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A mis padres y a mi hermanita

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Abstract in English

This doctoral dissertation is divided into three chapters. All of them deal with aspects related to the the impact of tourism on urban areas, but each one has a distinct topic and puts its focus on a specific standpoint.

The effect of Short-Term Rental on Local Consumption Amenities: Evidence from Madrid This paper examines the impact of the arrival of Airbnb on local consumption amenities in Madrid. We exploit the exogenous variation created by the timing and uneven distribution of Airbnb listings in the city to determine the impact on food and beverage establishments. Using an instrumental variable strategy, we find positive local effects on both the number of restaurants and their employees: an increase of fourteen Airbnb rooms in a given census tract leads to almost one more restaurant, and the same increase in a given neighborhood generates eleven new tourist-related employees. The results are robust to the specification and sample composition. This paper contributes to the literature on the economic impact of the platform economy on urban areas by providing evidence of market expansion externalities from short-term rentals. This paper has been published in the Journal of Regional Science.

When Local Business Faded Away: The Uneven Impact of Airbnb on the Geography of Economic Activities This paper investigates the unequal effect of Airbnb on the spatial organisation of economic activity in Madrid, Spain. Using establishment-level data from Madrid City Council and consumer-facing information from this short-term rental company, we find that Airbnb reshapes the urban space by encouraging tourist-oriented businesses, defined as businesses where tourists spend more than locals, at the expense of businesses primarily oriented to locals. These findings prove that short-term rentals do displace not only the local population but also resident-oriented businesses. Eventually, we show that our results are not driven by the method of measuring digital accommodation activity, other touristic actors, and confounders related to gentrification and the rise of online purchasing. This paper has been published in the Cambridge Journal of Regions, Economy and Society.

Your Room is Ready: Tourism and Urban Revival Tourism is an essential sector of the global economy, contributing significantly to GDP and employment. Despite its importance, our understanding of its impact on urban economic activity remains limited. This paper aims to fill this

gap by examining the impact of tourism on urban transformation using a dataset of hotel openings in Madrid from 2001-2010. I show that hotel openings positively impact the number of establishments and employment by using the number of protected buildings as an instrumental variable to account for the non-random distribution of hotel openings. Interestingly, hotel openings contribute to changes in the composition of the economic activities and the business structures, enhancing tourist-oriented corporate-owned businesses over other individual-owned companies. Finally, economic effects extend to the real estate market, increasing rental prices and residential investment. This paper is a solo coauthor paper and my Job Market Paper.

Abstract in Spanish

Esta tesis doctoral se divide en tres capítulos. Cada uno aborda diferentes aspectos del impacto del turismo en zonas urbanas, enfocándose en temas específicos desde distintas perspectivas.

El Efecto del Alquiler a Corto Plazo en las Comodidades de Consumo Local: Evidencia de Madrid Este estudio analiza el impacto de la llegada de Airbnb en las "consumption amenities" en Madrid. Se utiliza la variación exógena generada por la aparición y distribución irregular de los anuncios de Airbnb en la ciudad para evaluar su impacto en establecimientos de comida y bebida. Mediante una estrategia de variable instrumental, se observan efectos locales positivos en la cantidad de restaurantes y empleados: un incremento de catorce habitaciones de Airbnb en un sector censal determinado lleva a la apertura de casi un restaurante adicional, y el mismo aumento en un barrio genera once empleados turísticos nuevos. Los resultados son consistentes en diferentes especificaciones y muestras. Este artículo aporta a la literatura sobre el impacto económico de las plataformas digitales en zonas urbanas, demostrando externalidades de expansión de mercado de los alquileres a corto plazo. Publicado en el *Journal of Regional Science*.

Cuando el Negocio Local Desapareció: El Impacto Desigual de Airbnb en la Geografía de las Actividades Económicas Este artículo explora el efecto desigual de Airbnb en la organización espacial de la actividad económica en Madrid, España. Usando datos a nivel de establecimiento del Ayuntamiento de Madrid e información de Airbnb, se encuentra que Airbnb promueve negocios orientados al turismo, en detrimento de aquellos orientados a residentes locales. Estos hallazgos sugieren que los alquileres a corto plazo desplazan tanto a la población local como a negocios dirigidos a ellos. Los resultados se mantienen al controlar por otras variables como la actividad digital de alojamiento, otros actores turísticos y factores asociados a la gentrificación y el aumento de compras en línea. Publicado en el *Cambridge Journal of Regions, Economy and Society*.

Tu Habitación Está Lista: Turismo y Revitalización Urbana Este trabajo aborda la importancia del turismo en la economía global y su impacto en la actividad económica urbana. Mediante un análisis de aperturas de hoteles en Madrid entre 2001 y 2010, se demuestra que estas inciden positivamente en el número de establecimientos y empleo, utilizando

el número de edificios protegidos como variable instrumental para la distribución no aleatoria de las aperturas de hoteles. Las aperturas de hoteles favorecen a negocios orientados al turismo y afectan la estructura empresarial, fomentando empresas corporativas sobre individuales. Además, influyen en el mercado inmobiliario, aumentando los precios de alquiler e inversión residencial. Este artículo es una coautoría individual y constituye mi trabajo principal para el mercado laboral.

Introduction

Tourism is a major contributor to the global economy, accounting for approximately 10% of the worldwide GDP and employment figures, as highlighted by (World Travel Tourism Council, 2019). This sector is a key economic force, overshadowing established industries, including construction, transport, and information and communication.[1] As per WTO (2019), the number of international tourists leaped from 400 million in 1990 to 1.5 billion in 2019, with a significant increase in urban tourism. Factors such as the rise of short-term rental platforms like Airbnb and the growth of the hotel industry are key to this expansion.

However, economics has often disregarded thorough research in this field. In the past, tourism has been a concern only to certain countries and within the countries only to certain areas. However, the recent tourism boom, mainly driven by cities due to increasing global urbanization and improved transport connections, has raised numerous concerns about the economic impact of this activity. Only a handful of studies have delved into understanding the effects of tourism from a regional standpoint (Kadiyali and Kosová, 2013; Lanzara and Minerva, 2019; Faber and Gaubert, 2019; González, Surovtseva, et al., 2020; Favero and Malisan, 2021; Nocito, Sartarelli, and Sobbrio, 2023). The collective findings from these studies consistently highlight that tourism is associated with several economic benefits at the regional level. These benefits include increased income and higher levels of employment, specifically within the tourism sector. Additionally, there is a notable rise in overall spending

[1] To elaborate, the construction industry accounts for 6.2%, transport equipment for 1.3%, and information and communications for 3.2%. These statistics are derived from the EUKLEMS-INTRANPROD database (February 2023 release), reflecting data from 2019, just before the COVID-19 pandemic, and encompassing 30 countries (`https://euklems-intanprod-llee.luiss.it/`).

and an expansion in the number of businesses operating in the region.

However, it was not until the short-term rental disruption led by Airbnb that academics started to fully understand the economic impacts of tourism flows. In this regard, the emergence of short-term tourist rentals has caused a significant upheaval in the real estate market, primarily due to the shift from long-term to short-term rentals. The transition of properties from long-term to short-term rentals, influenced by platform accommodation companies like Airbnb, has contributed to an upward trend in housing rental prices. In parallel, the growth in house prices can be partly explained by the added benefit of owning a home that can potentially be used for short-term rentals, along with the reflection of these higher rental prices in the overall value of the property (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021; Batalha et al., 2022). Moreover, the influence of home-sharing platforms extends well beyond the housing market, creating a multifaceted impact on various sectors. These platforms have been found to adversely affect the traditional accommodation sector, as evidenced by studies like Zervas, Proserpio, and Byers (2017) and Li and Srinivasan (2019), which highlight a decline in performance for conventional lodging options. Additionally, issues like tax evasion have been brought to the forefront, as discussed in Garz and Schneider (2023). However, the presence of these platforms isn't solely negative. They have contributed to a more varied range of accommodation options, especially beneficial during periods of high demand when hotels are often at full capacity. This diversification has the potential to lower prices, offering more choices to consumers, as explored in the works of Farronato and Fradkin (2022) and Schaefer and Tran (2021).

However, little is known about the potential effect of tourist flows on the urban landscape. Tourists and residents exhibit distinct consumption habits, influencing local economies in different ways. The replacement of long-term residents with short-term ones, primarily due to the conversion of residential facilities into lodging accommodations, leads to an increased demand that particularly affects local stores. This surge in short-term residency can trigger growth in the local market, enhancing the demand for nearby consumption amenities like restaurants and retail services. Tourists generally spend more in these establishments than local residents (Meltzer and Schuetz, 2012; Meltzer and Capperis, 2017; Allen et al., 2020; Aparicio et al., 2021). However, this increase in tourist-related

establishments may come at the expense of other businesses, making the overall economic impact on the local economy ambiguous. Moreover, the impact of tourism on urban areas may change not only the composition of economic activities but also the business structures as the land appreciations may expel individual-owned businesses as they no longer can afford to pay higher commercial rents. Additionally, the unequal spread of tourism across a city alters the distribution of tourism's economic effects. This shift in lodging preferences may extend the economic advantages of tourism beyond the usual tourist areas.

With the aim to answer these research questions and to understand the effects of tourism on the economic landscape, this thesis uses the case of Madrid as a case of study. By focusing on this city, these papers provide insights that are both locally grounded and globally relevant, reflecting the city's role as a scenario for larger trends. The studies presented here aim to contribute to a more informed and balanced public debate, providing empirical evidence and thoughtful analysis to better understand the role of tourism and platform economies in urban economic landscapes.

The first paper of this thesis explores the impact of Airbnb, a leader in the short-term rental market, on local consumption amenities in Madrid during the period 2014-2019 (This paper was written together Massimo Riccaboni and Francisco J. Velazquez and has been published in the Journal of Regional Science with the title "The Effect of Short-Term Rentals on Local Consumption Amenities: Evidence from Madrid"). From the seminal paper of Glaeser, Kolko, and Saiz (2001), several studies have identified how changes in local demand affect the economic landscape of cities (Card, Mas, and Rothstein, 2008; Guerrieri, Hartley, and Hurst, 2013; Diamond, 2016; Behrens et al., 2022; Lanzara and Minerva, 2019). While previous studies have identified the influx of young, highly skilled individuals as a pivotal factor influencing urban transformations (Baum-Snow and Hartley, 2020; Couture and Handbury, 2020a; Moreno-Maldonado and Santamaria, 2021; Curci and Yousaf, 2022), this study shifts the focus to the role of Airbnb-driven tourism in the development of the 'consumption city'. It examines how the increase in tourism, prompted by short-term rentals, fosters the growth of consumption amenities using the census tract as the main geography and the 2014-2019 period as the time frame.

Addressing the challenge of Airbnb's non-random distribution across the city, this chapter introduces an innovative identification strategy to discern Airbnb's causal impact on local consumption amenities. Specifically, it employs a shift-share instrument, which combines the pre-Airbnb ratio of rental houses in each census tract (share) with the global trend in Airbnb searches on Google (shift). The spread of Airbnb within distinct areas is influenced by the local availability of housing suitable for short-term rental conversion. This growth is not uniform; it varies over time and across different census tracts, primarily due to the housing supply within each tract, a factor often determined by historical developments. These disparities in local housing supply lead to varying degrees of Airbnb market penetration across census tracts. This study leverages the differential growth rates of short-term rentals in census tracts to assess their impact on food and beverage establishments. By doing so, it provides insights into how Airbnb's expansion affects these specific types of local businesses.

The main findings reveal a significant influence of Airbnb on the proliferation of food and beverage establishments and employment in that sector, reflecting a broader market expansion effect triggered by the platform economy. The study underscores how a seemingly modest increase in Airbnb rooms can lead to substantial growth in both the number of local restaurants and tourism-related employment, reshaping the urban economic landscape in profound ways.

A key limitation identified in the preceding chapter is the unclear displacement effect of new establishments fostered by Airbnb on various economic activity types. Given the distinct consumption patterns of residents and tourists, Airbnb might disproportionately affect different economic sectors. To explore this hypothesis, the second chapter delves into Airbnb's varied impact on the spatial economic organization in Madrid. This work was written together Massimo Riccaboni and Francisco J. Velazquez and published in the "Cambridge Journal of Regions, Economy and Society" under the title "When Local Business Faded Away: The Uneven Impact of Airbnb on the Geography of Economic Activities", employs business premises in Madrid from 2014 to 2019 as the observational unit.

Specifically, the study uses linear probability models to examine if the surge in nearby short-term rental units influences business demo-

graphics, including openings, closures, and transitions (activity changes within premises) during this period. This approach allows for a more nuanced understanding of how Airbnb may be influencing business dynamics across different economic activities, offering a more detailed analysis than broader areal units like census tracts or neighborhoods.

The main findings reveal that Airbnb's expansion fosters the growth of tourist-oriented businesses, such as restaurants, bars, and to a lesser extent, tourist-focused retail outlets like souvenir shops. In contrast, there is a noticeable decline in local resident-focused businesses. This suggests that the rise in tourism-related establishments often displaces local businesses.

In the third paper of this thesis, the focus shifts to the broader tourism sector, with an emphasis on the impact of hotel openings in Madrid. Given the significant size of the hotel industry and its interconnection with various urban activities, understanding its economic impacts is crucial. Unlike short-term rental services, which are increasingly facing legal challenges, the hotel industry is a well-established sector likely to persist, irrespective of the future of short-term rentals. Thus, the final chapter, titled "Your Room is Ready: Tourism and Urban Revival" (solo coauthor Job Market Paper), concentrates on how hotel openings have influenced urban transformation in Madrid between 2001 and 2010. The causal relationship in this context is complex due to the strategic location selection by hoteliers, often based on unobservable local characteristics and future growth potential. This selection process raises the question of whether urban landscape changes are a result of or a reason for hotel development.

To overcome this challenge, this paper introduces an innovative instrumental approach: the use of protected buildings. The conversion of these buildings into hotels offers a unique solution to the economic difficulties of repurposing costly structures. Hotel guests are typically willing to pay a premium to stay in such heritage properties, making hotels one of the few businesses that can effectively capitalize on these buildings (Pedersen, 2002; Lee and Chhabra, 2015). This approach allows for a clearer understanding of the actual impact of new hotel openings on urban areas, separating the effect of hotels from the underlying, unobserved trends in city development.

The paper demonstrates that new hotel openings positively influence the growth of nearby establishments and employment, with these effects remaining consistent across various samples and specifications. The impact on different economic activities and urban areas, however, is varied: while tourist-focused businesses see significant benefits, production-oriented sectors tend to suffer. This indicates that hotels are pivotal in shifting cities from production to consumption-centric models. The increase in employment and business growth due to hotel openings stems from new economic activities, redistribution from adjacent areas, and broader urban development. Leisure tourism-oriented areas, in particular, show notable rises in employment and business numbers. Furthermore, hotel openings affect the real estate sector, leading to higher rental prices and increased residential investment, which often results in the replacement of individually-owned businesses by corporate entities in the same sector.

Together, these papers paint a comprehensive picture of the ripple effects of the platform economy and tourism on urban centers. They offer valuable insights into the benefits and challenges posed by these forces, highlighting the need for nuanced understanding and policy responses to manage their impact on the ever-evolving urban landscape.

Chapter 1

The Effect of Short-Term Rentals on Local Consumption Amenities: Evidence from Madrid

This paper examines the impact of the arrival of Airbnb on local consumption amenities in Madrid. We exploit the exogenous variation created by the timing and uneven distribution of Airbnb listings in the city to determine the impact on food and beverage establishments. Using an instrumental variable strategy, we find positive local effects on both the number of restaurants and their employees: an increase of fourteen Airbnb rooms in a given census tract leads to almost one more restaurant, and the same increase in a given neighborhood generates eleven new tourist-related employees. The results are robust to the specification and sample composition. This paper contributes to the literature on the economic impact of the platform economy on urban areas by providing evidence of market expansion externalities from short-term rentals.

This chapter is based on the work The Effect of Short-Term Rentals on Local Consumption Amenities: Evidence from Madrid in collaboration with Massimo Riccaboni and Francisco Javier Velazquez Angona and published in the Journal of Regional Science (see Hidalgo, Riccaboni,

and Velázquez (2024)).

1.1 Introduction

The economic landscape in urban areas is rapidly changing as peer-to-peer (P2P) accommodation platforms move into cities (Ferreri and Sanyal, 2018). In a short time, Airbnb, the leader in this sector, has grown from a few thousand properties in 2009 to more than seven million in 2020 in more than 100,000 cities worldwide.[1] The explosion of short-term rentals in urban areas has sparked a fierce debate about their economic impact. Several studies have pointed out the negative impact of the increase in housing prices and rents on the housing market (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021; Franco and Santos, 2021), the negative impact on hotel performance (Zervas, Proserpio, and Byers, 2017; Schaefer and Tran, 2021) and the impact on the welfare of residents and tourists (Almagro and Domınguez-Iino, 2019; Calder-Wang, 2019; Farronato and Fradkin, 2022).

The rise of short-term rental platforms calls for a closer examination of their impact on local economies, highlighting potential differences across areas. Tourists and residents have different consumption patterns, which affects local economic activity differently. As short-term residents take the place of long-term residents, Airbnb-induced demand increases, potentially impacting stores *locally*. The influx of short-term residents could promote a local market expansion effect that increases demand for nearby consumption facilities such as restaurants and retail services, as tourists tend to spend relatively more at these facilities compared to locals (Meltzer and Schuetz, 2012; Meltzer and Capperis, 2017; Allen et al., 2020; Aparicio et al., 2021). Moreover, the uneven distribution of short-term rentals in the city redistributes the economic impact of tourism throughout the urban area. Consequently, this new form of lodging could expand the benefits of tourism beyond traditional tourist hotspots. These disparate impacts support recent actions by local authorities to restrict short-term rentals in city centers while allowing them in peripheral areas (Valentin, 2021).

[1] See https://news.airbnb.com/about-us/

To analyze the impact of short-term rentals on tourism-related activities, we focus on how the arrival of Airbnb has fostered Madrid's food and beverage establishments. Four conditions allow us to pinpoint the impact of short-term rentals on local consumption amenities: (i) short-term rentals are more dispersed than traditional accommodations, which are concentrated in the city center. Local planning ordinances restrict the location of traditional accommodations whereas short-term rentals can spread unimpeded into existing dwellings across the city. The ability to bring visitors to non-touristic areas allows us to separate the effect of Airbnb from other accommodations; (ii) the rapid spread of Airbnb. The flexibility and lack of regulation have led to a sudden increase in these accommodations, which would be unthinkable with other regulated accommodation types; (iii) food and beverage establishments quickly respond to changes in local demand due to low start-up costs. This is especially important in a country like Spain, which welcomed more than 83 million tourists in 2019, making it the second most visited country in the world (World Travel Tourism Council, 2019); (iv) as hotel customers, Airbnb users are likely to spend a large portion of their time budget in the immediate vicinity of the accommodation (Shoval et al., 2011). Therefore, it is expected that Airbnb will redesign the surrounding area to better meet the needs of its new customers.

In this study, we introduce a novel methodological approach to exploit the exogenous variation generated by the uneven entry of Airbnb across the Madrid geography. To measure the impact of Airbnb on local consumption amenities, we use a Bartik-like instrumental variables (IV) approach that uses the share of rental housing in 2011 (prior to Airbnb's arrival in Madrid) and the number of worldwide Airbnb Google searches as an instrument for short-term rental activity. Our IV approach relies on the importance of the local supply of rental housing before Airbnb's arrival to explain the increase in the number of short-term rentals thereafter. We exploit the sharp geographic and temporal variation in the availability of short-term rentals by using census tracts and neighborhoods as our main geographic units of analysis.

Our results show that Airbnb's entry into the market has had a positive impact on both employment and the number of food and beverage establishments: an increase of fourteen Airbnb rooms in a given census tract translates into almost one more food and beverage establishment. The same increase in one neighborhood adds eleven new food and bev-

erage workers. The new and displaced businesses contribute equally to the creation of local consumption amenities. Moreover, the employment effects of Airbnb are equally explained by the intensive and extensive margins. Interestingly, the spillover effects of Airbnb on local consumption amenities are heterogeneous within the food and beverage industry, with restaurants benefiting the most from Airbnb penetration. Across the urban geography, Airbnb effects are stronger in less touristic areas, supporting the idea that peer-to-peer accommodations help redistribute tourism consumption across the city. We find no evidence of pre-trends, and our results are robust to sample composition and functional specification.

Overall, we make four contributions. First, we identify positive *local* effects on the food and beverage sector from short-term rental activity. We have access to a yearly finer-grained data set for all economic activities in Madrid from 2014 to 2019. The richness of our data allows us to identify areas where Airbnb enters by using the smallest available geographical unit of analysis: census tracts. Using a narrow geographic unit of analysis helps overcome the problems of heterogeneity within larger spatial units such as ZIP codes and neighborhoods.

