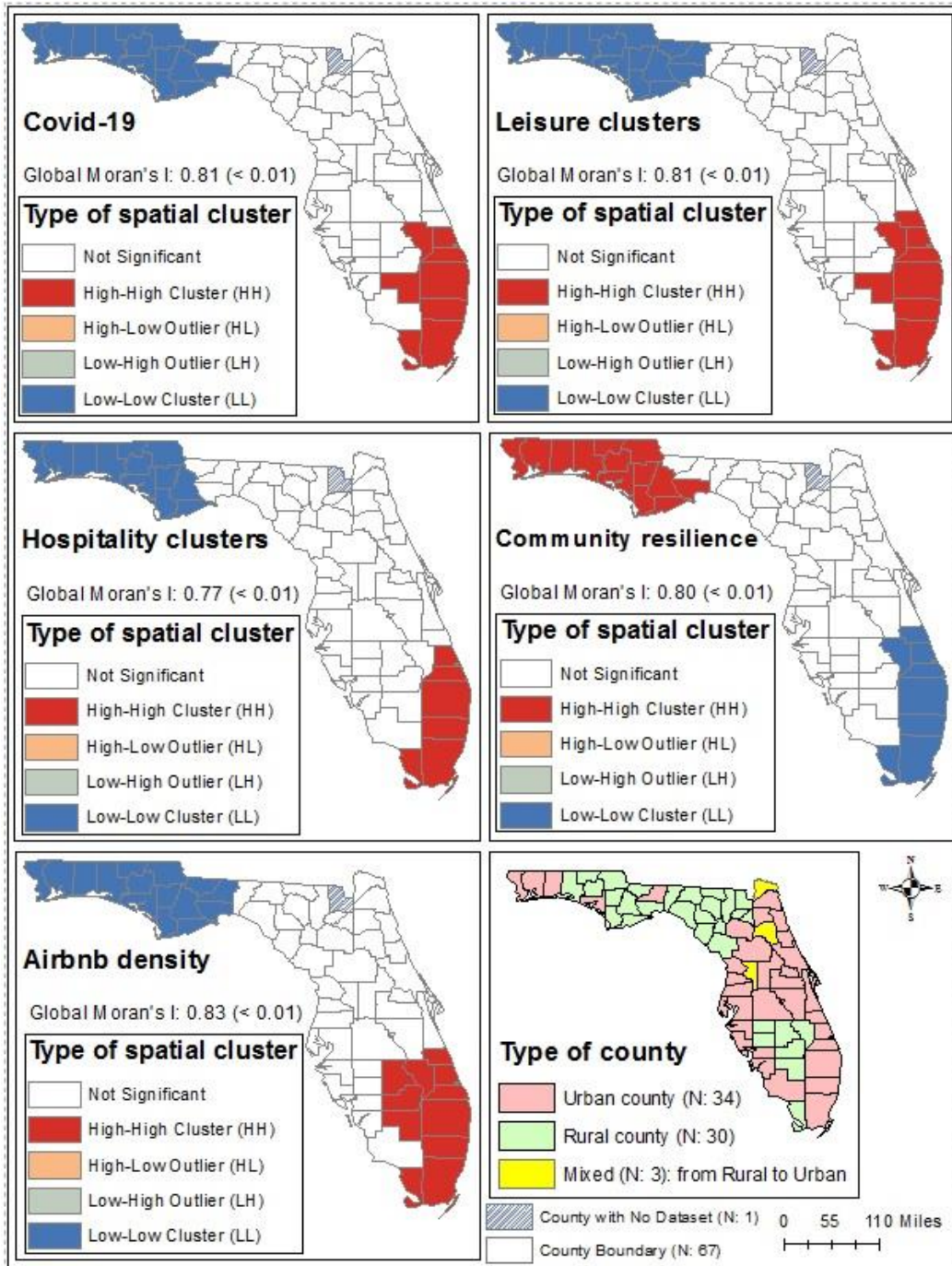
Fig. 4. Spatial distribution of clustered local GWR coefficients in Airbnb OCR model.