Second, we evaluate the heterogeneous effects of short-term rentals across food and beverage establishments typologies, identifying which types of food and beverage establishments cater to potential Airbnb users. We also examine the distributional effect of Airbnb and changes in the composition of the urban landscape. We find that the overall Airbnb-induced establishment effect is equally explained by a compositional shift within commercial real estates between food and other retail sectors and by an increase in the conversion of land to commercial use. Finally, we decompose the overall Airbnb-induced employment effect between the intensive and extensive margins and show that the positive effects also extend to incumbents.

Third, we contribute a new Bartik-like instrument to resolve the endogeneity of the Airbnb activity variable: the interaction between the share of rental houses for each census tract prior to Airbnb's arrival and worldwide Airbnb Google searches. Using a supply driver rather than a demand driver represents a novelty in the literature that may help overcome the inherent problem of using demand shares related to city center characteristics.

Fourth, this is the first study that analyzed the Airbnb economic spillover effect in a European city.[2] This is of particular interest because the distinction between commercial and residential areas is more nuanced in European urban areas than in the United States, although the difference is diminishing over time (Gordon and Cox, 2012). In particular, the mixed-use areas prevalent in Europe offer Airbnb more opportunities to transform the urban landscape compared to the US. This research is of particular importance given the role of tourism in Spain, the world's second most visited country, with Madrid seeing a staggering 60% increase in tourist flows from 2014 to 2019. It is expected that the introduction of short-term rentals in residential areas will have a significant impact on business configuration and favor the opening of food and beverage establishments.

The rest of the paper is organized as follows. Section 3.3 provides a review of the extant literature on the effect of short-term rentals on local urban economic activities. Section 3.4 and Section 3.5 describe the data and methodology, respectively. Section 1.5 presents and discusses our main findings. We draw our conclusions and discuss future research directions in Section 1.6.

1.2 Related literature

The rise of the sharing economy and, in particular, the crucial role played by home-sharing platforms have spurred a burgeoning literature about their impact on local economies.[3] Most of the literature is devoted to analyzing the impact of short-term rentals on the real estate sector, documenting the negative effects of Airbnb on housing prices and rents (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021; Batalha et al., 2022). The reallocation of housing from long-term to short-term rentals triggered by P2P accommodations has led to an increase in housing rental prices. Similarly, the increase in housing prices has been at-

[2]Not related to our research question, the only papers that analyze other Airbnb externalities in European contexts are Garcia-López et al. (2020), which look at the impact of Airbnb on rental prices in Barcelona, Almagro and Domınguez-Iino (2019), which examine the impact of Airbnb on neighborhood amenities in Amsterdam, and Fontana (2021), which examines tourist dissatisfaction resulting from Airbnb-induced tourism flows in London.

[3]For a comprehensive list of the contributions on the economic impact of Airbnb, see Table 16 in the Appendix.

tributed to an increase in the option value of owning a home, thanks to the possibility of short-term rentals and the capitalization of higher rental prices. The disruptive impact of home-sharing platforms goes beyond the housing sector, negatively affecting the performance of traditional accommodations (Zervas, Proserpio, and Byers, 2017; Li and Srinivasan, 2019), but at the same time contributing to a more diversified supply of accommodation and lowering prices as hotels face capacity constraints during periods of peak demand (Farronato and Fradkin, 2022; Schaefer and Tran, 2021).

Although most literature to date has emphasized the negative effects of Airbnb on local economies, the advent of short-term rentals has also brought positive externalities by stimulating neighborhood and residential investment (Xu and Xu, 2021a; Bekkerman et al., 2022). Specifically, Alyakoob and Rahman, 2019 and Basuroy, Kim, and Proserpio (2020) analyze whether Airbnb has had a positive impact on local food and beverage services. Alyakoob and Rahman (2019) consider neighborhood or ZIP code data for New York City whereas Basuroy, Kim, and Proserpio (2020) use aggregated information at the ZIP code level for the state of Texas. Both papers rely on a Difference-in-Differences (DiD) strategy that exploits the different timing and intensity of Airbnb's entry in different geographical areas. In this way, they can determine the impact of Airbnb, measured by the number of reviews or the number of reviews per household, on restaurant performance by comparing high and low Airbnb intensity zones before and after Airbnb entry. Both studies conclude that Airbnb has a positive impact on restaurant outcomes, although the intensity of the effect varies widely: a 1% increase in the number of reviews per household leads to a 1.7% increase in restaurant employment in New York (Alyakoob and Rahman, 2019); a 1% increase in the number of Airbnb reviews is associated with a 0.011% increase in restaurant revenue in the state of Texas (Basuroy, Kim, and Proserpio, 2020). The available studies focus on the U.S. context and do not consider the different effects across the geography of cities or among different types of establishments. Against this background, our study provides evidence of the overall impact of Airbnb on local consumption amenities in a European context. In addition, we rely on a different instrumental strategy and analyze Airbnb's effects across the geography and within the food and beverage sector.

Our study also relates to the literature on urban consumption (Glaeser,

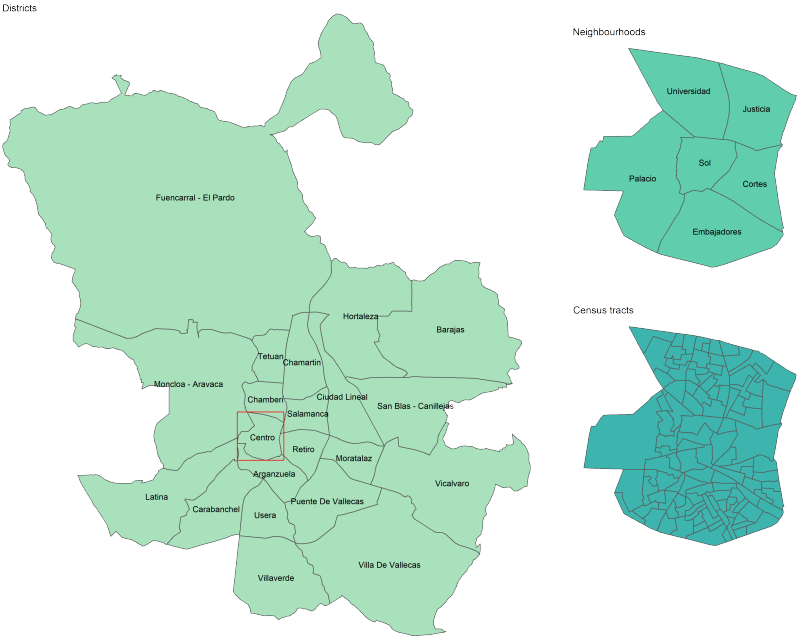
Kolko, and Saiz, 2001). Several works have shown how densely populated areas benefited from a large diversity and supply of food establishments (Mazzolari and Neumark, 2012; Couture, 2013; Schiff, 2015; Couture and Handbury, 2020b). The main channels explaining this trend include the overrepresentation of young people and the heterogeneity of citizens of ethnic origin in urban areas. Both the number of local consumption amenities and their quality have been shown to play a role (Kuang, 2017). Particularly relevant to our research question are the studies that show how spatial frictions explain the consumption, commuting, and pricing patterns of cities. Many papers emphasize the role of *local consumption* (Davis et al., 2019; Eizenberg, Lach, and Oren-Yiftach, 2021; Miyauchi, Nakajima, and Redding, 2021; Su, 2022): consumers are much less likely to visit venues that are far from their homes. This is critical to our study as we analyze the Airbnb-induced demand effect on *local* consumption amenities. Although most of the literature has analyzed the role of consumption amenities from the residents' perspective, we focus instead on how tourists foster the performance and the creation of food-related establishments near their accommodations.

1.3 Data

Given the expected local effects of Airbnb-induced demand, it is advisable to use the finest level of analysis available. Therefore, our primary geographic units of analysis are Madrid's census tracts. Census tracts are the smallest statistical unit in Spain. In particular, the city of Madrid is divided into districts (21), neighborhoods (128), and census tracts (2,409), from the largest to the smallest administrative unit (see Figure 1). Because th census tracts are constructed to represent a similar population (1,000-2,500 people) at a narrowly defined geographic resolution, they are suitable for analyzing local effects.[4]

[4]We create consistently-defined census tracts by setting the boundaries to the 2011 definition.

Figure 1: Administrative units in Madrid.



1.3.1 Airbnb

We create the Airbnb activity variable by collecting annual consumer-facing data from *Inside Airbnb* from 2014 to 2019.[5] As stated on its website, *Inside Airbnb* is an *"independent, non-commercial set of tools and data that allows you to explore how Airbnb is being used in cities around the world."* It provides listing information at different points in time from different cities around the world. For our purposes, we are most interested in the information on the geographical coordinates of the listing, size, and insights into short-term rental activity in Madrid.

We need to find a way to define when a listing is active or not. To do this, we use the date of the first and the last reviews as proxies for the beginning and the end of the period in which the listing was active on the platform. In addition, we consider the number of rooms in each accommodation as a proxy for its size. In this way, we identify the potential impact of Airbnb on food and beverage establishment users.[6] Finally, we decided to remove shared and private rooms and while keeping entire flats whenever we build our measure of Airbnb activity. Including shared and private rooms could confound the effect on local spending for Airbnb-induced tourists with the composition effect of owner-present and Airbnb users.

1.3.2 Local consumption amenities

We have obtained annual information from the Madrid City Council's census of business premises. The database, created by the Madrid City Council Statistics Department (*Servicio de Estadística Municipal*), covers

[5] *Inside Airbnb* provides annual snapshots of the evolution of the short-term rental sector in Madrid since 2015. As Airbnb appears in Madrid before 2015, we can recover the 2014 supply by considering the date of the first review as a proxy of a listing's opening, provided that the supply has not yet been deleted from the platform. At the end of our sample period, the Madrid City Council adopted a regulatory plan for short-term rentals (*Plan Especial de Hospedaje*). Under the new regulation, short-term rental activities were restricted to certain areas of the city. However, since the impact of such regulation was negligible (Urquiaga, Sanz, Sanchez, et al., 2019), we decided to include 2019 in our sample. The exclusion of the year 2019 does not affect our results.

[6] Previous papers have relied on different metrics of Airbnb activity such as the simple number of listings (Xu and Xu, 2021a), the number of reviews (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021), or the proportion of listings over the number of dwellings (Franco and Santos, 2021). In our analysis, we consider alternative measures of Airbnb activity as robustness checks.

the population of all business establishments in the Madrid municipality. The data set compresses establishment-level data under a four-digit NACE-based classification, location, and status (opening, closing, or undergoing reform). Since the objective of the study is to assess the impact of Airbnb on local consumption amenities, we focus on food and beverage establishments (NACE I.56), which account for the majority of tourist spending in Spain (INE, 2020a). Previous research has shown for the Madrid case that tourists' spending is mainly concentrated in restaurants (Aparicio et al., 2021). For this reason, our main dependent variable will be the total number of food and beverage establishments at the census tract level.[7]

We also have access to annual employment data for food service establishments from the Madrid City Council Statistics Department. However, since employment data are confidential, we only have access to neighborhood-level employment statistics from 2010 to 2019, so we consider the number of employees in the food and beverage service sector at the neighborhood level as the second dependent variable.

1.3.3 Control variables

We augment our data set with a set of variables to control for other factors related to either establishments or employment in the food and beverage industry. Previous studies have shown that these factors, such as population, proportion of foreigners, average household income, distance to the city center, and number of rooms in hotels and hostels, are important determinants (Mazzolari and Neumark, 2012; Schiff, 2015). Our goal is to control for local market demand, urban revival, tourism trends, and business cycles, adding population, income, and traditional accommodation supply variables. Demographic variables were obtained from the statistics of the Registry of Residents (*Padrón Municipal*) whereas information on traditional accommodations was obtained from the Madrid City Council Statistics Department and Expedia. Average household in-

[7]Food and beverage establishments included the following activities: restaurant, fast food restaurant, self-service restaurant, bar restaurant, bar with kitchen, cafe, chocolate shop, tea room and ice cream parlor, bar without performance, bar with performance, tavern, bar without kitchen, cafe with performance. We disregard other consumption amenities highlighted in the literature as 1) the consumer pool is not local, e.g., museums, performance arts, and sports events and 2) they are not fully tourist-oriented, e.g., grocery, clothing, and gyms.

come was taken from the Spanish Household Income Distribution Atlas and distance to the city center from the Spanish National Geographic Institute[8].For a final list of all variables used, see Table 17 in the Appendix.

1.3.4 Descriptive statistics

Airbnb activity and the number of food and beverage establishments have increased in Madrid during the period studied. At the same time, the total supply of hotel rooms has changed only slightly (see Table 1 and Figure 2). This divergence is explained in part by local planning ordinances that restrict the location of traditional accommodations and the flexibility of short-term rental supply based on already existing dwellings. We can also observe how socio-demographic indicators such as average household income or population size improve over the period studied. This is the result of the recovery process that took place in Madrid in the years following the Great Recession and the bursting of the Spanish housing bubble.

Table 1: DESCRIPTIVE STATISTICS

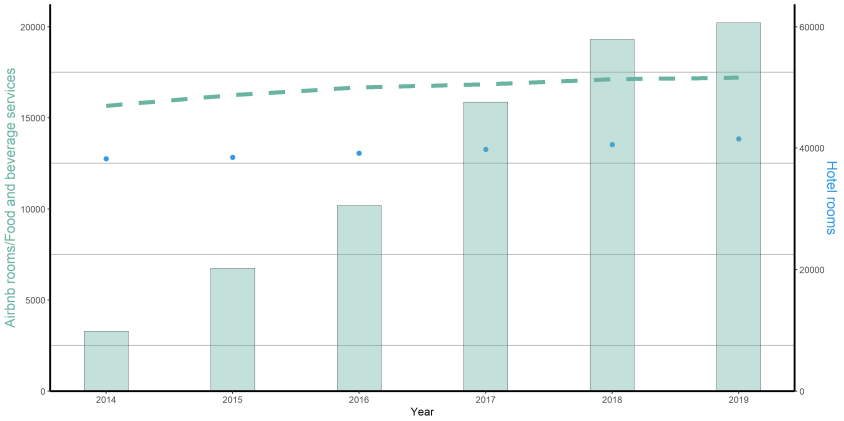
	2014			2019		
	Sum	Mean	S.d.	Sum	Mean	S.d.
Food and beverage establishments	15,660	6.501	8.124	17,212	7.145	9.094
Airbnb listings	2,153	0.894	3.516	12,763	5.298	16.598
Airbnb rooms	3,288	1.365	5.337	20,215	8.391	25.855
Hotel rooms	38,255	15.88	83.099	41,534	17.241	87.894
% Foreign population	311.7	0.129	0.071	356.9	0.148	0.085
Population	3,166,465	1,314.431	508.245	3,278,988	1,361.141	668.755
Avg. household income	86,736,299	36,005.105	14876.846	99,176,288	41,169.069	17,359.439

Notes: N = 14454, census tracts = 2409. Descriptive statistics for census tract level observation.

The positive correlation between short-term rentals and food and beverage establishments holds spatially as well, as we can see in Figure 3. The uneven distribution of short-term rentals across the city suggests that Airbnb is boosting local consumption not only in the city center (where the number of Airbnbs has increased the most) but also in more peripheral areas. Because peer-to-peer accommodations are based on owners' dwellings, they can quickly spread across the urban geography. In turn, Airbnb listings tend to localize not only near tourist attractions, which in the case of Madrid coincide with the city center and surrounding areas, but also in other non-touristic neighborhoods.

[8]We measure the distance to the center as the distance from *Puerta del Sol* (main square in Madrid city) to the centroid of each census tract.

Figure 2: Number of food and beverage establishments, Airbnb and hotel rooms from 2014 to 2019.



Notes: Left scale is for food and beverage establishments (dashed) and Airbnb rooms (bars). Right scale is for evolution of hotel rooms (dots).

1.4 Methodology

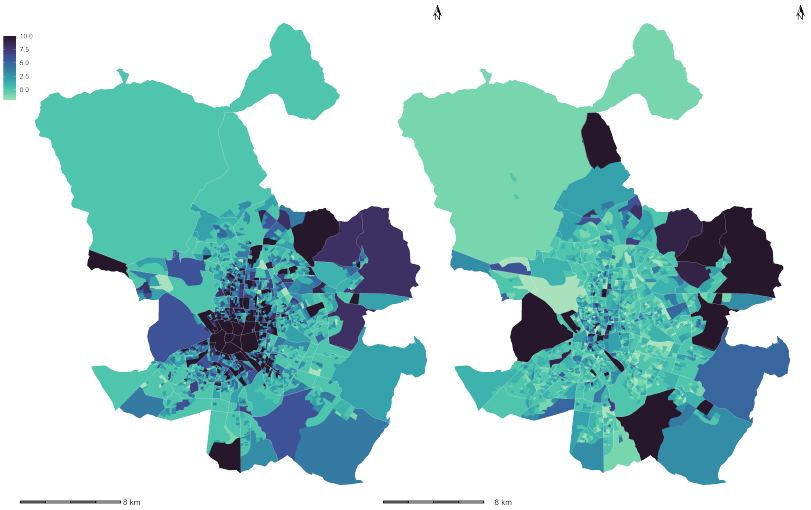
1.4.1 Model specification

The objective of this article is to investigate the impact of Airbnb's entry in Madrid on the local food and beverage sector. We argue that the entry of Airbnb might have a positive impact on local food and beverage activities, especially in non-touristic areas. To answer our research question, we start with our baseline specification, which takes the following form:

$$Y_{i,t} = \beta Airbnb\ rooms_{i,t} + \rho X_{i,t} + \delta_t + \gamma_i + \epsilon_{i,t} \tag{1.1}$$

where $Y_{i,t}$ is the number of food and beverage establishments in a census tract i in year t, $Airbnb\ rooms_{i,t}$ is the number of rooms in Airbnb listings in each census tract, $X_{i,t}$ are time-varying variables, δ_t are year fixed effects, and γ_i are census tract fixed effects. Among the time-varying characteristics, we include the population, the proportion of foreign residents, the average household income, and the number of traditional accommodation rooms. With this set of variables, we aim to control for time-varying census-specific trends correlated with the number of food

Figure 3: Spatial correlation in the change of the number of Airbnb rooms and consumption amenities during the period 2014-2019.



(a) Δ Airbnb rooms 2014-2019

(b) Δ Consumption amenities 2014-2019

Notes: Map (a) plots the change in the number of short-term rentals during the period 2019-2014 whereas map (b) depicts the change in food and beverage establishments for the same period.

and beverage establishments and Airbnb listings as a local process of urban revival, business cycle, and tourism trends other than short-term rentals. To account for time-invariant characteristics, like the size area, we add census tract fixed effects. We include year-time fixed effects for cyclical changes. Finally, we also include the interaction between a time trend and the distance to the center to allow for different trends according to the geographical location of each census tract.

Above all, we are interested in β of Eq. 1.1, which measures the average treatment effect of Airbnb on the number of food and beverage establishments. However, the number and type of Airbnb rooms are likely correlated with the disturbance term because of time-varying unobserved location characteristics (e.g., changing census tract amenities). Besides, we may have a problem of reverse causality as the number of food and beverage establishments might attract (agglomeration effect) or deter (inhibition effect) new Airbnb listings. Finally, we do not know exactly when they are active and when they are not, since we approximate the number of active Airbnb rooms with the number of listings with customer reviews. Therefore, our empirical setting requires an instrumental variable (IV) strategy to account for the endogeneity of our variable of interest.

Our IV strategy is based on a Bartik-like instrument, where we use the share of rental houses in each census tract in 2011 (before Airbnb's arrival to Madrid) as the initial shares and the worldwide Airbnb Google searches as the shift.[9] The growth of Airbnb rentals in an area depends on the local supply of rental houses that can be let out for Airbnb. As Airbnb grows globally over time, the number of Airbnb listings increases at different rates in different census tracts due to the availability of houses that can be rented out for Airbnb. As a result, census tract housing supply, which is primarily historically determined, causes different tracts to experience different levels of Airbnb penetration. We use this variation in the growth of short-term rentals in the census tract to measure the effects on food and beverage establishments.

It is easy to see that the shares explain either the extensive or the intensive margin of the treatment, while the shift describes the timing.

[9] We get tenancy type information from the Spanish Census 2011 and the number of worldwide searches of the word Airbnb from Google Trends. This variable is measured annually and is normalized to 100 for the year with the highest number of searches.