Conclusion and Discussion

COVID-19 has heavily hit the tourism and lodging industry, especially small tourism businesses such as Airbnb listings that are vulnerable to crises and disasters. Using combined data on Airbnb performance, COVID-19, and local resources in 67 Florida counties over the months of 2020, this study used spatial econometric models and GIS techniques and further examined the spatially varying effects of COVID-19, leisure clusters, hospitality clusters, and community resilience on

the growth rates of Airbnb revenue (i.e., RevPAL) and booking (i.e., OCR) performance. Overall, our findings reveal that COVID-19 had negative impacts on two performance metrics across counties—more negative in rural areas and less negative in urban areas. Our results of tourism clusters indicate that Airbnb listings in rural counties with a high specialization of leisure businesses were more disrupted by COVID-19; they were less disrupted when they specialized in hospitality businesses, implying the existence of different roles of the clustering of each tourism industry (i.e., diseconomies and economies of agglomeration effect) in terms of moderating the negative impacts of COVID-19. Finally, the findings demonstrated that community resilience played a significant role as a local resource in attenuating the negative impact of COVID-19 on Airbnb operating performance with greater significance in rural areas than urban areas.

Our study contributes to the literature on peer-to-peer accommodation and tourism crisis management by empirically investigating the spatially varying relationship between COVID-19 and Airbnb performance with consideration of two types of local resources (i.e., tourism clusters and community resilience). First, our study reveals the importance of the "community-centered tourism framework" (Higgins-Desbiolles et al. 2019) to understand heterogeneous Airbnb business disruptions, harnessing the well-being of local communities, and preparing for a future pandemic crisis. Specifically, we identified an urban and rural divide in terms of the COVID-19 shock to the Airbnb business (i.e., more shocks to rural Airbnb listings). This finding is aligned with prior research on the SARS crisis in China showing that due to heavy reliance on tourism businesses, the economy of rural communities was hurt more significantly than that of urban communities (Zeng et al. 2005). The reason for less Airbnb losses in urban areas can be explained by the purpose of a trip (e.g., business purposes in cities and leisure purposes in towns). A recent study has shown that business travelers' intentions to use an Airbnb listing during the pandemic are higher than those of leisure-oriented travelers (Jang, Kim, Kim, and Kim 2021).

Second, this study offers evidence for the spatial variations of tourism specialization on Airbnb business during the COVID-19 pandemic, thereby extending the tourism cluster theory (Michael 2003). The empirical results suggest that although a region's tourism clusters positively shaped the overall experience for Airbnb consumers before the pandemic (Gutiérrez et al. 2017; Lee et al. 2020), Airbnb revenue in certain areas (e.g., northwest Florida) during the pandemic was affected negatively by the specialization of or overdependence on leisure businesses ("agglomeration diseconomies") but was affected positively by the clustering of hospitality businesses ("agglomeration economies"). This interesting case may arise because Airbnb listings benefit from reinforcing the agglomeration economies of similar firms (e.g., hotels and restaurants) and the agglomeration diseconomies of different firms (e.g., museums and parks) under the COVID-19-induced business lockdown (Parr 2002).

Third, this study maintains the importance of community resilience for the Airbnb business to cope with a crisis or disaster regardless of the type of community (i.e., urban vs. rural). This finding can be explained by the heterogeneous drivers of crisis resilience—that is, economic capital in urban areas and community capital in rural areas (Cutter et al. 2016). In the northwest Florida region where both economies and diseconomies of tourism specialization exist, community resilience played a critical role in attenuating the negative impact of COVID-19 on Airbnb performance. This finding suggests that each region needs to have a localized and combinative approach when preparing and planning these two types of local resources (i.e., tourism clusters and community resilience).

Finally, the results of community-specific Airbnb disruptions resonate with research showing that peer-to-peer accommodation markets are affected by COVID-19 and local resources within a community ("intracommunity effects") and across neighboring communities ("intercommunity effects"). This finding is particularly important for Airbnb businesses because Airbnb-driven value co-creation occurs in the venue configuration where Airbnb guests have overall tourism experiences in a certain destination (Vargo and Lusch 2008). Furthermore, our findings underscore the location advantage in that Airbnb performance during the pandemic is affected not only by community-specific local resources but also by (positive or negative) spatial spillovers across neighboring communities (Lee et al. 2020; Yang and Fik 2014).

Our empirical findings offer practical insights for stakeholders in the peer-to-peer accommodation economy. Specifically, this research suggests that Airbnb listings need to take full advantage of two types of local resources in their own counties to attenuate the negative impact of COVID-19 on their revenue and booking performance. Airbnb hosts are encouraged to conduct a detailed analysis of the specialized tourism clusters (e.g., leisure and hospitality) and the drivers of community resilience (e.g., economic capital and social capital), which generate agglomeration (dis)economies and crisis management capacity, respectively, and reflect these components in their during- or post-COVID-19 marketing activities. For example, Airbnb hosts in rural areas need to utilize the agglomeration economies of hospitality industries (e.g., hotels and restaurants) and specific resilience factor(s) in their destinations in terms of product offerings and communication messages to potential guests. In addition, urban Airbnb hosts could target business travelers or "bleisure" travelers who combine leisure motivations with work obligations (Lichy and McLeay 2018) because business-oriented travelers will more voluntarily implement personal measures to avoid viral infection for a trip to cities than leisure travelers (Jang et al. 2020).

From a policy perspective, the local government should take a place-based approach to cope with the current pandemic crisis and prepare for a future crisis because a one-size-fits-all strategy cannot reflect the multidimensional nature of community configurations (Cutter et al. 2016). Depending on the geographical features of individual and neighboring communities, policymakers need to understand how a combination of COVID-19, leisure clusters, hospitality clusters, community resilience, Airbnb density, and other factors attenuates the negative impact of COVID-19 on the Airbnb business across communities. Our empirical findings (Table 4) report Florida county-specific remedies for Airbnb COVID-19 disruptions. For example, Calhoun County, which is in a rural area, could leverage the advantage of hospitality clusters and community resilience to improve Airbnb revenue performance during the pandemic. Notably, the reason that Airbnb listings in Hendry County showed sound booking performance despite high COVID-19 statistics could be explained by the agglomeration economies of leisure businesses and Airbnb listings in that county. In addition, information on Miami-Dade County (i.e., the most populated county in Florida) suggests that although COVID-19 cases and deaths increased, business travelers continued to book Airbnb accommodation due to the agglomeration of leisure and hospitality businesses and the density of Airbnb listings in that county. As such, local government agents can provide Airbnb hosts community-specific marketing support to by communicating the advantages of local resources to domestic tourists when the lockdown is lifted. In the long run, policymakers should plan localized tourism industry promotions that are aligned with resilient Airbnb business management during the pandemic.

Table 4. Distribution of county-specific variables for remedying strategies ("hot spot").

Type	Name	DV: Airbnb RevPAL growth rate				
		Covid-19	Leisure clusters	Hospitality clusters	Community resilience	Airbnb density
Rural	Calhoun			◉	~	
	Franklin				~	
	Gadsden			◉		
	Glades					
	Gulf			◉	~	
	Hendry	▣	●			
	Highlands	▣				
	Holmes			◉	~	
	Jackson			◉	~	
	Jefferson			◉		
	Liberty			◉	~	
	Madison			◉		
	Monroe	▣	●			○
	Okeechobee	▣	●			
	Wakulla			◉		
	Walton			◉	~	
	Washington			◉	~	
Urban	Bay			◉	~	
	Escambia				~	
	Indian River		●			
	Leon			◉		
	Okaloosa				~	
	Broward	▣	●			
	Martin	▣	●			○
	Miami-Dade	▣	●			○
	Palm Beach	▣	●			○
	St. Lucie	▣	●			○
Number of counties		9	9	13	11	5

Although the findings are insightful, there are several study limitations. First, because the empirical models are specific to the population of Floridian Airbnb listings, the findings of this study cannot be applied to other regions and countries. Future research can resolve the applicability issue by collecting and analyzing the empirical data, related to Airbnb performance, tourism clusters, and community resilience, from other study areas. Second, this research focused on the early stage of the COVID-19 crisis and fails to capture how the relationship between COVID-19 and Airbnb business performance evolved over the period. Future studies can resolve this limitation by collecting longitudinal data over the pandemic lifecycle. Finally, due to a multicollinearity issue among variables, this study did not decompose tourism clusters and community resilience into detailed components. For instance, the leisure industry comprises the subindustries of art, entertainment, and recreation (Lee et al. 2020), and community resilience consists of social, economic, community capital, housing/infrastructure, institutional, and

environmental dimensions (Cutter et al. 2014). By using advanced modeling techniques, future studies can use decomposed resource components to explain what specific set of local resources leads to better Airbnb performance during the pandemic.

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