More formally:

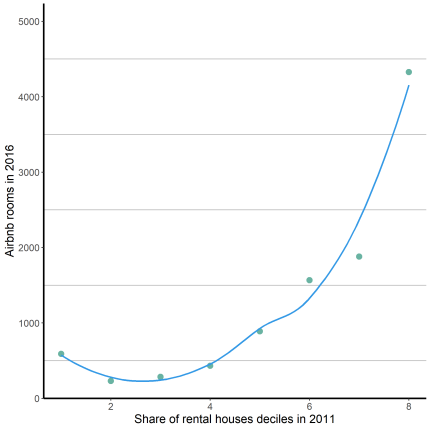
$$Shift\text{-}Share_{i,t} = Share\ Rental\ houses_{i,2011} \times Worldwide\ Airbnb\ Google\ Searches_t \tag{1.2}$$

where $Share\ Rental\ houses_{i,2011}$ are the share rental houses in census tract i in 2011, and $Worldwide\ Airbnb\ Google\ Searches_t$ are the normalized worldwide Airbnb Google searches. The relevance of our instrument is based on the fact that, as Horn and Merante (2017a) have shown, the main mechanism by which Airbnb expands in the real estate sector is by decreasing of the stock of long-term rentals and increasing of the supply of short-term rentals. Indeed, we can observe that there is a positive and significant relationship between the share of rental houses in each census tracts and subsequent Airbnb activity (in Figure 4, panel a). We can also observe that the evolution of worldwide Airbnb Google Searches mimics Airbnb growth (in Figure 4, panel b).

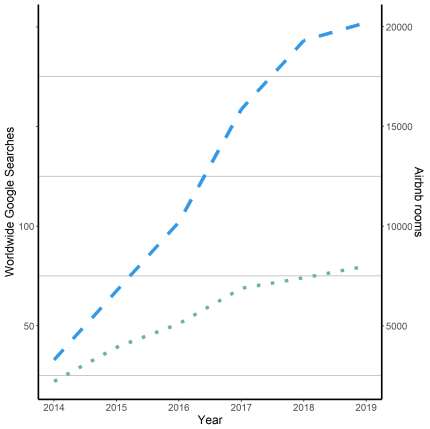
Differently from Garcia-López et al. (2020) and Barron, Kung, and Proserpio (2021), we rely on a supply share driver rather than a demand share for two reasons. First, the share of rental houses predicts prospective Airbnb activity outside the city center (see Figure 21). Short-term rentals are based on owners' idle property rather than construction. Therefore, between two census tracts located at the same distance to the city center, it is more likely that new Airbnb listings appear in the census tract with the higher share of rental houses as hosts may find it easier to switch from long-term rentals to short-term rentals rather than investing in new flats. Second, the number of tourist features used in Garcia-López et al. (2020) and Barron, Kung, and Proserpio (2021) may violate the exclusion restriction, as they are directly related to the distance to the city cente, where most of the tourist amenities are concentrated. Regarding our shift instrument, the number of worldwide Airbnb Google searches parallels the timing and expansion of Airbnb in Madrid, as Figure 4, panel (b) shows. The basic idea behind using this shift is that potential hosts in Madrid are more likely to rent their property in the short-term market in response to growing interest in Airbnb as a global platform (Barron, Kung, and Proserpio, 2021).

Regarding the exclusion restriction, it is highly unlikely that global Airbnb Google searches are directly correlated with the increase in Madrid's overall attractiveness. Airbnb is a global company with a presence in

Figure 4: Shift-share instrument relevance.



(a) Airbnb Madrid supply and rental houses.



(b) Worldwide Airbnb Google searches and Airbnb Madrid supply.

Notes: Subplot (a) depicts how Airbnb supply in 2016 is positively correlated with the share of rental houses divided by deciles. Subplot (b) shows the evolution of worldwide Airbnb Google searches (dashed dotted line) and the growth of Airbnb in Madrid (dashed line).

more than 100 000 cities in over 190 countries. Therefore, we can confidently claim that our Bartik-like instrument's shift part is exogenous to local conditions in Madrid. To satisfy the exclusion restriction, our share instrument $Share\ Rental\ houses_{i,2011}$ must be correlated only with the *changes* in our dependent variable through the effect of Airbnb. In our setting, the main channel through which the stock of rental houses before Airbnb's arrival should affect the number of food and beverage establishments is through the switch from long-term rentals to short-term rentals driven by Airbnb disruption. We test for this condition as follows.

First, we check whether our share instrument predicts changes in the number of food and beverage establishments for census tracts that have never experienced any Airbnb activity. This exercise aims to prove whether the instrument is valid and correlated only with the dependent variable through its effects on Airbnb. We find no significant relationship between our share instrument and the change in the number of food and beverage establishments in those census tracts (see the estimates of the reduced form of our baseline IV specification in **??** and **??** in Column 1 from Table 28).

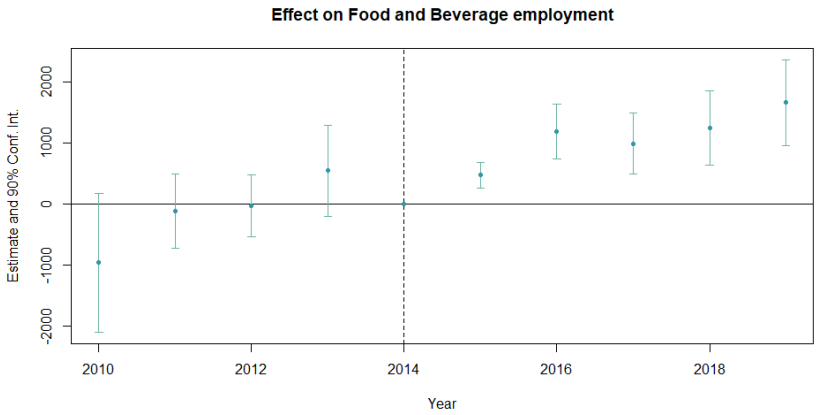
Table 2: IV VALIDITY EXERCISES

	No Airbnb census tracts	Parallel trend		Alternative instruments				
	(1)	2005-2010 (2)	2014-2019 (3)	Share Rental houses 2001 (4)	Total dwellings (5)	Rental houses (6)	Empty houses (7)	Share rental + empty houses (8)
Share Rental houses	0.006							
	(0.005)							
Change Airbnb rooms		0.004	0.064***					
		(0.015)	(0.013)					
Airbnb rooms				0.064***	0.123***	0.086***	0.096***	0.065***
				(0.013)	(0.028)	(0.020)	(0.034)	(0.014)
Covariates	x	x	x	x	x	x	x	x
Census tract FE				x	x	x	x	x
Year FE				x	x	x	x	x
Distance × year				x	x	x	x	x
F Stat				67.299	62.123	78.450	20.565	75.826
Observations	4,614	2,301	2,301	13,680	14,454	14,454	14,454	14,454

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. The dependent variable is the number of food and beverage establishments in Columns 1 and 4-8 and the change in the number of food and beverage establishments in Columns 2 and 3. The errors are clustered at the census tract level in 1 and 4-8 and robust in 2-3. We use as an instrument for *Airbnb rooms* variables the interaction between the share of rental houses in 2011 and worldwide Airbnb Google searches in Columns 2-3. From column 4, we keep the shift part, worldwide Airbnb Google searches, and we change the share in the following way: share of rental houses in 2001 in Column 4, the total number of dwellings in Column 5, number of rental houses in Column 6, number of empty houses in Column 7 and share of rental and empty houses in Column 8. Columns 1 is the reduced form regression, whereas columns 2-8 provide second-stage IV coefficients. The endogenous variable is the change in the number of Airbnb rooms in columns 2-3 and the number of Airbnb rooms in columns 4-8. Column 1 includes all census tracts with no Airbnb activity during our time period. Columns 2-4 include only census tracts which share the same boundaries as the 2011 definition. Columns 5-8 include all census tracts according to the 2011 boundary definition. Column 2 does not include income as a covariate because of missing information about this variable previous to 2014 and includes distance as an additional regressor. We add distance time trends in Columns 1 and 4-8. We do not include income in the Column 3 specification for the purpose of comparison.

Second, a key concern with the instrument is that census tracts with a high proportion of rental houses can explain changes in local consumption amenities even before Airbnb's arrival (Goldsmith-Pinkham, Sorkin, and Swift, 2020; Borusyak, Hull, and Jaravel, 2022). On the one hand, as can be seen in Figure 15, long-term residents' taste for tourism-related activities hardly changed over the period of study, regardless of the type of tenancy. On the other hand, to show that the parallel trends hold in our setting, we regress the change in the number of food and beverage

Figure 5: Event study plot for establishments 2005-2019.



Notes: Omit data from the years 2011 to 2013 due to unavailability of food and beverage establishment information.

establishments in the pre-period 2005-2010 against the change in Airbnb rooms in 2014-2019 predicted by the share of rental houses in 2011.[10] We control for population size, share of foreign population, distance to the city center, and number of traditional accommodation rooms measured in 2005. We find that the coefficient of interest is not statistically significant for the period before Airbnb's entry. However, for the 2014-2019 period, where we repeat the same specification but use contemporaneous data on local consumption establishments, it is significant (see column 2 and column 3 in Table 28 and for the event study version Figure 5). All in all, our results show that historical areas with a high proportion of rental houses are not located in census tracts that already underwent different trends correlated with the evolution of local consumption amenities.

Having demonstrated the validity of our proposed instrumental strategy, we now turn to analyze the impact of Airbnb's arrival on the food and beverage establishments in Section 1.5.

[10] We have obtained annual information on local consumption amenities from the census of commercial premises of the Madrid region. This database contains information on all establishments in the Madrid region for the period 1998-2010. For our purposes, we restrict the data on consumption amenities to the city of Madrid.

1.5 Results

In this section, we summarize the main results of our analysis. First, we describe and discuss the estimates of the effect of Airbnb on the food and beverage sector for our baseline specification and then for our instrumental strategy specification. We then decompose the overall effect into displacement and net food and beverage establishment creation.

Table 11 presents the results of our baseline OLS and IV specifications. Our baseline sample includes 2 409 census tracts for six years. Our dependent variables are the number of food and beverage establishments in Columns 1-5 and the number of new and established business premises, using 2014 as the reference year, in Columns 6 and 7, respectively. In Column 1, we regress the number of food and beverage establishments on the number of Airbnb rooms, controlling for time-varying controls. Due to the potential existence of time-invariant census-specific characteristics related to the number of food and beverage establishments and the Airbnb activity or the existence of a common trend that equally affects all our geographical units, we add census tract and year fixed effects in Columns 2 to 7. Finally, we also include the interaction between a time trend and the distance to the center to allow for different trends according to the geographical location of each census tract in Columns 3 and 5-7.

Table 3: THE IMPACT OF AIRBNB ON THE NUMBER OF FOOD AND BEVERAGE ESTABLISHMENTS (OLS AND IV).

	OLS			IV			
	(1)	(2)	(3)	(4)	(5)	(6)^a	(7)^b
Airbnb rooms	0.197***	0.022***	0.021***	0.054***	0.071***	0.039***	0.032***
	(0.009)	(0.004)	(0.004)	(0.009)	(0.014)	(0.008)	(0.009)
Covariates	x	x	x	x	x	x	x
Census tract fixed effects		x	x	x	x	x	x
Year fixed effects		x	x	x	x	x	x
Distance × year			x		x	x	x
Adjusted R-squared	0.450	0.986	0.987				
F Stat, Excluded instrument				48.466	68.246	68.246	68.246

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. ^{a} new food and beverage business premises, ^{b} existing food and beverage business premises. Heteroskedasticity standard errors for Column 1 and cluster standard errors at the census tract level for Columns 2-7. The dependent variable is the number of food and beverage establishments in Columns 1-5, the number of new food and beverage establishments in Column 6^a, and the number of existing food and beverage establishments in column 7^b using as reference existing establishments in 2014. We use the interaction between the share of rental houses in 2011 and the worldwide Airbnb Google searches as an instrument for *Airbnb rooms* variable.

At first glance, the results do not seem to depend on the selected model: in all models, we find a positive and significant effect of Airbnb

activity on the number of food and beverage establishments. In this way, our results confirm previous findings in the literature that have shown a positive link between Airbnb and consumption amenities (Alyakoob and Rahman, 2019; Basuroy, Kim, and Proserpio, 2020; Xu and Xu, 2021a). The inclusion of controls makes the coefficients for Airbnb activity somewhat reduced. However, they remain significant across all specifications. Although we control for an extensive range of factors, we cannot rule out unobserved time-varying characteristics related to Airbnb activity and the changes in the number of food and beverage establishments. Therefore, we use an instrumental variable strategy to overcome the potential endogeneity problem in the Airbnb activity variable. Our instrument, the interaction between the share of rental houses in 2011 and worldwide Airbnb Google searches, predicts Airbnb activity as can be seen in the Kleibergen-Paap Wald F-test value. In the second stage, we can see that the sign of the Airbnb effect remains positive and the magnitude has increased.[11]

It is noteworthy that the IV coefficient (column 5) is more than twice as large as the OLS coefficient (column 2). This result is consisting with previous studies that also found a downward bias in the OLS specification (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021; Fontana, 2021). A potential reason about this downward bias is that measurement error presents a challenge in accurately determining the number of active listings in the market, particularly with respect to Airbnb listing entry and exit rates (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021; Xu and Xu, 2021a). This uncertainty introduces noise into the data that can bias the estimated coefficients. As a result, the OLS estimates may be biased downward. We attempt to address this issue by using the date of the first and last reviews as a proxy for the begin-

[11] One potential criticism of our share instrument is that the proportion of rental houses may be affected by Airbnb's arrival because of the anticipation behavior of future hosts. To rule out potential anticipated demand for short-term rentals in 2011, we modify our share component by computing the share of rental houses in 2001 using 2001 Spanish census information. Column 4 in Table 28 confirms our initial findings. Also, we show that our main results hold no matter the source of exogenous variation exploited in our identification strategy. We select a series of supply share drivers instruments related to the number of food and beverage establishments only from their effect on the posterior evolution of Airbnb. Columns 5-8 in Table 28 show that our main tenets hold with either an absolute measure as the total number of houses, total number of rental houses, and total number of empty houses or a relative measure such as the proportion of rental and empty houses. However, our share instrument lost relevance in some cases as can be seen in the lower values of the Kleibergen-Paap Wald F-test.

ning and end of the period in which the listing has been active on the platform.

In economic terms, our estimates show that each addition of 14 Airbnb rooms increases the number of food and beverage establishments in each census tract by one more consumption amenity and leads to annual Airbnb-induced tourism expenditures totaling 342 881 euros.[12] In terms of the number of establishments, the change in the number of Airbnb rooms per tract from 2014 to 2019 averaged 5. Consequently, our estimates suggest that a tract with the average influx of Airbnb rooms had about one-third of an additional establishment (0.335), an increase of about 46% over the baseline number of consumption amenities in the tract.

Finally, our coefficient may mask crowding out effects from other non-local consumption amenities. To rule out the possibility that Airbnb's entry is associated with pure displacement effects, and to understand compositional changes within the urban landscape, we divide our main dependent variable, the number of food and beverage establishments, into two groups: the construction of new storefronts that offer food service and established storefronts that switch to food service establishments. New establishments represent the opening of new physical business premises, taking the number of establishments present in 2014 as the reference.[13] We can observe that the growth in local consumption amenities led by Airbnb is equally attributable to new and existing establishments. The sums of the individual groups approximate our coefficient of 0.071 food and beverage establishments per census tract per year, as expected given that we estimate a linear additive specification. As a re-

[12] Based on an average occupancy rate of 55% (INE, 2023c) and assuming two people per room, this translates to 5 621 overnight stays per year in 2019. Considering that the average daily expenditure of an urban tourist in Spain is 225 euros, of which 27% spent on restaurants (INE, 2023b), tourists in Madrid spend about 61 euros per day on food and beverages. Thus, the 14 Airbnb rooms would contribute a direct expenditure of 342 881 euros to this sector. In addition, the average turnover of a restaurant in Madrid in 2019 was 267 877 euros (INE, 2023a). Therefore, the total effect is split between local spending by tourists nearby and in other parts of the city, and between established and newly added businesses.

[13] As an example, a business premise that offered hairdresser services in 2014 and starts to offer restaurant services in the following years would be in our group of established business premises which switch the service offer. The construction of new business premises that offer food and beverage services would be in the new establishment group. Therefore, the growth in consumption amenities can occur through two channels: (1) the opening of new business premises, i.e., the construction of new physical stores, and (2) the switching activities within an existing business premise that was already established.

sult, we find that Airbnb contributes to changing the urban landscape by shifting the composition within commercial real estate between food and other retail sectors and converting land to commercial use through the opening of new physical stores.

1.5.1 Robustness checks

We address the threats to the identification of our main findings in the following way. First, we check that our main findings hold even if we change the functional form of our regression specification. Instead of a level-level specification, we estimate a log-level equation by taking the logarithm of our dependent variable and also running a control function IV non-linear model. We also show that our results hold even when we change the measure of short-term rental activity and control for spatial spillovers. Second, we focus on a different city and different samples to test that specific tracts do not drive our results. Finally, we use different aggregation scales as the unit of observation.

Alternative specification

For our baseline specification, we opted for a level-level form since many census tracts have only a few food and beverage establishments. Using a logarithmic transformation instead of levels, we would give more importance to small absolute changes than warrants. However, we estimate a log-level specification to show that our main findings are not model-specification-dependent. Moreover, we re-estimate our IV equation specification using a novel control function IV approach that was proposed by Lin and Wooldridge (2019) and allows us to estimate non-linear scenarios with fixed effects. Table 12 shows that our results do not depend on the specific functional form of the model and are similar in magnitude: an increase in 10 Airbnb rooms translates to a 4% increase in food and beverage establishments.

As a second robustness check, we turn our attention to the way of measuring our dependent variable. The consumer-facing information retrieved from *Inside Airbnb* includes a great variety of size-related variables like the number of rooms, the number of beds, and the maximum number of guests for each listing. Also, it provides information about the demand, such as the total number of reviews. The number of Airbnb rooms may not be the best measure of Airbnb activity as it may capture

some housing characteristics of some areas of the city and does not reflect the actual level of demand. As each variable conveys different information from the listing, we decide to check whether our results are robust using different measures of Airbnb activity, like the number of Airbnb listings or the number of reviews for each listing. Again, the results in Table 12 show that our findings are not sensitive to alternative ways of measuring short-term rental activity.[14]

In our baseline specification of the model, we assume that the Airbnb-induced effect on tourism demand is limited to the census tract where the Airbnb listing is located. This is a strong assumption given the small size of our geographic unit of analysis. Although using census tracts allows us to better capture the impact of Airbnb on the number of food and beverage establishments, their smaller size makes them more susceptible to spillover issues from other short-term rental accommodations in surrounding census tracts than larger administrative units such as neighborhoods or ZIP codes. If we do not account for the presence of spillover problems, we overestimate the impact of Airbnb on the number of food and beverage establishments, but we may also be underestimating it. On the one hand, the critical mass of potential customers increases with Airbnb tourists from each census tract and Airbnb guests from neighboring census tracts. On the other hand, by creating food and beverage clusters, Airbnb could shift demand away from census tracts without short-term rentals, leading to an increase in the number of food and beverage establishments in census tracts with a strong Airbnb presence and a decrease in surrounding neighborhoods.

To account for the distributional effect of the Airbnb presence in neighboring census tracts, we include the spatial lag of our variable of interest as another regressor: the weighted number of Airbnb rooms in census tracts neighbors.[15] Since Airbnb guests are more likely to con-

[14] To compare the magnitude of these coefficients to our baseline specification, we calculated the average number of listings, reviews, and bedrooms per census tract from 2014-2019. We then multiplied these numbers by the appropriate coefficient in each specification. The results are summarized in Table 18, where we report the mean values, coefficients, and average effects for each variable. As can be seen, the coefficients are quite similar in magnitude. Our baseline specification can be considered the more conservative of the three measurements. These calculations support our claim that the results are not sensitive to different ways of measuring short-term rentals.

[15] Census tracts neighbors are defined as all areas up to 500 meters away from each census tract centroid.

sume only in nearby tracts, we expect Airbnb-induced tourism demand to affect only nearby areas. Since the weighted number of Airbnb rooms in nearby census tracts is likely endogenous, we instrument the spatial lag of Airbnb rooms with the interaction between global Airbnb Google searches and the spatial lag of the share of rental houses in 2011.

Table 12 (E) shows the results of our baseline IV specification we have extended by including the spatial lag of Airbnb activity and, as its instrument, the spatial lag of our shift-share variable. We see that our coefficient of interest does not change when we account for potential spatial spillovers.[16] Therefore, we can conclude that our baseline model is defined at the appropriate level and it captures the full effect of Airbnb on local consumption amenities.

Table 4: ROBUSTNESS CHECKS

Alternative specification	Coefficient	Alternative sample	Coefficient
A. Alternative specification (Log-log IV)	0.004***	F. Alternative sample (Barcelona)	0.154***
	(0.002)		(0.053)
B. Alternative specification (Poisson IV)	0.004***	G. Alternative sample (No hotel census tracts)	0.119***
	(0.002)		(0.029)
C. Alternative Airbnb measure (Listings)	0.1526***	H. Alternative sample (No city center and periphery)	0.116***
	(0.053)		(0.025)
D. Alternative Airbnb measure (Reviews)	0.002***	I. Alternative aggregation unit (Neighborhoods)	0.045***
	(0.012)		(0.010)
E. Spatial Spillover (Spatial Matrix)	0.068***	J. Alternative aggregation unit (Transport zones)	0.056***
	(0.014)		(0.006)

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. The dependent variable is the number of food and beverage establishments. All specifications are IV regressions with clustered standard errors at the census tract level in results A-H and neighborhood and transport zones in results I and J, respectively. We use the interaction between the share of rental houses in 2011 and worldwide Airbnb Google searches as an instrument for *Airbnb rooms* variable. Results A-E provide estimates of the effect of Airbnb on local consumption amenities where we modify our IV specification as follows: taking logarithms of the dependent variable (A), estimating a control function IV proposed by Lin and Wooldridge (2019) (B), changing the number of Airbnb rooms for the number of listings (C) and the number of reviews (D) and adding the spatial lag of the number of Airbnb rooms from census tract neighbors up to 500 meters away. Results F-J provide estimates of the effect of Airbnb on local consumption amenities where we modify our baseline sample in the following way: in result F, we estimate the same IV specification for Barcelona. Results G and H limit the sample to census tracts with no hotel rooms and census tracts outside the city center or near the airport, respectively. Finally, results I and J aggregate the data into neighborhood and transport zone areas.

Alternative sample

So far, we have seen that our baseline results do not depend on the functional form, the way of measuring our variable of interest, or the existence of spatial spillovers. In this section, we test the robustness of our results using different samples. First, we leverage that our instrumental variable strategy relies on open-access information accessible in every country to see whether our main tenets hold in other contexts. In particular, we have chosen the city of Barcelona, which has also undergone rapid tourism growth in short-term rental activity (Gutiérrez et al., 2017;

[16] The coefficient of the spatial lag of Airbnb activity is not significant in our specification.

Garcia-López et al., 2020). We have collected local consumption amenities information from the Barcelona City Council's census of business premises for the three cross-sections that correspond to 2014, 2016, and 2019. We complement this information with the population, the proportion of the foreign population, the average household income, the distance to the city center, and the number of traditional accommodation rooms. We apply our instrumental variable strategy as in our baseline IV specification (Column 5 in Table 11). The positive and statistically significant coefficient in F from Table 12 shows that Airbnb spillover effects onto food and beverage services also hold in a context other than Madrid, despite the fact that the Barcelona sample comes from a different data set and covers a different time period, which may contribute to the observed difference in magnitude.

A potential violation of our exclusion restriction may stem from the non-random location of the Airbnb listings as most short-term rentals are in the city center and close to the airport. Because of this non-random Airbnb listing location, the main challenge is to disentangle the impact of Airbnb on food and beverage establishments from other effects triggered by traditional accommodations or local visitors. For instance, the number of food and beverage establishments may be increasing because of additional tourist flows coming from new or existing hotels in areas identified by our instrument as having a high share of rental houses prior to the arrival of Airbnb and, potentially, a large number of Airbnb rooms thereafter. This phenomenon is relevant to Madrid, where tourists are concentrated mainly in the city center (García-Palomares, Gutiérrez, and Mínguez, 2015; Salas-Olmedo et al., 2018; Aparicio et al., 2021). That issue is partially solved by controlling for time-varying accommodation activities that directly affect tourist-related businesses like traditional accommodation rooms and distance to the city center time trends. Still, we cannot rule out other phenomena, such as a change in locals' taste toward eating out in the city center or a higher demand for the existing accommodations units.

We approach the problem of an increase in demand stemming from new or existing traditional accommodations or changes in locals' taste towards eating out in the city center as follows. In the first exercise, we remove the census tracts where a hotel is located. In this manner, we rule out potential spatial spillover effects from hotel users. In a second

exercise, we remove census tracts in the city center or near the airport.[17] Results G and H in Table 12 rule out that city center characteristics or traditional accommodation confounders drive our results. In this regard, it seems that Airbnb has a more significant impact on non-tourist areas as these short-term rentals may be seen as a substitute for hotels Zervas, Proserpio, and Byers (2017). Therefore, the Airbnb-induced tourism effect is attenuated whenever other accommodations are around. Also, the opportunity cost of opening new establishments is lower in areas outside downtown because of a downward-sloping commercial rent gradient, although the COVID-19 disruption may attenuate this trend (Rosenthal, Strange, and Urrego, 2021).

Finally, we further test whether our main tenets hold whenever we use the same regression specification and city but change our geographical unit of analysis. Instead of census tracts, we aggregate our data to the neighborhood level (128) and transport zones (481).[18] This exercise aims to address the ubiquitous statistical problem in spatial analysis framed as the Modifiable Areal Unit Problem (MAUP). Moreover, we reduce the concerns about spatial spillovers not captured in our spatial matrix specification by aggregating our data to larger administrative units, whose boundaries should be big enough to contain the effects of Airbnb spillovers.

Table 12 (G and H) shows that even though we find a positive and significant effect of Airbnb activity on the number of food and beverage establishments, this effect is higher in magnitude whenever we use our smaller geographical unit of analysis, the census tracts. The reduced size of that administrative unit of analysis allows us to better identify the tourism-induced effect of Airbnb as they are less heterogeneous than within neighborhoods or transport zones, which may explain the smaller magnitude of the coefficient.

[17] We are removing three city center neighborhoods and three neighborhoods close to the airport. In particular, we remove the following neighborhoods: Aeropuerto, Casco Histórico de Barajas, Alameda de Osuna, Palacio, Cortes, Justicia and Sol.

[18] Transport zones (ZTs) constitute one of the basic spatial units for analysis and aggregation of information in Madrid. The Madrid Regional Transport Consortium defines them to collect information for doing surveys regarding the mobility patterns of Madrid's inhabitants. Its size approximates a scale of territorial division between the neighborhood and the census tract.

1.5.2 Extensions

Having examined the impact of Airbnb on local consumption amenities and the robustness of our results, we now turn to the mechanisms that might explain these results. First, we analyze whether Airbnb's spillover effects on establishment formation extend to employment in these activities by disaggregating the total Airbnb-induced employment effect between the intensive and extensive margins. Second, we evaluate whether there are heterogeneous effects within activities classified as local consumption amenities. Finally, we evaluate the impact of short-term rentals on other local economic activities related to gentrification and urban revitalization.

Employment

Along with the analysis, we focused on the impact of Airbnb on the number of food and beverage establishments. However, employment in this sector may have also increased. Unfortunately, we do not have access to restaurant employment numbers at the census tract level, only at the neighborhood level on an annual basis. Therefore, to test whether restaurant employment has been affected by Airbnb's entry into Madrid, we repeat our IV specification using neighborhoods as the geographic unit of analysis and years as the time frame. Table 5 column 1 summarizes the main results.

Overall, the effect of Airbnb activity on employment is greater than the effect it has on the number of food and beverage establishments, as the employment variable is jointly picking up the effect of the extensive margin (positive variation in the number of restaurants) and the intensive margin (positive variation in the employment of restaurants). Because of the inaccessibility of individual employment data, we cannot disentangle one effect from the other. However, we can obtain a back-of-envelope estimate under the assumption that new restaurants and existing restaurants vary employment equally.[19] The extensive and intensive margins contribute equally to the increase in food and beverage employment.

[19]The proof of the approximate decomposition is provided in **??** and **??** in the Appendix A.

Although we have previously ruled out the existence of different pre-trends in the change of the number of food and beverage establishments for census tracts where the share of housing rentals was high in 2011, we still do not know whether our instrumental strategy also satisfies the parallel trend assumption when the dependent variable is the employment of the restaurants. To check for parallel trends, we can use the employment level data for food and beverage establishments at the neighborhood level from 2010 onward.

Therefore, following Goldsmith-Pinkham, Sorkin, and Swift (2020), we run the following event study

$$Employment\ food\,beverage_{i,t} = \sum_{t \neq 2014} \lambda_t \times \delta Rental\ houses_{2011} + \rho X_{i,t} + \delta_t + \gamma_i + \epsilon_{i,t} \tag{1.3}$$

where we interact the share of rental houses in 2011, *Rental houses*, with year dummy variables λ_t, using 2014 as the base year. We choose 2014 as our base year as, in this year, Airbnb activity in Madrid became more significant. We control for the population, the proportion of the foreign population, the number of traditional accommodations and the distance to the city center time trends. As our main results are driven mainly by areas where the share of rental houses is high, the main idea of this test is to check whether those areas were also experiencing a different trend in the evolution of the outcome variable. As can be seen in Figure 6, the coefficients before Airbnb's entry are not different from zero. This result reinforces our conclusion that it was Airbnb that was responsible for the increase in employment in the food and beverage sector. Thus, we can conclude that there is no evidence of a violation of the parallel trends assumption or that Airbnb did not enter the neighborhoods after observing an expansion of the food and beverage sector.

Heterogeneous effects

So far, we have analyzed the Airbnb-induced tourism demand effect on the number of food and beverage establishments as a whole. However, our data set allows us to see whether Airbnb also fosters the entry of some local consumption amenities individually. Therefore, in Columns 2-5 in Table 5, we run our preferred specification of the IV model using: the number of restaurants, the number of bars, the number of cafes, and the number of clubs as dependent variables. We find a larger effect

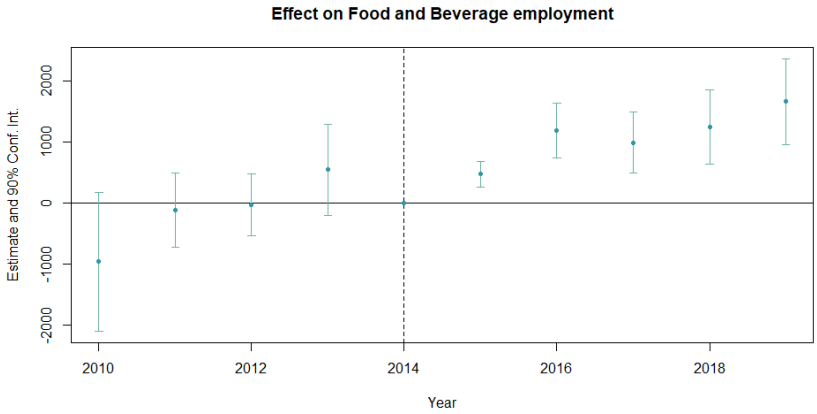


Figure 6: Event study plots for employment 2010-2019.

in the first category. This makes perfect sense since restaurants are the most tourist-oriented food and beverage establishments, whereas locals use bars and cafes regularly. Consistent with our previous findings, the sums of the individual categories roughly yield our coefficient of 0.071 food and beverage establishments per census tract per year, as expected given that we estimate a linear additive specification.

Table 5: MECHANISM.

	Employment	Heterogeneous effects				Gentrification activities
	Food and Beverage	Restaurants	Bars	Cafes	Clubs	Cultural and creative industries
	(1)	(2)	(3)	(4)	(5)	(6)
Airbnb rooms	0.7976**	0.036***	0.023***	0.011**	-0.001	0.007
	(0.356)	(0.008)	(0.006)	(0.006)	(0.002)	(0.006)
Covariates	x	x	x	x	x	x
Census tract fixed effects	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x
Distance × year	x	x	x	x	x	x
F Stat, Excluded instrument	0.27777	0.98363	0.98368	0.99453	0.17362	0.97535
R^2	0.27777	0.98363	0.98368	0.99453	0.17362	0.97535

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. The dependent variable is the employment in food and beverage establishments in Column 1, the number of restaurants, bars, cafes and clubs in Columns 2-5, and the number of cultural and creative industries as in Behrens et al. (2018) in Column 6. All specifications are IV regressions with clustered standard errors at the neighborhood level (Column 1) and census tract level (Columns 2-6). We use the interaction between the share of rental houses in 2011 and the worldwide Airbnb Google searches as an instrument for *Airbnb rooms* variable. We remove El Viso and Castilla neighborhoods in our Column 1 specification due to inconsistent temporal data in the employment variable. Both neighborhoods are outside the city center.

The impact of Airbnb on other local economic activities

We are well aware that there may still be census-tract-specific, time-varying unobservables variables in our analysis that correlated with Airbnb and the number of food and beverage establishments. To test that Airbnb and not other factors influence our results, we exploit that short-term rental accommodations should affect only tourist-related activities, in general, and local consumption amenities in particular. Therefore, we conduct our analysis on activities that could be related to a confounding factor, such as urban revival and cultural and creative sectors activities.[20] The presence of this confounding factor, which correlates with the presence of Airbnb and the number of food and beverage establishments, could invalidate our identification strategy, as we would falsely claim that Airbnb is behind the explosion in the number of food and beverage establishments. Conversely, if there is no unobserved time-varying trend, we should not find any effect of Airbnb on those economic activities, as Airbnb mainly promotes tourist-related activities. Column 6 in Table 5 shows no effect of Airbnb on non-tourist-related activities.

1.6 Conclusions

This article examines the impact of Airbnb, the most popular short-term rental company, on local consumption amenities. Using a fine-grained census of local business datasets and exploiting the exogenous variation created by the rapid and uneven entry of short-term rentals into Madrid's geography, we find positive and significant effects on the food and beverage sector. These effects can be explained by both displacement and the creation of new establishments. Interestingly, the spillover effects of Airbnb on local consumption amenities are heterogeneous within the food and beverage industry, with restaurants benefiting the most from Airbnb disruption. We find that the effects are stronger in less touristic areas, supporting the idea that peer-to-peer accommodations help redistribute tourism consumption in the city. Our results are very robust across different specifications: they are not affected by the form of the functional specification, the way Airbnb activity is measured, or the

[20] For a list of all activities related to those sectors, please see the Table 24 in the Appendix. This information was extracted from the Madrid City Council's census and cross-checked with the Behrens et al. (2018) classification of gentrifiers.

presence of spatial spillovers. They are also robust to sample composition: using a different city, filtering out specific census tracts, and using a different scale of analysis.

In this paper, we contribute to the debate on the impact of the platform economy on urban areas. We provide evidence about market expansion externalities brought by Airbnb into the city through higher employment and local consumption amenities. Moreover, market expansion effects are higher in tourist areas off-the-beaten, which may help relive tourist flows from central areas and redistribute tourism consumption in the city. However, other effects in the form of disamenities like noise and higher rental prices should also be taken into account to analyze the global effect of Airbnb on urban areas.

Hence, this study highlights the importance of taking into account the uneven effect of short-term rentals over urban geography. Viewing the city as a homogeneous area entails risks obscuring heterogeneous effects, which may lead to inappropriate public policies. Therefore, our study yields noteworthy policy implications regarding Airbnb regulation by providing some rationale for allowing short-term rentals outside the city centers due to their potentially higher positive economic spillovers. Indeed, current legislation is following that direction in cities like Madrid and Barcelona (Urquiaga, Sanz, Sanchez, et al., 2019). On top of that, the redistribution of tourist flows within the city is key to the survival of the sector, as the negative effects on residents of central areas may provoke reactions against tourists that could jeopardize the entire sector (Allen et al., 2020).

Nevertheless, further research is needed. Although we have focused on the effect of short-term rentals on local consumption amenities in this study, other economic activities may also be affected by the arrival of short-term rentals. In this regard, a more holistic approach is needed to examine how short-term rentals reshape cities by considering the overall impact of short-term rentals on the geography of all economic activities. Since the IV approach we present in this paper is very general and can be applied to different cities, another possible future development is to extend our analysis to different urban areas other than Spanish cities. All in all, the larger and undetermined externalities of short-term rentals deserve more attention to understand their potential impact on urban areas. **Gianstefani:2023**, Garcia, Miller, and Morehouse (2022)

Chapter 2

When Local Business Faded Away: The Uneven Impact of Airbnb on the Geography of Economic Activities

This paper investigates the unequal effect of Airbnb on the spatial organisation of economic activity in Madrid, Spain. Using establishment-level data from Madrid City Council and consumer-facing information from this short-term rental company, we find that Airbnb reshapes the urban space by encouraging tourist-oriented businesses, defined as businesses where tourists spend more than locals, at the expense of businesses primarily oriented to locals. These findings prove that short-term rentals do displace not only the local population but also resident-oriented businesses. Eventually, we show that our results are not driven by the method of measuring digital accommodation activity, other touristic actors, and confounders related to gentrification and the rise of online purchasing.

This chapter is based on the work 'When Local Business Faded Away: The Uneven Impact of Airbnb on the Geography of Economic Activities'

in collaboration with Massimo Riccaboni and Francisco Javier Velazquez Angona and published in the Cambridge Journal of Regions, Economy and Society (see Hidalgo, Riccaboni, and Velazquez (2023)).

2.1 Introduction

The rise of 'home-sharing' economic platforms is posing numerous challenges to urban planners and policy makers (Ferreri and Sanyal, 2018). While much of the public debate and academic literature have focused on the negative impact of short-term rentals on housing affordability (Garcia-López et al., 2020), there is still a lack of understanding about how platforms like Airbnb are changing the economic landscape of urban areas (Celata, Hendrickson, and Sanna, 2017). Specifically, it is still unclear to what extent the expansion of short-term rentals is affecting the mix of economic activities within cities. In that regard, the expansion of the short-term rentals phenomenon differs from other touristification processes as short-term rentals not only increase the accommodation capacity in certain areas, but also spread throughout urban geography, ultimately exacerbating problematic relations between residents and tourists as local businesses may be displaced. In turn, the loss of local businesses may lead to a decline in the local population, as they no longer have access to the services they need for daily living.

The main focus of this paper is to examine the consequences of the displacement of residents by tourists on the economic landscape. Tourists tend to have different consumption patterns than residents, and the influx of these new customers can affect various businesses in different ways. This impact is primarily local, as residents and tourists often spend a large portion of their time in the areas surrounding their accommodations. Local businesses[1] that serve the needs of residents are more likely to be negatively impacted by the arrival of tourists if their offerings do not match the preferences of tourists. On the other hand, businesses that cater to tourists may benefit from the influx of tourists facilitated by Airbnb, as short-term rentals expand their potential demand. Finally, the spatial organisation of urban economic activity may also be affected by Airbnb, as short-term rentals do not concentrate only in city centre areas but expand across the urban geography, blurring the touristic city.

[1] We will use the terms 'local business', 'resident-oriented', or 'local-oriented establishment' to refer to activities that serve the needs primarily of the local community.

Therefore, a central research question is the extent to which Airbnb influences the economic landscape of urban areas.

To investigate the impact of Airbnb on the spatial organisation of economic activity, we study the case of Madrid, Spain. Using establishment-level data from the Madrid City Council and consumer-facing data from Airbnb, we analyse how the local economy was affected by Airbnb from 2014 to 2019. We first assess the impact of Airbnb on the birth and death of establishments. We go beyond traditional measures of establishment turnover to examine transitions, or establishments that were open in 2014 or 2019 but have changed their primary activity. We are interested in whether Airbnb promotes establishments that cater to tourists, intended as businesses where tourists spend relatively more than locals, and whether local businesses are being replaced by establishments in different sectors, such as restaurants or souvenir shops replacing drugstores or butcher shops. To do this, we take advantage of the temporary nature of our data and the uneven distribution of short-term rentals to isolate the impact of Airbnb from other trends related to e-commerce or gentrification.

Our main findings suggest that Airbnb contributes to business formation, particularly the creation of establishments that cater to tourists, such as restaurants and bars, and to a lesser extent, tourist-oriented retail shops like souvenir or gift stores. Conversely, we observe a decline in resident-oriented establishments, including both tradable and non-tradable businesses. Our results show that the increase in tourist-oriented establishments comes at the expense of local businesses. We complement our results with an instrumental variable strategy and show that our baseline results are robust to alternative measures of short-term rental activity, other factors contributing to tourism gentrification aside from Airbnb, and confounders related to gentrification and the growth of online shopping occurring at the same time as the disruption of digital accommodation. This study adds to the literature on the economic impact of platform economies by providing the first evidence of the unequal effect of Airbnb on the spatial economic organisation within a city. Additionally, we propose a new methodology and classification to identify which businesses are at risk of decline due to Airbnb disruption in local areas.

The rest of the paper is organised as follows. In the next section, we

provide a brief review of the previous literature. Afterwards, we describe our data and methodology in detail. Subsequently, we present our results and the corresponding robustness checks. Finally, we conclude by drawing our findings together in the last section.

2.2 Tourism gentrification and neighbourhood change

Over the last decade, urban tourism flows have skyrocketed, spurred by the outbreak of the digital platform economy (Stabrowski, 2017). Regardless of other tourist accommodations like hotels and hostels, digital platform-mediated short-term rentals have leveraged the existing stock of local housing to develop their activity. Flexibility and the lack of ad-hoc regulation in the early stages explain why we have recently witnessed enormous growth in short-term rentals. However, platform accommodation-induced tourism has not come without a cost. Several studies have noted how the proliferation of short-term rentals in urban areas is related to the increase in housing and rental prices (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021). In that regard, 'home-sharing accommodations' have accelerated the already existing gentrification process (Wachsmuth and Weisler, 2018; Yrigoy, 2019; Ardura Urquiaga, Lorente-Riverola, and Ruiz Sanchez, 2020; Cocola-Gant and Gago, 2021). In particular, the widespread use of digital platforms nowadays spurs the expansion of digital accommodation companies across countries, intensifying transnational gentrification dynamics where worldwide higher-income classes appropriate local urban space (Sigler and Wachsmuth, 2015; Bantman-Masum, 2020).

Tourism gentrification, understood as a subset of the transnational gentrification process, diverges from other local population displacement processes. Classical gentrification displaces the resident population with higher-income individuals. Conversely, tourism gentrification implies a substitution of residents for tourists who do not settle down permanently (Lees and Ley, 2008). Looking at the consequences, both processes modify urban space. Unlike classical gentrification, which contributes to business transformations in line with the needs of the new affluent residents, tourism gentrification triggers urban changes to better satisfy tourists' needs (Behrens et al., 2018; Jover and Díaz-Parra, 2020). Despite

those differences, the two processes may sometimes overlap as residents may also mimic broader tourist lifestyle attitudes (Novy, 2018). Short-term rental disruption adds another layer to the complexity of tourism-led gentrification. On the one hand, home-sharing accommodations allow landlords to generate extra income by renting unused housing space as rooms (Guttentag, 2015). However, commercial actors have monopolised the sector in recent years (Gil and Sequera, 2020). Therefore, to what extent Airbnb displaces the local population is context-specific and depends on the magnitude of Airbnb's professionalisation. Moreover, the geographic distribution of short-term rentals differs from other traditional accommodations. Home-sharing accommodations are more dispersed than hotels, which are concentrated in the city centre (Gutiérrez et al., 2017; Xu and Xu, 2021b). The possibility of bringing tourists to residential areas could exacerbate the tension between local serving businesses and tourist-oriented activities but, at the same time, it contributes to decongesting tourism from central city areas. Besides, traditional accommodations already provide consumption amenities within their facilities; therefore, the potential impact on the local area is attenuated.

In the empirical literature about gentrification impacts on neighbourhood outcomes, only a handful of studies have gone beyond demographic and housing market changes, focusing on the transformation of business activities in those neighbourhoods (Lester and Hartley, 2014; Schuetz, 2014; Meltzer, 2016; Behrens et al., 2018; Glaeser, Luca, and Moszkowski, 2020). In this literature, leisure amenities and cultural and creative sectors have been marked as the primary services brought in by gentrifiers. The literature on Airbnb-led gentrification and business transformation is scant, and most papers have focused on the spillover of Airbnb effects on consumption amenities (Alyakoob and Rahman 2019; Basuroy, Kim, and Proserpio 2020; Hidalgo, Riccaboni, and Velázquez 2024). This paper contributes to filling this gap, taking a broader approach to investigate how short-term rentals reshape urban space, considering the overall effect of short-term rentals across the spatial organisation of retail businesses.

2.3 Methodology

2.3.1 Data

Study area

Our study takes place in the city of Madrid. We choose the city of Madrid as a compelling case study since it is one of the most prominent destinations in Europe by the number of Airbnb listings (Statista, 2019), and it is the most visited city in Spain (INE, 2020b). These characteristics make Madrid a valuable case study for examining the impact of the accommodation platform economy on the urban economic landscape.

Dependent variable

For our study, we used administrative records from the Madrid Statistical Department, specifically the Madrid City Council's census of business premises. This dataset contains monthly information on all business premises in the Madrid municipality from 2014.[2] We focused on establishment dynamics in October 2014 and October 2019. We choose the same month to avoid seasonality problems. To eliminate the influence of new urban development on our analysis, we only consider business premises that were present in the dataset throughout the entire study period. This allows us to focus on changes in establishment dynamics driven by local demand rather than supply factors. The dataset includes information on the location and accessibility of each premise, as well as data on the business activities of each establishment.

For our purposes, we are interested in businesses that cater to tourists or residents and whose consumption is local. The local consumption condition is key in our analysis since we are exploiting the fact that Airbnb users spend a high proportion of their time budget in nearby areas of their accommodation, ultimately impacting the urban economic landscape. To classify the establishments as tourist-oriented or resident-oriented, we rely on already-existing classifications and adapt them to our setting (Meltzer and Schuetz, 2012; Meltzer and Capperis, 2017; Allen et al., 2020; Aparicio et al., 2021). For the purpose of this classification, we consider establishments to be tourist-oriented if the expenditure

[2]In our dataset, a business premise refers to the physical property where an establishment conducts its activities. For more information about the dataset, please see Appendix.

of tourists is higher than that of residents. As a result, mostly tourist-oriented activities comprise local consumption amenities such as restaurants, bars and coffee shops. Previous research has shown that Airbnb is behind the rise in food and beverage establishments (Alyakoob and Rahman 2019; Basuroy, Kim, and Proserpio 2020; Hidalgo, Riccaboni, and Velázquez 2024). On top of that, food and beverage services correspond to the main expenditures made *in situ* by tourists (INE, 2020c; Aparicio et al., 2021). We complement this group with other stores that target tourist needs like clothing, souvenirs, gifts, or currency exchange stores.

For resident-oriented establishments, we select those activities that fulfil the basic needs of daily life. In particular, we cover a broad set of neighbourhood amenities that serve local consumer demand directly (Meltzer and Capperis, 2017). We include in this group tradable and non-tradable services. Among the tradable category are food-related stores such as butcheries or fishmongers and device-related stores like drug-stores, phone and newsagent stores. The non-tradable group includes personal care and education services: hairdressers, depilation, and nursery schools. We decided not to include higher-level education and health services in our analysis as they might not have only local consumption. We do not include other potential local businesses, such as pharmacies or tobacco shops, as the location is regulated and responds to local planning ordinances, and therefore their location is not subject to the same potential displacement as other neighbourhood uses. In order to avoid the overlap of activities that cater to tourists or locals, businesses that host both tourist-and resident-oriented activities are not classified as either tourist-or local-oriented establishments. Table 6 shows our proposed classification.

After classifying establishments based on their target population and their activity, we calculated the first set of business dynamics variables: birth and death. *Birth* (*Death*) is a binary variable that is assigned a value of 1 for establishments that were closed (opened) in 2014 and opened (closed) in 2019. In order to understand the impact of Airbnb on business activities, we further distinguished birth and death by our proposed classification of tourist-and resident-oriented businesses. As a result, our first group of business dynamics variables consists of: *birth*, *birth-tourist*, *birth-resident*, *death*, *death-tourist*, and *death-resident*.

Table 6: TOURIST-ORIENTED AND RESIDENT-ORIENTED ACTIVITIES CLASSIFICATION

Establishment type	Activity code	Activity description
Tourist-oriented		
Souvenirs	661002, 477807, 477808	Exchange currency, Expositions, Gift shop
Restaurant	561001, 561004	Restaurant, Bar restaurant
Bar	561005, 563002, 563005	Bar with kitchen, Bar without kitchen, Bar with performance
Ice-cream parlour	472902,472903, 472904	Ice-cream parlour (in-place elaboration), Ice-cream take-away
Cafe	561006, 561007	Cafe, Teahouse
Limited-Service Eating places	472406, 472407	Take-away (in-place elaboration), Take-away
Ready-made meals	471101	Ready-meal store
Pastry shops	472402, 472403	Pastry, Pastry with baked goods
Clothing store	477101	Retail trade of clothing in specialised stores
Resident-oriented		
Clothing textile	464201,952004, 960101	Textile shop, Textile laundry, Tailor
Furnishing	475903, 433001	Furnishing
Retail food	471104, 472907, 472102, 472203, 472302	Convenience, Fruit, Butchery, Fishmonger, Candy
Retail non food	477801, 474201, 931008	Drugstore, Phone store, Gym
Beauty salon	960206, 960203,960201	Hairdresser, Beauty salon, Depilation
Car workshop	452002,472102, 855001	Car workshop, Driving School
Newsagent	476201, 821001	Newsagent, Print shop
Nursery	851001	Nursery school

Notes: Activity codes refer to the most disaggregated information about business service offerings. These codes are based on the classification of activities used by the Madrid City Council. The proposed classification is not exhaustive as other activities which are not categorised as either tourist or local-oriented are not considered as they do not satisfy the local consumption assumption and expenditure patterns, despite being present in the Madrid City Council census of business premises.

As a second step, we focused on transitions, i.e., business premises that changed their main activity and storefront name between 2014 and 2019.[3] Therefore, we created a binary variable *transition* that is assigned a value of 1 for business premises that were open in both years but changed their activities during the period 2014-2019. This group is of particular interest because it allows us to measure the effect of Airbnb on business displacement. Unlike other business dynamics metrics such as births or deaths, transitions better reflect the reorientation of local supply because they refer to establishments that are open in our five-year period but change their service offerings. Births and deaths, on the other hand, might be more closely tied to long-term business trends. For the case of births, we do not have information about the business premises prior to 2014. For the case of deaths, we are unable to go beyond 2019 because of the COVID-19 outbreak, which has caused unprecedented disruption to business dynamics. In particular, the implementation of furlough schemes in the tourism sector in Spain prevents us from including recent years in our time frame because of the difficulty of distinguishing the impact of the decline in tourist flows due to public aid (Hidalgo et al., 2022).

[3]For example, a transition in our study would refer to a business premise that offered DVD rental services in 2014 but changed its storefront name and activity to offer mobile phone accessories at a later date. Our dataset does not allow us to identify ownership, so it is possible that the same owner changed the focus of their business or that a new owner took over the premise.

Figure 7: Resident-oriented establishments displaced by tourist-oriented

Notes: Business premises hosting resident-oriented activities in 2014 (left) and the same business premises hosting tourist-oriented activities in 2019 (right) in the Embajadores neighbourhood in Madrid.

As we are interested in examining whether Airbnb-induced tourism contributes to the displacement of establishments towards tourist-oriented activities, we defined two binary dependent variables, *transition-tourist* and *transition-resident*, which are assigned a value of 1 for business premises that changed their offerings in 2019 towards tourist-or resident-oriented activities, respectively. Additionally, it is possible that Airbnb may contribute to the displacement of establishments towards tourist-oriented activities at the expense of businesses that are more focused on serving the needs of local residents. To test this hypothesis, we focus on two specific transitions: *transition resident-tourist* and *transition tourist-resident*. *Transition resident-tourist* (*transition tourist-resident*) is assigned a value of 1 for establishments that became tourist-oriented (resident-oriented) in 2019, given that they were resident-oriented (tourist-oriented) in 2014. Figure 7 provides evidence of spatial displacement of resident-oriented businesses by tourist-oriented activities in the trendy tourist neighbourhood of Embajadores in Madrid.

2.3.2 Short-term rental activity

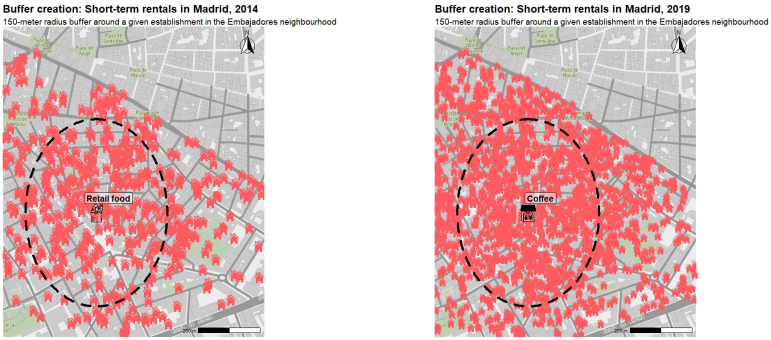
To measure short-term rental activity, we used consumer-facing information from the largest company in the sector, Airbnb. Specifically, we ob-

tained data from Inside Airbnb, an independent, non-commercial website that scrapes information directly from the Airbnb site for various cities and countries worldwide.[4] The entry of Airbnb in Madrid is not evenly distributed, concentrated in the city centre and spreading to the periphery (Gil and Sequera, 2020; Hidalgo, Riccaboni, and Velázquez, 2024). As a result, establishments in Madrid are differently exposed to Airbnb-induced tourism depending on the location of Airbnb listings. To consider this pattern of short-term rental activity and its influence on the retail business sector, we draw a 150-meter radius buffer around each business premise in 2014 and 2019.[5] Then, we count the number of short-term rentals within each buffer and calculate the absolute difference in the number of short-term rentals in each buffer over the five-year period. Figure 8 shows the creation of the buffer using the Embajadores neighbourhood as in Figure 7. We preferred our Airbnb intensity measure for aggregating short-term rental data instead of census tracts or neighbourhoods because both are based on arbitrary boundaries that may not reflect the Airbnb-induced tourism effect around each business premise. Additionally, buffers are homogeneous measures in size and shape, while other predefined spatial partitions may be heterogeneous in shape and scale. In that regard, the creation of buffers around each establishment allows for measuring its potential demand in a more reliable way compared with pre-established administrative measures, where the location of the establishment is not necessarily central. Lastly, we address the issue of jittering coordinates by Airbnb by using a 300-meter circumference area.

[4]Inside Airbnb began collecting Airbnb data for Madrid in 2015. To obtain data for 2014, we used the date of the first review as a proxy for when the listing was first opened, assuming it had not been deleted from the platform. Additionally, we applied the following filter to remove any inactive listings from our dataset: we only included listings that received at least one review in the previous year. similar to the approach taken in Zervas, Proserpio, and Byers (2017) and Garcia-López et al. (2020). Therefore, we excluded listings that did not receive a review since October 2018 for available listings in October 2019. Similarly, we dropped listings that did not receive a review since 2013 for available listings in October 2014. We chose October as our reference month to account for potential seasonal fluctuations in the number of short-term rentals in Madrid.

[5]Previous contributions in the STRs literature have relied on different aggregation measures such as census tracts (Horn and Merante, 2017b; Xu and Xu, 2021b; Hidalgo, Riccaboni, and Velázquez, 2024), ZIP codes (Koster, Ommeren, and Volkhausen, 2021; Bekkerman et al., 2022; Chen, Wei, and Xie, 2022), and neighbourhoods (López, Mínguez, and Mur, 2020; Batalha et al., 2022). Only a few studies have used rings as aggregation measures (Sheppard, Udell, et al., 2016; Zou, 2020; Venerandi et al., 2022).

Figure 8: Buffer creation



Notes: Short-term rentals (represented by red house icons) located near a business premise that provides retail food in the Embajadores neighbourhood in 2014 (left). On the right, you can see short-term rentals near the same business in 2019, but now offering Cafe services.

2.3.3 Control variables

We complement our dataset with socio-demographic information which contributes to explaining urban establishment dynamics such as population and average household income at the census tract level. We also add distance to the city centre as an additional covariate to control for city centre trends. Finally, we include a dummy variable to measure the accessibility level of the establishment (ground level or within a mall). A final list with all the variables used can be found in Table 20 and its main descriptive statistics in Table 21 in the Appendix.

2.3.4 Specification

The purpose of this paper is to investigate the impact of Airbnb's entry into urban business transformation. Specifically, we aim to determine to what extent Airbnb has affected business dynamics metrics such as the probability of openings, business closures, or changes in business activity, distinguishing between establishments oriented towards tourists and those oriented towards residents. To address our research question, we use the following linear probability model specification:

$$\Pr(\textit{Establishments dynamics}_i^{2019-2014}) = \beta Airbnb_i + \rho X_c + \delta Z_i + \alpha_s + \gamma_n + \epsilon_i \tag{2.1}$$

where $Establishments\ dynamics_i^{2019-2014}$ refers to the business dynamics outcome variables in Table 20 depending on the specification. Our main coefficient of interest is β, which measures the effect of a change in the number of short-term rentals around a 150-meters radius buffer of business premises i on the probability that the establishment undergoes any change in business activity. We expand our specification to control for socio-demographic characteristics measured in 2014 at the census tract level X_c, such as population and the average household income. We measure them at the beginning of our sample period to avoid potential contamination effects from our treatment variable. To account for different geographical business dynamics trends depending on the location of the economic activity, we add the distance to the city centre as an explanatory variable. We include establishments-specific characteristics Z_i related to its accessibility (ground level or within a mall) and we control for activity α_s and neighbourhood γ_n fixed effects.[6] In this way, we account for potential trends in the emergence or decline of certain economic activities in the city and unobserved time-invariant characteristics at the neighbourhood level. We cluster the standard errors at the neighbourhood level as business premises share commonalities at a higher treatment level. Besides, we avoid the potential problem of overlapping buffers.

One potential concern in our baseline specification is that general trends may influence the dynamics of tourist and local-oriented establishments in addition to the presence of Airbnb. While we have controlled for socioeconomic trends and included time-invariant location characteristics and activity-specific trends, there may still be some unconfounded factors that our ordinary least squares (OLS) specification cannot control for. To address this issue, we used an instrumental variable (IV) strategy. We use the number of rental houses in 2011 as an

[6]We include activity fixed effects at the current activity level for *birth*, *death* and *transition* specifications. Conversely, we include activity fixed effects at the previous activity level for *transition tourist* and *transition local tourist* specifications to prevent them from interfering with our dependent variable. Whenever we condition birth or death to be a tourist-or resident-oriented activity, we do not include any activity fixed effects because of collinearity with the dependent variable.

instrument for our Airbnb variable, following the approach of Hidalgo, Riccaboni, and Velázquez (2024). The idea behind this instrument is that short-term rentals are more likely to grow in areas with a higher stock of rental houses since Airbnb's entry into the market reduces the supply of long-term rentals to capitalise on the short-term rental price premium (Horn and Merante, 2017b; Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021).

We obtained rental house data from the Spanish 2011 Census, which is available only at the census tract level. Since our buffers are larger than the median census tract area in Madrid, we imputed the number of rental houses in each buffer using the proportion of the area of each census tract within the buffer (See Figure 17 in the Appendix).[7]

2.4 Results

This study aims to investigate the effect of short-term rentals on the dynamics of urban establishments, using the city of Madrid as a case study. The units of analysis in this study are business premises. We examine whether business premises in Madrid experienced any changes in their business status between October 2014 and October 2019. In the first stage of the analysis, we investigate the effect of Airbnb on the probability that an establishment opens or closes, and whether this change in activity status is driven by the orientation of the establishment to tourists or residents. In the second stage, we focus on transitions: establishments that were open in 2014 and 2019 but changed their main activity. We also differentiate between tourist-oriented and resident-oriented businesses in our analysis of transitions to understand the nature of retail change. Finally, we investigate whether the transitions related to tourism come at the expense of local businesses.

Table 7 presents the results of the first set of business dynamics variables using a baseline linear probability model specification. The sam-

[7]Our imputation procedure relies on the assumption that rental homes in 2011 were evenly distributed within census tracts, which may not be accurate for some large tracts located far from the city centre but is reasonable for most tracts, which have a similar size. It is worth noting that only a few of the census tracts within the boundaries of the Madrid municipality are highlighted because of their large size and low population density, as these tracts are primarily made up of parks.

ple size for each specification varies because of the different comparison groups. In the case of the birth group, we include only inactive establishments that were present between 2014 and 2019, and establishments that were born in 2019 and closed in 2014. In the death group, we include all establishments that were open in both 2014 and 2019, and those that were closed in 2019 but opened in 2014. When examining the impact of being a tourist-oriented or resident-oriented business on birth or death probabilities, we use only establishments in the respective category (births and deaths) as the comparison group.

Table 7: LINEAR PROBABILITY MODEL FOR ESTABLISHMENTS BIRTH AND DEATH DYNAMICS OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	Pr(Birth = 1)	Pr(Birth, tourist = 1)	Pr(Birth, resident = 1)	Pr(Death = 1)	Pr(Death, tourist = 1)	Pr(Death, resident = 1)
Airbnb buffer	0.010***	0.015***	-0.012***	0.001	-0.004	0.015**
	(0.004)	(0.006)	(0.004)	(0.001)	(0.012)	(0.007)
Mean dependent variable	0.792	0.193	0.238	0.0233	0.195	0.262
Marginal percentage effect	1.120	7.756	5.036	4.298	2.052	5.730
R^2	0.17657	0.06799	0.03202	0.02464	0.13997	0.09923
Observations	7,732	6,123	6,123	74,227	1,868	1,868

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. The standard errors for the estimates are clustered at the neighbourhood level. The Airbnb buffer variable represents the absolute change in the number of short-term rentals within a 150-meter radius ring around each establishment between 2014 and 2019. The coefficient for this variable is scaled by 15, which represents the average Airbnb listing change within the buffer. The model also includes control variables such as the logarithm of the population, average household income at the census tract level, a dummy variable to identify the accessibility of the establishment (grouped or storefront), and distance to the city centre. Neighbourhood fixed effects are included in each specification, and activity codes fixed effects are included in the first and fourth columns. The number of observations varies across each specification depending on the reference comparison group. The birth group comprises only inactive establishments that were present between 2014 and 2019, and establishments that were born in 2019 and closed in 2014. The death group includes all establishments that were open in both 2014 and 2019, and those that were closed in 2019 but open in 2014. When examining the impact of being a tourist-oriented or resident-oriented business on birth or death probabilities, we use only establishments in the respective category (establishments that were born in 2019 and closed in 2014 for births and establishments that were closed in 2019 but open in 2014) for deaths as the comparison group.

The results in Table 7 show that Airbnb has a positive effect on the creation of new establishments (Column 1), but does not seem to affect the probability of closure (Column 4). This finding is consistent with the work of Jiménez, Ortuño, and Pérez-Rodríguez (2022), who found that Airbnb has a positive impact on the arrival of tourists in several Spanish cities, including Madrid. The positive effect of short-term rentals on business openings may be due to the additional income flows generated by Airbnb-induced tourism. However, it is worth noting that the impact of Airbnb on business premises' service offerings is not uniform. In particular, Airbnb increases the probability of entry of tourist-oriented businesses (Column 2) but decreases the probability of the creation of resident-oriented establishments (Column 3). A reverse pattern is observed for the case of closures, with an increase in the probability of closure for resident-oriented establishments (Column 6).

Table 7 provides insights into the impact of the arrival of short-term rentals on the dynamics of businesses in Madrid, but we must be cautious in interpreting the results because of the coefficient of interest in these specifications. Airbnb listings may be self-selecting in areas of the city where some form of urban revitalisation is occurring. In this case, the positive effect on the birth and the null effect on the death specification

may be due to unobserved city-specific events that would have occurred even in the counterfactual scenario where Airbnb did not enter these areas. To address this issue, we perform an instrumental variable analysis and report the results in Table 22. These results confirm the findings from the baseline model, and in some cases, the effects are even stronger under the instrumental variable model.

Last, the birth and death specifications are subject to left and right censoring due to data limitations. Therefore, we complement our first set of business dynamics variables with the transition group to try to partially address censoring. Table 8 summarises the main results.

Table 8: LINEAR PROBABILITY MODEL FOR ESTABLISHMENTS TRANSITIONS DYNAMICS (OLS)

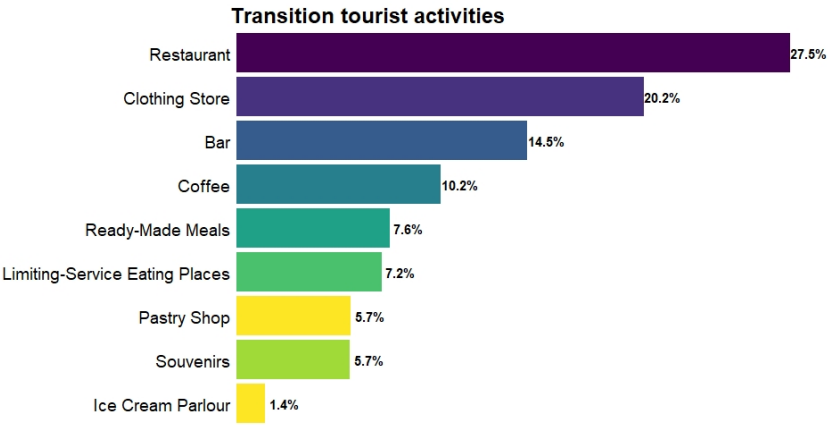
Dependent Variable:	(7) Pr(Transition = 1)	(8) Pr(Trans, tourist = 1)	(9) Pr(Trans, resident = 1)	(10) Pr(Trans, resident-tourist = 1)	(11) Pr(Trans, tourist-resident = 1)
Airbnb buffer	0.003***	0.010*	-0.007**	0.025***	-0.004
	(0.0001)	(0.006)	(0.004)	(0.007)	(0.004)
Mean dependent variable	0.109	0.244	0.219	0.217	0.197
Marginal percentage effect	2.752	4.098	3.196	11.520	2.030
R^2	0.228	0.184	0.107	0.169	0.218
Observations	85,791	9,334	9,334	1,518	1,600

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. The standard errors for the estimates are clustered at the neighbourhood level. The Airbnb buffer variable represents the absolute change in the number of short-term rentals within a 150-meter radius ring around each establishment between 2014 and 2019. The coefficient for this variable is scaled by 15, which represents the average Airbnb listing change within the buffer. The model also includes control variables such as the logarithm of the population, average household income at the census tract level, a dummy variable to identify the accessibility of the establishment (grouped or storefront), and distance to the city centre. Neighbourhood fixed effects are included in each specification, and activity codes fixed effects are included in the first and fourth columns. The number of observations varies across each specification depending on the reference comparison group. The transitions group is comprised of all establishments that were open both in 2014 and 2019 with no change and establishments that were open in both 2014 and 2019 and change activity and storefront name. The transition-tourist and transition-residents group is comprised only of transition establishments. The transition resident-tourist (transition tourist-resident) group is comprised only of transition establishments whose previous activity was local-oriented (tourist-oriented).

The results of our second set of business dynamics metrics confirm the findings from the previous analysis: Airbnb increases the probability that business premise will transition to a tourist-oriented activity (Column 8). Specifically, an increase of 15 Airbnb listings (the average Airbnb listing change within the buffer) around a business premises that undergoes any type of transition increases the probability of transitioning to a tourist-oriented establishment by 1 percentage points, which represents a 4% increase over the mean of the dependent variable. At the same time, this increase in short-term rentals decreases the probability of transitioning to a local business by a similar magnitude (Column 9). As shown in Figure 9, the increase in the probability of transitioning to a tourist-oriented business is driven mainly by clothing stores, restaurants, bars and cafe services. These establishments typically have more flexible opening hours that are more convenient for tourists, as they are open during the day and at night, while souvenir or gift shops are usually only open during the day.

So far, we have found that Airbnb contributes to the rise of tourist-oriented business in Madrid, measured through births and transitions. At the same time, short-term rental negatively affects local businesses

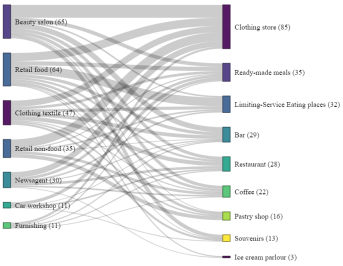
Figure 9: Tourist-oriented transitions



Notes: Business premises transitions toward tourist-oriented establishments during the period October 2014-October 2019.

by increasing the probability of closure and decreasing the probability of birth and transition. We claim that the main mechanism behind our findings is the substitution of residents for tourists whose consumption patterns differ from those of residents. While the growth of businesses that cater to tourists may be part of a larger trend related to the growth of the short-term rental sector in Spain and Madrid (Jiménez, Ortuño, and Pérez-Rodríguez, 2022), it is also possible that other factors are contributing to the decline of businesses that cater to residents. To pinpoint the specific role of Airbnb in this shift, we have analysed whether the transition of businesses to those that cater to tourists is occurring at the expense of other sectors or, more specifically, at the expense of local-oriented businesses. We have found that Airbnb has a greater impact on the displacement of non-tourist related activities (See Columns 10 and 11 of Table 8 for the OLS baseline model and Table 23 for the IV model). Indeed, whereas Airbnb increases the probability that an establishment becomes tourist-oriented, conditional on being a local business in the past, we do not observe the opposite. To get a better picture of which types of local activities are being displaced by touristic business,

Figure 10: Resident-oriented establishments displaced by tourist-oriented establishments



Notes: Transitions towards tourist services in 2019 (right) conditional on offering resident-oriented activities in 2014 (left).

we reproduce in Figure IV the transition from resident to tourist-oriented activities. We can observe that consumption amenities account for most resident-tourist transitions in both directions, i.e., from food-oriented local businesses to food-oriented tourist establishments. Moreover, other non-tradable local businesses such as beauty salons or clothing textile activities are also crowded out, reflecting that the displacement of local activities is not concentrated in specific sectors.

Consequently, our findings reveal the important role that Airbnb has played in the reconfiguration of economic activity in the city of Madrid, a case that can be extended to other European tourist cities where ad-hoc regulations are being introduced to cope with the diffusion of short-term renting (Valentin et al., 2019).

2.5 Robustness checks

In this section, we test the robustness of our main results from Table 8 in different ways. First, we control whether our main tenets hold whenever we modify the way we measure short-term rental activity. Second, we leverage the heterogeneous distribution of short-term rental activity across Madrid by removing from our sample all observations within a neighbourhood where a new hotel settles to avoid contamination of tourist effects stemming from traditional accommodations. Third, we

test whether the transitions towards tourism-oriented business and the decline in resident-oriented establishments mask other business-related phenomena beyond Airbnb-induced tourism, such as gentrification and e-commerce.

2.5.1 Short-term rental measurement

To account for the fact that some businesses may be more exposed to local demand shocks caused by Airbnb than others, we have used a 150-meter radius buffer around each business premises as our main variable of interest to calculate the change in the number of short-term rentals over a five-year period. This approach allows us to avoid using administrative units such as census tracts or neighbourhoods, which may not accurately reflect the specific impact of Airbnb on business dynamics. However, this method does not take into account the size of each accommodation unit or its demand. To address this issue, we used the maximum number of guests that a listing can accommodate as an alternative measure of Airbnb activity, calculating the difference between 2019 and 2014 for each buffer. We also considered the number of reviews for each listing as another measure of Airbnb activity, calculating the difference between 2019 and 2014 for each buffer. Furthermore, we have varied our buffer by 50 meters up and down in alternative specifications to test the robustness. Results A, B and C, and D from Table 12 show that our main findings hold regardless of the method used to measure Airbnb activity.

2.5.2 Traditional accommodations

To further assess the impact of Airbnb on local businesses, we have examined whether our main findings hold when we remove certain neighbourhoods from our sample where new traditional accommodations have opened.[8] We are deleting mainly city centre neighbourhoods where the bulk of the short-term rental activity is concentrated. Our decision is conservative as we do not expect all economic activities in the neighbourhood to be affected by the arrival of a new hotel, but only those closest to it. However, our decision to exclude these neighbourhoods is also motivated by the fact that the location of new hotels can be seen

[8]The neighbourhoods where new hotels locate are Sol, Cortes, Justicia, Universidad, Casco H. Vallecas, Castilla, Nueva España, Prosperidad, Casco Histórico de Barajas, Arguelles, Cuatro Caminos and Recoletos.

as a proxy for the overall tourist attractiveness of an area. As such, it is likely that changes in the economic activity in these neighbourhoods are driven by overall tourist flows rather than short-term rentals-induced tourism. The results in E from Table 12 provide evidence that business displacement is driven mainly by Airbnb's arrival and not other trends in the tourism sector. In principle, this is because Airbnb concentrates not only on tourist enclaves but also on other residential areas with good public transit and cultural cachet (Gutiérrez et al., 2017; Wachsmuth and Weisler, 2018; Deboosere et al., 2019). We can observe that once touristic neighbourhoods are removed, the probability of a transition to a tourist-oriented business doubles. Therefore, outside the touristic area of the city, the effect of Airbnb is even more intense and disruptive.

Table 9: ROBUSTNESS CHECKS

Dependent Variable:	Pr(Transition = 1)	Pr(Trans, tourist = 1)	Pr(Trans, resident = 1)	Pr(Trans, resident-tourist = 1)	Pr(Trans, tourist-resident = 1)
A. Airbnb buffer (Guests)	0.003***	0.010**	-0.005**	0.025***	-0.003
	(0.0001)	(0.005)	(0.0003)	(0.005)	(0.004)
B. Airbnb buffer (Reviews)	0.002***	0.008*	-0.006*	0.019*	-0.007*
	(0.0001)	(0.004)	(0.003)	(0.010)	(0.003)
C. Airbnb buffer (Radius 100m)	0.004***	0.019**	-0.010	0.054***	-0.001
	(0.001)	(0.009)	(0.007)	(0.016)	(0.007)
D. Airbnb buffer (Radius 200m)	0.001***	0.007	-0.004**	0.016**	-0.004
	(0.0001)	(0.004)	(0.003)	(0.006)	(0.003)
E. Airbnb buffer (No hotel neighbourhoods)	0.003**	0.018***	-0.004	0.022**	-0.004
	(0.001)	(0.003)	(0.004)	(0.009)	(0.004)
F. Airbnb buffer (Only non-tradables)	0.003***	0.010*	-0.004**	0.033**	0.009
	(0.0001)	(0.006)	(0.001)	(0.016)	(0.004)
G. Airbnb buffer (Broader trends)	0.003***	0.009*	-0.007**	0.025**	0.009
	(0.0001)	(0.003)	(0.001)	(0.008)	(0.015)
Dependent Variable:	Pr(Transition = 1)	Pr(Trans, gentrifiers = 1)	Pr(Trans, resident = 1)	Pr(Trans, resident-gentrifiers = 1)	Pr(Trans, gentrifiers-resident = 1)
H. Airbnb buffer	0.003***	-0.001	-0.007**	-0.004	-0.034
	(0.0001)	(0.001)	(0.004)	(0.004)	(0.036)

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. Cluster standard errors at the neighbourhood level. Airbnb buffer guests variable represents the absolute change in the total capacity (maximum number of guests) in each Airbnb listing within a 150-meter radius ring around each establishment between 2014 and 2019. The Airbnb buffer reviews variable represents the absolute change in the total number of reviews for each Airbnb listing within a 150-meter radius ring around each establishment between 2014 and 2019. Airbnb buffer variable represents the absolute change in the number of short-term rentals within a 150-meter radius ring around each establishment between 2014 and 2019 in rows E-G, a 100-meter radius in row C, and a 200-meter radius in row D. The coefficient for each variable has been multiplied by the average increase in the Airbnb measure in each specification, i.e., 1000, 50, and 15 for reviews, guests, and Airbnb listing measures, respectively. The model also includes control variables such as the logarithm of the population, average household income at the census tract level, a dummy variable to identify the accessibility of the establishment (grouped or storefront), and distance to the city centre. Neighbourhood fixed effects are included in each specification, and activity codes fixed effects are included in all specifications. The number of observations varies across each specification depending on the reference group. The transitions group is made up of all establishments that were open in both 2014 and 2019 with no change and establishments that were open in both 2014 and 2019 and change activity and storefront name. The transition-tourist and transition-residents group is comprised only of transition establishments, The transition resident-tourist (transition tourist-resident) group is comprised only of transition establishments whose previous activity was local-oriented (tourist-oriented).

2.5.3 Gentrification and e-commerce

Our business classification for tourism is made up mainly of amenities for consumption, such as food and beverage establishments. While tourists often spend a significant amount of their financial budget on food while on vacation, local residents also consume these amenities. In this case, 'touristification' may be confused with the adoption of tourist-like behaviours and consumption habits by local residents. Moreover, the proliferation of food and beverage establishments has been connected to the process of gentrification in several studies (Novy, 2018; Almagro and Dominguez-Iino, 2022). If Airbnb enters areas where locals are more likely to adopt tourist-like consumption patterns, our results may not accurately capture the pure effect of Airbnb-induced tourism. To address this potential confounder, we conduct a falsification exercise by

replacing tourist-oriented activities with those that have been linked to gentrification.[9] Our findings, shown in Result H in Table 12, suggest that gentrification does not account for our previous results. These findings align with the idea that Airbnb does not necessarily concentrate on gentrifying areas and can be found beyond central business districts with high rates of traditional accommodations, as noted by Wachsmuth and Weisler (2018).

The prevalence of tradable establishments in our local-business category makes our empirical analysis exceptionally sensitive to shocks related to this sector. One possible explanation for the decline in local businesses could be the rise of e-commerce. If this trend is happening in the same areas where Airbnb is present, we would be capturing the combined impact of online shopping and tourist activity driven by Airbnb. To ensure that our results are specifically due to a local demand shock caused by Airbnb and not any other factors, we restrict our resident-oriented category to only non-tradable businesses.[10] Additionally, in another exercise, we exclude clothing businesses, ready-made meal providers, and limited-service eating places from our classification of businesses oriented towards tourists. We made this decision because the concentration of short-term rentals and clothing stores in the city centre of Madrid makes it difficult to distinguish the effects of Airbnb-induced tourism from other local spending effects. We also chose to exclude ready-made meals and limited-service eating places due to their potential relationship with the growth of ridesharing businesses (Gorback, 2020). Finally, we did not include newsagents in our classification of businesses oriented towards residents because their decline may be due to the death of print media. Result G in Table 12 confirms that our main findings are not affected by broader trends.

As a final check, we employ sensitivity analysis tools for regression models developed by Cinelli and Hazlett (2020) to assess whether our results are robust to the potential existence of confounders, interacting non-linearly. Table 29 in the Appendix confirms our main findings.

[9]The list of gentrification activities can be found in Table 24 in the Appendix. That classification comprises mainly leisure amenities and cultural and creative sectors. It is important to bear in mind that the classification above is based on Behrens et al. (2018), who focuses on a different context and time frame (New York 2000-2010).

[10]The non-tradable resident-oriented establishments are: Textile laundry, Tailor, Furnishing services, Hairdresser, Beauty and depilation salon, Driving and Nursery school.

2.6 Discussion and conclusion

The emergence of the accommodation platform economy, with Airbnb being a prominent player, has significantly impacted the spatial organisation of urban economies. However, this impact varies across locations and different types of businesses. Using Madrid as a case study, we found that short-term rentals reshaped the urban space to better meet the needs of tourists. However, the impact on the economy, driven largely by the growth of tourist-oriented businesses, masks negative effects on non-touristic sectors. In particular, businesses that cater to the needs of local residents are particularly impacted by the arrival of short-term rentals, indicating that Airbnb does displace resident-oriented businesses. Our findings are robust to alternative measures of Airbnb activity, and to other tourist actors or confounding factors related to gentrification and the rise of online shopping.

The present study makes meaningful contributions to tourism gentrification and neighbourhood change literature. We show that the effect of Airbnb exposition expands beyond the city centre. In this way, short-term rentals may fuel uneven geographies by contributing to expelling the population from non-central neighbourhoods. At the same time, Airbnb-induced tourism can help to decongest the city centre of tourists and redistribute them better across the city. The uneven effect on the spatial organisation of the economic activity demands local authorities to address two issues: the levels of short-term rentals that are considered globally desirable in the city and the manner in which they are distributed throughout the territory. Therefore, policymakers should take into account the uneven impact of Airbnb on businesses depending on their target consumers, possibly undertaking initiatives such as food security measures to ensure that the basic needs of local residents are met. In addition, the loss of local businesses may compromise the 15-minute city strategy, which is already in place in a growing number of cities. Otherwise, there is a risk of eroding the collective city space in the affected neighbourhoods, thus amplifying the touristification phenomenon already taking place in urban areas. We believe that our results may help design policy interventions that consider not only its immediate effect on the housing rental market but also the structural change in the geography of economic activities.

Further research is necessary to confirm our findings across cities

and over time. Our methodology, which is based on existing classifications of tourist-oriented versus local-oriented businesses, publicly available information on short-term rentals, and business register data, can be easily replicated in other contexts. However, it is worth noting that there are some limitations to our study. Sometimes, tourist-oriented and local-oriented establishments may overlap in terms of their target consumers, and future research could complement our proposed methodology by using surveys and establishment reviews from recommendation platforms to better classify activities and thoroughly examine the touristification phenomenon. It is also important to determine the persistence of the transition from resident-oriented to tourist-oriented activities and whether it may be influenced by factors such as urban geography and socio-demographic characteristics. The disruption caused by the COVID-19 pandemic provides a unique opportunity to evaluate the resilience of urban areas that were previously reliant on tourist amenities.

Chapter 3

Your Room is Ready: Tourism and Urban Revival

Tourism is an essential sector of the global economy, contributing significantly to GDP and employment. Despite its importance, our understanding of its impact on urban economic activity remains limited. This paper aims to fill this gap by examining the impact of tourism on urban transformation using a dataset of hotel openings in Madrid from 2001-2010. I show that hotel openings positively impact the number of establishments and employment by using the number of protected buildings as an instrumental variable to account for the non-random distribution of hotel openings. Interestingly, hotel openings contribute to changes in the composition of the economic activities and the business structures, enhancing tourist-oriented corporate-owned businesses over other individual-owned companies. Finally, economic effects extend to the real estate market, increasing rental prices and residential investment.

This chapter is based on the work 'Your Room is Ready: Tourism and Urban Revival' (see Hidalgo (2024). In particular, this chapter is my Job Market paper (solo-coauthor paper, Alberto Hidalgo) and extends the analysis of the economic impact of tourism in Hidalgo, Riccaboni, and Velázquez (2024) and Hidalgo, Riccaboni, and Velazquez (2023) to the case of hotel openings.

3.1 Introduction

Tourism plays a pivotal role in the global economy, contributing around 10% to global GDP and employment (World Travel Tourism Council, 2019). It stands out as one of the largest economic sectors, surpassing traditional industries such as construction, transport, information, and communication.[1] According to WTO (2019), international tourist arrivals have surged from 400 million in 1990 to 1.5 billion in 2019, with urban tourism leading this trend. At the core of this growth are hotels, representing the largest player in the tourism sector (Kosová and Sertsios, 2018).

Hotels can significantly impact the local economic landscape because their services are inherently non-tradeable, requiring consumption where they are offered. This form of trade in which customers travel to suppliers can transform the composition of local economic activities, driven by differences in tourist consumption patterns compared to residents (Allen et al., 2020). Tourists demand a series of goods and services more intensively, such as restaurants, gift stores, bars, and cafes (Hidalgo, Riccaboni, and Velázquez, 2024). In turn, the increase in new tourist-oriented businesses and employment can come at the expense of other tradeable activities, making the overall effect of hotel-induced tourism on the local economy unclear (González, Surovtseva, et al., 2020; Gálvez-Iniesta, Groizard, and Portella-Carbó, 2023). In addition, hotel openings can affect the real estate market, either depriving or revitalizing the hotel's surrounding areas. On the one hand, converting residential land to accommodation use can create a negative supply shock in the housing sector, leading to higher rents (Garcia-López et al., 2020). Also, hotels in new or renovated buildings can enhance an area's overall appeal and vibrancy, potentially driving up property values (Carlino and Saiz, 2019). In contrast, hotel-induced tourism can cause nuisances and changes in amenities, making it less attractive to residents (Fontana, 2021). The potential impact of hotel openings on the real estate market can further reshape the economic landscape, affecting businesses differently based on their business structure. In this regard, individual-owned companies, lacking shared resources, may be more sensitive to rising land rental prices, as

[1] Specifically, construction (6.2%), transport equipment (1.3%), and the information and communications sector (3.2%). These figures are based on employment data from the EUKLEMS-INTRANPROD database, released in February 2023. The data refer to 2019, the year before COVID-19, and cover an aggregated basis for 30 countries with available information (source: `https://euklems-intanprod-llee.luiss.it/`).

their fixed operating costs make them vulnerable to financial challenges. All in all, hotels exert demand and supply pressure on the local economy, the labor market, and the land market, making the overall economic impact an important research question worth investigating.

To explore the impact of tourism on urban economies, this paper focuses on the contribution of hotel openings to urban transformation. Specifically, I examine how hotel openings influence the number of businesses, employment, and the housing sector within hotel surroundings in Madrid during the 2001-2010 period. Madrid is an ideal destination to study the impact of tourism on cities. It is one of Europe's leading urban tourist destinations and Spain's capital. This country ranks second globally in international tourist arrivals and income from non-resident tourists (World Travel Tourism Council, 2019). To understand the impact of hotels on urban transformation, I build a unique fine-grained dataset at the census tract level that combines hotel supply development, establishment-level data, and employment. I also collect data on rental prices and building renovation permits to analyze hotel impacts beyond local economic activity. By studying the main channels through which hotel openings affect the local economy, I aim to provide a comprehensive understanding of how tourism shapes the urban landscape.

Causal identification in this context is challenging as hoteliers select new locations based on unobserved local characteristics and trends. For instance, if hoteliers could predict which areas of the city would flourish in the future, they may systematically place hotels in these zones. This would make it difficult to understand whether changes in the urban landscape are a cause or a consequence of hotel growth. To address this issue, I propose a novel instrument - the number of protected buildings - to tackle the non-random distribution of hotel openings throughout the city.[2] The adaptive reuse of protected buildings for accommodation facilities offers urban developers a solution to the economic challenges associated with repurposing expensive structures, as hotel guests are willing to pay more to stay in these facilities (Pedersen, 2002; Lee and Chhabra, 2015). In turn, hotels are among the few economic activities that uniquely benefit from using protected buildings for their operations, turning these

[2]Protected buildings are structures of particular architectural and historical interest that merit special protection. The list of protected buildings, established by the Madrid City Council in 1997, includes structures built before the onset of the tourist boom examined in this paper. For further details on protected buildings, see Appendix C.1.

heritage structures into profitable assets (Lezcano González and Novo Malvárez, 2023). This approach mirrors the instrumental strategy employed by Faber and Gaubert (2019), who study the regional economic impact of tourism in Mexico, using environmental and historical amenities to predict tourism attractiveness.[3] Here, I study the impact of hotel-induced tourism in an urban setting by predicting hotel location decisions rather than overall tourism development using the number of protected buildings as an instrument.

Crucially for the identification strategy, I show that protected buildings strongly predict hotel openings across urban geography. In addition, the identification strategy is further supported in the context of Madrid, where changes in land use regulations during the analysis period have considerably facilitated the conversion of buildings into accommodation facilities (Comunidad de Madrid, 2005). Also, I demonstrate that protected buildings do not directly impact economic outcomes in areas without and prior hotel openings. Lastly, I provide evidence that the source of variation that I am exploiting comes mainly from protected buildings converted into accommodation facilities and not from other economic activities.

The main findings reveal that hotel openings positively impact the number of establishments and employment in the surrounding areas. Notably, employment effects are driven by the indirect impact of hotel opening on other economic activities rather than the direct impact of hotel employees, confirming the multiplier effect of tourism in other sectors (Exceltur, 2018). In quantitative terms, the main estimates reveal a substantial impact. Hotel openings explain the 27% variation in the number of establishments and the 82% variation in employment in the hotel surroundings between 2001 and 2010. These figures highlight the significant role that hotel openings play in shaping the urban economic landscape. Results are robust to different samples and specifications and consistent with varying measures of the outcome of interest, hotel activity, and the geography and period chosen.

Further analyses reveal substantial heterogeneity in the effects of ho-

[3]While unrelated to the primary research question, Gamalerio et al. (2023) employed a similar approach, using group accommodation buildings (such as homes for disabled people, the elderly, orphans, and drug addicts) to predict the presence of refugees in Italian municipalities.

tel openings on local economic activity. In particular, these effects vary significantly across different sectors. Hotel openings positively impact tourist-oriented businesses such as restaurants, bars, and souvenir stores but lead to a decrease in production-based activities. This phenomenon signals a structural shift in the city's economic landscape, characterized by a progressive reduction of the tradeable goods in favor of services, especially those targeting tourists. Furthermore, the impact of hotel openings varies widely throughout the city. Hotels in areas specializing in leisure tourism experience more significant increases in employment and the number of establishments. Besides, hotel openings spur job and establishment creation by reducing vacancy rates and the construction of new stores. Last, the rise in businesses and jobs, fostered by hotel openings, stems from the net creation of new establishments but also from shifting economic activities from neighboring areas. This reinforces the concept that newly established hotels tend to create economic clusters, promoting growth and simultaneously attracting existing economic activities toward these emerging centers.

Lastly, the economic effects of hotel openings also extend to the real estate market, leading to increased rental prices and residential investment. Interestingly, the rise in housing prices appears to be driven by an amenity effect rather than converting residential units into accommodation facilities, reducing the stock of rental houses resulting from improved urban amenities. In light of this, the findings underscore an alternative mechanism through which hotels influence the real estate market, as opposed to the reallocation of housing units away from long-term rentals to short-term rentals led by Airbnb. Finally, the increase in rental prices further reshapes the economic landscape, where corporate-owned businesses with a potentially stronger financial position displace individual-owned companies within the same economic activity. This finding underscores the role of tourism, which changes the composition of local economic activities and reshapes the legal structure of companies within the same sector.

This paper contributes to the emerging field of research on the economic impacts of tourism.[4] Several studies have focused on analyzing these impacts from a regional perspective (Kadiyali and Kosová, 2013;

[4]For a comprehensive list of the recent contributions in the literature on the economic impact of tourism, see **??** in the Appendix C.

Lanzara and Minerva, 2019; Faber and Gaubert, 2019; González, Surovtseva, et al., 2020; Favero and Malisan, 2021; Nocito, Sartarelli, and Sobbrio, 2023). The main results show that tourism is associated with increased income, employment in the tourism industry, expenditure, and the number of businesses, with positive spillovers in other sectors. Within this body of literature, short-term rental disruption has sparked significant interest in studying the economic impacts of tourism in cities. Consequently, the rise of Airbnb-induced tourism has been associated with a higher number of consumption amenities (Alyakoob and Rahman, 2022; Hidalgo, Riccaboni, and Velázquez, 2024), housing and rental appreciation (Garcia-López et al., 2020; Barron, Kung, and Proserpio, 2021) increased residential investment (Xu and Xu, 2021b; Bekkerman et al., 2022), resident discontent (Fontana, 2021), tax evasion (Garz and Schneider, 2023), displacement of businesses geared toward residents (Hidalgo, Riccaboni, and Velazquez, 2023) and the welfare impact on residents and tourists (Allen et al., 2020; Farronato and Fradkin, 2022; Almagro and Dominguez-Iino, 2022).

Concerning the literature, this paper makes several contributions. First, it is the first study to analyze the economic impacts of hotels on urban transformation. Although hotels play a central role in the tourism sector, previous research has focused primarily on other aspects of tourism, overlooking the specific effects of hotels. The lodging industry, which specializes in offering non-tradeable services meant for consumption precisely where they are produced, can reshape the urban economic landscape due to its sheer size and interrelatedness with other activities. Unlike short-term rentals, hotels are typically established in previously unused or newly constructed buildings, which helps reduce the displacement of residents and lessens the crowding-out effect on residents' consumption of goods and services. Second, it addresses a significant methodological challenge by introducing a novel instrument -the number of protected buildings- to tackle the endogeneity arising from the non-random distribution of hotels throughout the city. This instrument is based on the premise that hoteliers are among the stakeholders who can effectively utilize protected buildings' historical and architectural features to create unique and desirable accommodations that attract hotel users. By repurposing these protected buildings, hotels can capitalize on the value users place on historical and architectural elements.

Building on the work of Glaeser, Kolko, and Saiz, 2001, this research

adds a novel dimension to understanding how the composition of local demand influences the urban economic landscape (Card, Mas, and Rothstein, 2008; Guerrieri, Hartley, and Hurst, 2013; Diamond, 2016; Behrens et al., 2022; Lanzara and Minerva, 2019). While previous studies have identified the influx of young, highly skilled individuals as a critical driver of these changes (Baum-Snow and Hartley, 2020; Couture and Handbury, 2020a; Moreno-Maldonado and Santamaria, 2021; Curci and Yousaf, 2022), this study focuses on how hotel-induced tourism contributes to the emergence of the consumption city by enhancing urban amenities, including consumption-related establishments and aesthetic improvements facilitated by building renovation permits. In this context, the closest paper to this is Lanzara and Minerva (2019), which provides a theoretical framework for understanding the welfare effects of tourism in the city. In the paper, the authors show how tourism alters the sectoral composition of the local economy, driving up land prices and leading to structural transformation away from the tradeable sector, with a focus on specialization in services. I further extend and complement their work by empirically testing these theoretical predictions within the city in a causal setting.

Finally, this paper contributes to the growing empirical literature that leverages within-city variation to credibly identify the effects of economic shocks on various aspects of urban economic outcomes. These include immigration (Mazzolari and Neumark, 2012; Olney, 2013), the entry of big-box stores (Haltiwanger, Jarmin, and Krizan, 2010; Wang, 2023), the impact of ride-sharing services (Gorback, 2022; Daniele et al., 2022; Norris and Xiong, 2023), and the influence of sports facilities (Bradbury, 2022; Abbiasov and Sedov, 2023). Against this background, I leverage a supply shock to gain insights into how tourism affects business and employment dynamics and the real estate market.

The rest of the paper is organized as follows. Section 3.2 presents the data and Section 3.3 describes the empirical strategy. Section 3.4 presents the main findings and tests its robustness. I delve into the heterogeneity and extensions in Section 3.5. Finally, I discuss future research in Section 1.5.

3.2 Data

To assess the influence of tourism on economic activity, I have assembled a comprehensive dataset aggregated at the level of census tracts.[5] This dataset includes several variables, such as hotel openings, the number of establishments, employment, rental prices, residential renovation permits, and a wide range of sociodemographic characteristics.

3.2.1 Hotel information

The data set used in this analysis incorporates details on Madrid's hotel supply from 2001 to 2010.[6] The main data source is the Official Hotel Guide, an annual bulletin published by Tourspain, a public Spanish agency charged with overseeing tourism promotion, from 1936 through 2010. More precisely, the data include each hotel's coordinates, category and typology, opening date, and the number of rooms. I restrict the analysis to years before 2010 to avoid possible contamination effects of other tourist drivers, such as short-term rental disruption.[7]

Figure 11 illustrates the geographic distribution of new hotel rooms across census tracts within Madrid municipality. The distribution of hotel room openings spans the city yet shows a notable agglomeration in proximity to the city center, the business district (North), and the airport (Northeast). This pattern underscores the presence of agglomeration economies and the influence of location determinants within the hotel industry (Freedman and Kosová, 2012). Additionally, we can see a clear connection between space and time since hotels tend to open in these specific census tracts from 2001 to 2010.

In 2001-2010, 188 hotels were opened, translating to 13,510 new hotel rooms, almost an expansion of 50% of the previous overall supply.[8]

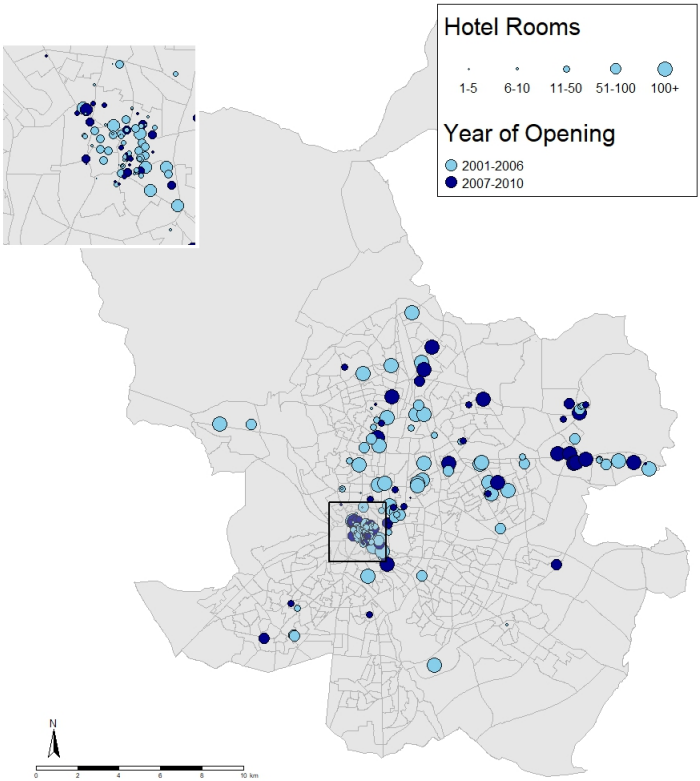
[5]Census tracts are the smallest statistical unit in Spain. In particular, the city of Madrid is divided into districts (21), neighborhoods (128), and census tracts (2358) according to 2001 city boundaries, from the largest to the smallest administrative unit (see Figure 19).

[6]In this context, the term "hotel" broadly includes a variety of accommodation types, such as hotels, hostels, boarding houses, motels, and resorts, to maintain clarity in exposition.

[7]Despite Airbnb's arrival in Madrid in 2009, the number of Airbnb listings didn't start to surge until 2014 (Hidalgo, Riccaboni, and Velázquez, 2024).

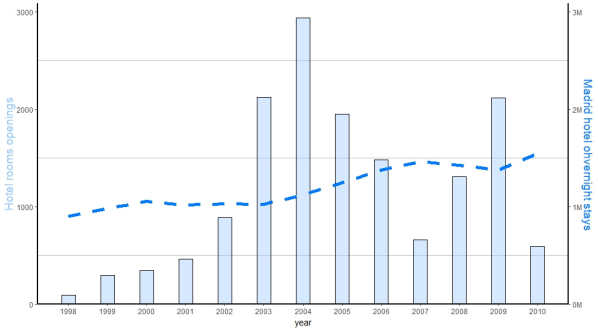
[8]Between 2001 and 2011, only four hotels experienced permanent closures, while nine

Figure 11: Spatial distribution of hotel room changes from 2001 to 2010



Notes: Gray lines limit commuting polygons.

Figure 12: Hotel room openings and Madrid hotel overnights from 2001 to 2010.



Notes: The left scale is for hotel room openings (bars), and the right scale is for the evolution of Madrid hotel overnight stays (dashed lines).

The influx of new hotels peaked in 2004 with almost 3000 hotel rooms opening, as depicted in Figure 14. On the demand side, there was a noticeable increase in overnight stays in Madrid, which experienced a minor drop during the initial years of the Great Recession. Despite this, both supply and demand demonstrated rapid recovery in subsequent years, highlighting the resilience of the tourism sector to buffer against the adverse impacts of the economic downturn (Antonakakis, Dragouni, and Filis, 2015). Regarding distribution across hotel categories, 4-star hotels are significantly ahead in the number of new openings and available rooms. This trend underscores the pivotal role that high-rated hotels have played in fueling recent tourism growth (see Figure 20 in Appendix C).

3.2.2 Outcome of interest

Establishment and employment. Information on employment and establishment comes from *Directorio de Actividades Economicas*. This dataset provides georeferenced information for the universe of all economic activities in the Madrid region during the period 2001-2010. The data set compresses business-level data under a four-digit NACE-based classifi-

others, which had opened before this period, temporarily ceased operations for renovations

cation, location, and employment size class.[9]

Housing information. Housing data comes from different sources. First, I collect rental market data from the rental guarantee database provided by the Madrid Regional Housing Department for 2001-2010. Second, I obtain residential permits from the Madrid City Council that cover the 2007-2013 period. Lastly, I gather information from the 2001 and 2011 Spanish census about the number of rental units and total dwellings.

3.2.3 Protected buildings

The information on protected buildings come from the *"Plan General de Ordenación Urbana de Madrid de 1997"*, a regulatory document guiding urban development in Madrid, Spain. This dataset outlines comprehensive guidelines covering land use, density, infrastructure, and building conservation, with the goal of achieving balanced and sustainable urban growth. It includes a detailed list of buildings that hold cultural, historical, or architectural significance. These buildings are legally protected to ensure their preservation, aligning with the broader framework of urban development. In this paper, I consider all protected buildings in my instrumental strategy, regardless of their protection level, except for monuments, museums, and other non-lodging facilities, which have been excluded from the analysis. In this way, I keep 18047 protected buildings out of 19476.

3.2.4 Sociodemographic variables

I enrich the dataset by incorporating additional variables that help to account for various factors related to changes in the local economy, such as the population, the share of educated people, and the unemployment rate. I collect this information from the Spanish 2001 census. By including those sociodemographic characteristics, I aim to control for other trends related to changes in the number of establishments, such as gentrification and urban revival (Baum-Snow and Hartley, 2020; Behrens et

[9]There are ten size classes: 1, 1-4, 5-9, 10-19, 20-49, 50-99, 100-199, 200-499, 500-999 and +900. I take the minimum of each category to attribute employment at the establishment level and remove observations for the last two size classes due to the imputation noise. The results remain consistent regardless of other imputation measures, such as the class mark or the maximum or including all size class categories.

al., 2022; Couture and Handbury, 2023).

Table 21 presents the descriptive statistics of the main variables in this study (see Table 27 in Appendix C for the description and sources of the variables and Appendix C.1 for a more detailed explanation of the data collection).

Table 10: DESCRIPTIVE STATISTICS

Panel A: Change 2001-2010			
	Sum	Mean	S.D
Establishments	11,171	4.737	17.47
Employment	59,733	25.332	217.733
Hotel rooms	13,632	5.781	51.078
Panel B: Level 2001			
	Sum	Mean.	S.D
Establishments	111,513	47.291	61.352
Employment	619,534	262.737	639.855
Hotel rooms	27,360	11.603	66.34
Protected buildings	18,962	8.042	17.517
Population	2,971,924	6204.434	3386.223
Share college	-	0.214	0.125
Unemployment rate	-	0.126	0.033

Notes: N = 2358. Descriptive statistics for commuting zone level observation.

3.3 Empirical strategy

This paper aims to investigate the impact of the entry of hotels into urban transformation. In the first part, I aim to determine to what extent hotel openings have affected the surrounding areas regarding the number of establishments and employment. To address this research question, I employ the following regression specification:

$$\triangle Y_i = \beta \triangle Hotel\ rooms_i + \rho X_i + \delta Z_n + \epsilon_i$$

where i indexes census tracts and the operator $\triangle$ denotes long-run

differences from 2001 to 2010.[10] The main dependent variables, $\triangle Y_i$, are the change in the number of establishments and employment as a proxy of local economic activity. The key explanatory variable, $\triangle Hotel\ rooms_i$, measures the change in the stock of hotel rooms in a given census tract. This measure captures the number of hotel openings and the size.

I complement the specification and expand it to control for sociodemographic characteristics measured in 2001 at the census tract level X_i, such as population, the share of educated people, and the unemployment rate. I measure them at the beginning of the sample period to avoid potential contamination effects of the treatment variable. To account for different geographical business dynamics trends depending on the location of the economic activity, I add the distance to the city center as an explanatory variable.[11] To address the concern that the results are driven by differential pre-hotel opening establishment and employment changes, I include the change in the number of establishments from 1990 to 1997. In this way, the specification allows for differential trends in establishment and employment 2001–2010 based on pre-existing trends. Lastly, I incorporate spatial district fixed effect, Z_n, to control for contemporaneous shocks common to all the census tracts of a given district. By including these fixed effects, I effectively capture and account for factors that remain constant over time but vary across different census tracts within the district. Including district fixed effects and the set of sociodemographic covariates implies that β is estimated from changes in the number of hotel rooms within the census tract over time, compared to other census tracts in the same district with similar pre-determined and geographical characteristics during the ten window period.

However, the coefficient of interest β could still be correlated with unobserved changes that are not partial out in the regression specification, therefore biasing the coefficient in an unclear direction. On the one hand, hotel openings may be higher in areas more attractive to local amenities

[10] I chose to employ long differences over yearly panel data due to the absence of time-varying control variables at the census tract level and the treatment's inherent nature. Although there are areas where hotels have opened several facilities within the same tract over the years, many census tracts only experimented with one hotel opening over the period, making long differences the most convenient specification to identify contemporaneous and subsequent economic effects. As a robustness check, I use a panel data specification and found that the results remain consistent.

[11] I measure the distance to the center as the distance from Puerta del Sol (main square in Madrid city) to the centroid of each census tract.

and with higher perceived quality. On the other hand, hotel openings can be concentrated in the declining zones with lower land costs and limited investment prospects, such as those close to airports or critical transportation hubs, catering primarily to business travelers (Lee and Jang, 2011).

To address any remaining non-randomness in hotel opening locations across census tracts, I use the number of protected buildings as an instrument for the variation in the number of hotel rooms in a given census tract. Specifically,

$$\triangle Hotel\ rooms_i = \alpha Protected\ Buildings_i + \rho X_i + \delta Z_n + \epsilon_i \qquad (3.1)$$

Protected buildings have been identified as one of the key price determinants in the hotel management literature (Henderson, 2011; Henderson, 2013; Lee and Chhabra, 2015; Pena et al., 2016). The adaptive reuse of historic buildings for accommodation facilities allows developers to overcome the economic viability of adapting costly structures for new uses, which will not be affordable or cost-effective for other economic activities. Hotel users highly value the opportunity to be hosted in these protected buildings due to their aesthetics and architectural value, making them willing to pay a premium for such unique and culturally rich experiences. As a result, many countries have implemented this approach to modify existing historic buildings to serve purposes that are usually different from their original purpose, with the conversion of historic buildings into hotels also serving as a method of preservation.[12]

Furthermore, several changes to existing land use regulations were approved during the analysis period in Madrid to facilitate the opening of new accommodations by easing the requirements for establishing accommodation facilities (Comunidad de Madrid, 2005). These regulations aimed to respond to the developing demand for hotel rooms due to the increase in tourist flows and to strengthen its bid for the 2012 Olympic Games (see Figure 18 for real examples of the transformation of protected buildings into accommodation facilities in Madrid). In this

[12]For instance, the creation of public-managed hotel chain "Paradores" in Spain, a collection of hotels established in castles, fortresses, and other historic structures, *La Oficina del Historiador* with its hotel chain "Habaguanex" in Cuba, which places hotels in small and medium historical buildings, and *Pousadas* in Portugal.

manner, the timing of the regulation can be considered exogenous, as it was explicitly chosen to boost the chances of hosting the Olympic Games without affecting any other economic activities except the lodging industry.

The instrument has two requirements to yield a causal estimate of hotel openings on local economic activity. The first is a strong relationship between hotel room openings and the number of protected buildings. The second requirement is that, conditional on covariates, the number of protected buildings is uncorrelated with unobserved determinants of changes in local economic activity. That is, the number of protected buildings impacts changes in local economic activity only by hosting hotel facilities. I provide evidence in favor of these requirements.

First, I present evidence to support the first requirement in Figure 21 and Figure 22 in Appendix C. As shown in Figure 21, census tracts with many protected buildings exhibit a higher concentration of hotel room openings. This strong relationship also holds spatially, as demonstrated in Figure 22, where I plot the spatial distribution of protected buildings and hotel room openings across census tracts.

Concerning the exclusion restriction, the identification strategy assumes that census tracts with a higher concentration of protected buildings affect local economic activity only through their impact on hotel location decisions and their subsequent economic effects. I provide evidence in favor of the validity of the instrument as follows.

First, I check whether the instrument predicts changes in the number of establishments and employment for census tracts that have never experienced any hotel presence. This exercise aims to show that the number of protected buildings is only related to changes in the outcomes of interests through its effects on hotel openings. I do not find any significant relation between the instrument and the difference in the number of establishments and employment in these areas (see estimates in columns 1-2 in Table 28 in Appendix C).

Second, an important consideration regarding the instrumental variable is the potential influence of the number of protected buildings on an area's economic activity, even before the hotel openings. To examine this, I test whether pre-period changes in both outcomes of interest

are correlated with subsequent changes in hotel penetration predicted by the instrument. In this manner, I regress changes in the number of establishments and employment between 1970 and 1980 against the predicted changes in the number of hotel room openings by protected buildings between 2001 and 2010. I provide evidence that census tracts with protected buildings and hotel openings are not areas already undergoing different trends correlated with changes in local economic activity (see columns 3-4 in Table 28). Furthermore, I conduct a placebo test to ensure that the instrumental variable strategy accurately reflects the effects of repurposing protected buildings into accommodation facilities rather than any spurious correlation due to unobserved activity influencing changes in the number of establishments and employment. Specifically, I implement a randomized treatment test akin to Christian and Barrett (2017) and Barron, Kung, and Proserpio (2021). In this test, I randomly redistribute the variation in hotel room openings across census tracts experiencing hotel openings and run the baseline IV specification. This procedure is repeated 1,000 times. Figure 23 in Appendix C shows it can be that the effect of hotel room openings is statistically insignificant for over 98% of the randomized allocations, provides evidence that the relationship between the change in the number of hotel rooms predicted by the instrument and the difference in the number of establishments and employment is not spurious.

Third, the previous exercises do not provide evidence against a potential confounder correlated in time and space with the variation in the number of hotel rooms, the concentration of protected buildings, and the evolution of economic activity. However, the number of protected buildings in an area may be correlated with other socioeconomic trends like gentrification. To test this hypothesis, I check whether the predicted variation in the hotel rooms leveraged by the instrumental strategy predicts sociodemographic and urban transformation changes related to gentrification. In particular, I measure gentrification through an establishment perspective using the variation in the number of cultural and creative sector activities.[13] The main findings show no effect of hotel openings on

[13]I adapt the classification proposed by Behrens et al. (2022) to this setting and include the following activities: 9272 Other recreational activities, 9252 Activities of museums and preservation of historical sites and buildings, 9231 Artistic and literary creation and interpretation, 9211 Film and video production, 7484 Other business activities, 7481 Photography activities7440 Advertising, 7414 Consultation and advisory services on business management and direction, 5225 Retail trade of beverages, 5227 Other retail trade in specialized

gentrification activities (see estimates in Columns 5-6 in Table 28 in the Appendix).

Fourth, the relevance of the instrumental variable strategy is based on the fact that hotels are one of the few economic activities that can take advantage of the repurposing of historic buildings, as hotel guests value being hosted in those facilities. However, firms may select these buildings as their headquarters due to aesthetics (Bargenda, 2015). This could lead to changes in the urban landscape that could be driven by those activities, confounding the effects of hotel economic impacts. To test for this issue, I examine whether the change in the number of hotel rooms predicted by the instrument is correlated with a variation in the number of firms' headquarters in each census tract. The existence of this confounder, associated with the presence of hotels and the change in the dynamics of the local economy, could invalidate the identification strategy, as I would mistakenly attribute the increase in the number of establishments and employment to hotels. Columns 7-8 in Table 28 show no effect of the hotel openings predicted by the instrument on the location of the headquarters.

Fifth, to ensure the reliability of the identification strategy and assess whether hotel openings effectively capture the presence of hotel guests and tourists in the vicinity, I conduct an additional exercise. This exercise involves testing the predictive capacity of hotel openings for the presence of tourists in the area. To achieve this, I gather photographs taken by tourists from the Flickr platform.[14] The results in column 9 of Table 28 show that hotel openings positively impact the number of photos tourists take in the census tracts. Finally, I employ sensitivity analysis tools for regression models developed by Cinelli and Hazlett (2020) and Cinelli and Hazlett (2022) to assess whether the results are robust to the potential existence of other confounders apart from gentrification and other economic activities or all of them interacting non-linearly. Table 29 in the Appendix C confirms that it is highly unlikely that the main results

food establishments, 7420 Technical services of architecture and engineering and other related technical consulting activities, 9133 Other associative activities, 2211 Book publishing. The codes reflect the Spanish 1993 NACE-based classification of economic activities.

[14] I differentiate between photos taken by tourists and residents by considering users who captured photos in Madrid over a continuous 7-day period between 2007 and 2013. Then, I compute the difference between the tourist photo stock in each census tract between 2007 and 2013.

are driven by a potential confounder.

Having provided evidence about the validity of the proposed instrumental strategy, I now analyze the effect of hotel opening on the number of establishments and employment in Section 3.4.

3.4 Results

Table 11 displays the results of the OLS (columns 1-4) and IV (columns 5-8) specifications. The sample includes 2358 census tracts in Madrid. The dependent variables are long differences computed between 2001 and 2010 for the number of establishments and employment. I instrument for the variation in the number of hotel rooms with the number of protected buildings in the same area in columns 5-8. Columns 2, 4, 6, and 8 include, as control variables measured in 2001, the population, the share of educated people, and the unemployment rate. I also include the change in the number of establishments from 1990 to 1997 to control for differential trends in establishment and employment based on pre-existing trends. Finally, I add district fixed effects to remove time-invariant unobserved heterogeneity and the distance to the city center to control for geographical characteristics across census tracts within districts.

Table 11: THE IMPACT OF HOTEL ROOM OPENINGS ON THE NUMBER OF ESTABLISHMENTS AND EMPLOYMENT (OLS AND IV).

	OLS				IV			
	Δ Establishments		Δ Employment		Δ Establishments		Δ Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Hotel rooms	0.121***	0.118***	1.29***	1.28***	0.222**	0.222**	4.52*	4.18*
	(0.022)	(0.021)	(0.365)	(0.361)	(0.112)	(0.094)	(2.50)	(2.12)
Covariates		x		x		x		x
Adjusted R-squared	0.164	0.187	0.112	0.13				
F Stat, Excluded instru.					9.25	10.84	9.25	10.84
Observations	2358	2358	2358	2358	2358	2358	2358	2358

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, ** and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010. I use the number of protected buildings as an instrument for the variation in hotel rooms. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center in Madrid. Fixed effects at the district level.

The main results show a positive effect of hotel openings on the number of establishments and employment, regardless of the model specification.[15] The inclusion of controls reduces the coefficients for changes in the number of hotel rooms. However, they remain significant across all specifications. Although I control for an extensive range of factors, I cannot rule out unobserved time-varying characteristics related to hotel entry and the changes in the number of establishments and employment. Therefore, I use an instrumental variable strategy to overcome the potential endogeneity problem in the hotel location decision. The instrument, the number of protected buildings, predicts hotel location decisions, as can be seen in the Kleibergen-Paap Wald F-test value. In the second stage, we can see that the sign of the hotel room effect remains positive, and the magnitude has slightly increased.[16]

Notably, the coefficients tend to be slightly larger for the IV specification. This suggests that omitted factors are negatively correlated with changes in the number of establishments and employment but positively correlated with hotel room availability decisions, and measurement errors may push down the coefficient's OLS magnitude. In that sense, hotels may cluster in census tracts with restricted investment prospects, typically featuring lower prices. The affordability of these areas can at-

[15]Table 30 in Appendix C presents the first-stage, reduced-form, and regression results, taking the mark class and the maximum of the employment size class as a robustness check. Also, I include all employment-size classes without removing the two largest categories. Last, I remove hotel employees to test that mechanical increases in the number of hotel employees do not drive the employment effects in each census tract. In particular, I find consistent results showing that tourism-induced employment comes mainly from tourist activities other than the hotel industry (Exceltur, 2018). The results show the strength of the instrument and the stability of the coefficient of interest for different employment imputation measures and excluding hotel employees.

[16]One potential criticism of the instrumental strategy lies in the fact that protected buildings encompass a diverse array of structures, making it challenging to pinpoint which types of repurposed structures are driving the observed results. I incorporate all protected buildings into the instrumental strategy in the baseline specification, irrespective of their protection level, except monuments, museums, and other non-lodging facilities, which have been excluded from the study. To show that the results remain consistent no matter the typology of the protected buildings used as instruments, I follow the classification provided by the Madrid City Council and created four different instruments: the number of protected buildings with protection levels I, II, and III, and the total number of all protected buildings. The results in Table 31 reveal that the significance and magnitude of the results remain consistent, with minor exceptions noted in the establishment specification when paired with the number of protected buildings at level II. This null effect may be attributed to the limited variability observed due to these buildings' small number and specific characteristics, which may pose challenges in repurposing.

tract more accommodations, leading to a greater concentration of hotels in such places. Although the data set provides detailed information on hotel openings, it is essential to note that there may be measurement errors, especially for potentially small accommodations that were not included. Finally, an additional explanation for the larger magnitude of IV coefficients may be that IV estimates capture the effect of the treatment on a specific subset of the population - the compliers. In this context, census tracts whose treatment status, the opening of new hotels, is influenced by the instrument, the number of protected buildings. Consequently, in the presence of heterogeneity of the effect, IV coefficients estimate the local average treatment effect (LATE) related to places with a high density of protected buildings, which may be more sensitive regarding economic activity to hotel openings. On the other hand, the OLS estimates capture the average effect of hotel openings across all areas, including those where hotels open, for reasons unrelated to protected buildings. This average effect might be diluted by including areas where the impact of hotel openings is less pronounced.

To further investigate whether the downward bias in the OLS estimate is the result of a problem of omitted variable bias plus the presence of heterogeneity on the effect, I proceed to estimate the IV specification separately by subgroups. In particular, I identify depriving census tracts according to the Spanish Catalog of Vulnerable Neighborhoods and repeat the IV and OLS specifications for depriving and not depriving tracts.[17] As demonstrated in Table 32 of Appendix C, the relative stability of IV estimates across subgroups contrasted with the substantial variability in the OLS estimate. This implies that while the IV estimates specifically reflect the impact of new hotel openings on a select subgroup of census tracts characterized by the presence of protected buildings, which enhances the propensity for new hotel establishments, the OLS estimates represent the general effect of hotel openings across all tracts, being those estimates downward biased, stemming from the tendency of hotel development to be predominantly focused in economically disadvantaged tracts.

[17]The "Catalog of Vulnerable Neighborhoods" from the Spanish Ministry of Development is a comprehensive database that identifies and characterizes neighborhoods across Spain deemed vulnerable from a socio-economic and urban perspective in 2011. This catalog serves as a critical tool for urban planning and policy-making, offering insights into areas that may require targeted interventions for improvement and redevelopment.

In quantitative terms, the coefficients in columns 6 and 8 suggest that each additional hotel room creates .222 establishments and 4.18 employees. This equates to an approximate 27% increase in establishments and an 82% increase in employment explained by hotel openings from baseline levels in an average commuting zone during the period 2001-2010.[18] In summary, the impact of hotel rooms on employment is larger than the impact of the number of establishments. This is because the employment variable considers both the increase in the number of establishments and the increase in the workforce within existing establishments. To contextualize these figures, it can be inferred that 100 overnight stays would typically stimulate a rise of 1.5 employees and .12 establishments, given the average room occupancy in Madrid in 2010. These estimates are consistent with the 2-5 jobs per room observed in other studies (Kadiyali and Kosová, 2013; Exceltur, 2022).[19]

3.4.1 Robustness checks

Now, I test the robustness of the results to changes in the set of controls, specifications, and sample definitions.

Alternative specification

In the first part, I show that the results are robust to different specifications. I check whether the main tenets hold whenever I augment the baseline specification, including the pre-treatment control variables in levels and changes. Then, I change the way of measuring the main variable of interest using the number of hotel opening units without taking into account the size. After that, I estimate the model using panel data

[18] These figures were computed by taking into account the average increase in the number of hotel rooms, which was approximately 5, and the average changes in the number of establishments and employment, which were around 4 and 25, respectively, between 2001 and 2010.

[19] Although not directly related to our main research question, Hidalgo, Riccaboni, and Velázquez (2024) adopted a similar methodology for Madrid, albeit in a different time frame and with a distinct focus. Specifically, they examined the effects of Airbnb's presence in Madrid from 2014 to 2019. Their analysis, which used the increase in Airbnb rooms and an instrumental variable approach involving the proportion of rental houses and changes in the number of consumption amenities in each census tract, yielded an estimate of .064. This is comparable to the .057 estimate that would be obtained by limiting the scope of activities to consumer amenities alone, as shown in Table 33 in the Appendix C.

instead of long differences. Finally, I address the potential spatial correlation among census tracts from nearby census tracts in different neighborhoods.

To begin with, I augment the baseline regression specification by incorporating the changes in the explanatory variables as additional control variables.[20] This allows me to consider relevant dynamics, such as the influx of highly skilled young people, which can contribute to urban transformation in the area (Baum-Snow and Hartley, 2020; Couture and Handbury, 2020a; Curci and Yousaf, 2022). As evident in result A in Table 12, there is minimal change in the coefficients' magnitudes, suggesting that potential confounding factors related to gentrification are unlikely to drive the results. As an additional robustness check, I test whether the main results hold by measuring hotel-induced tourism through the number of hotel opening units. The decision to use the number of hotel room openings in the baseline specification is based on the fact that I can control the hotel size in this way. Again, the sign of the result B in Table 12 shows that the findings are not sensitive to alternative ways of measuring hotel activity, although the magnitude of the coefficient has changed due to the different metrics.

Then, I take advantage of the time variation in the analysis and run a yearly panel data specification. I employ long differences over yearly panel data due to the absence of time-varying control variables and the treatment's inherent nature. Although some census tracts have seen multiple hotel openings at the same location over the years, many census tracts had only one hotel opening during the entire period. To solve the endogeneity problem that arises from the non-random location and timing of hotel openings, I interact the number of protected buildings with the total hotels' overnights in Spain as a proxy for tourists in a shift-share style.[21] Result C reveals that the choice of a long difference over panel

[20] Specifically, I calculate the decade-long differences (2001-2010) in the proportion of degree holders and population. I exclude decade-long differences in the proportion of unemployed individuals since this information is unavailable for 2010.

[21] While the number of protected buildings explains the extensive and intensive margin of the treatment, the Spain hotel overnights describe the timing. Previously, Garcia-López et al. (2020) and Hidalgo, Riccaboni, and Velázquez (2024) have used a similar identification strategy in a panel data context to instrument the growth and location of short-term rentals. Specifically, while both studies use the same shift (Google searches worldwide for Airbnb), Garcia-López et al. (2020) use the number of tourist attractions, and Hidalgo, Riccaboni, and Velázquez (2024) use the proportion of rental houses as the share.

data does not affect the significance of the results.

Table 12: ROBUSTNESS CHECKS

Variable	Establishment	Employment
Alternative specification		
A. Long-diff controls	0.229**	4.37*
	(0.104)	(2.38)
B. Number of hotel openings	8.64**	205.0**
	(4.26)	(104.1)
C. Panel data	0.138***	3.65***
	(0.074)	(1.24)
D. Conley errors	0.222***	4.18***
	(0.093)	(1.89)
Alternative sample		
E. Tourist attractions	0.252**	4.434***
	(0.104)	(2.33)
F. Pre-crisis (2001-2006)	0.334***	6.96**
	(0.123)	(3.33)
G. Great Recession (2007-2010)	0.313**	-0.366
	(0.136)	(1.75)
H. Unit of observation: commuting zones	0.330*	2.73*
	(0.176)	(1.36)
I. Unit of observation: neighborhood	0.481***	3.60***
	(0.199)	(1.36)

Notes: Statistical significance at levels 1, 5, and 10% is indicated by ***, ** and *, respectively. All specifications are IV regressions with clustered standard errors at the neighborhood level in results A-B and E-H, census tracts in result C, Conley in D, and heteroskedasticity in I. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2011. Control variables include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance to the city center in results A-D and G-I. Result D specification only controls for the same variable interacted with time-varying year dummies due to the lack of time-varying regressors. I include district-fixed effects in Results A-H. The number of observations remains constant in all specifications (2358), except Results C (2348), Results E (235800), Results H (585), and Results I (128 neighborhoods).

Up to this point, all the specifications have employed cluster standard errors at the neighborhood level. However, neighborhoods that serve as administrative units may not capture the influence of agglomeration and

other economic factors. Consequently, census tracts located close to each other but in different neighborhoods may be exposed to similar shocks and trends. To address the potential spatial correlation among census tracts from different neighborhoods, I adopt the HAC method proposed by Conley (1999), with a parameter value of 2 km. This choice is informed by previous research that indicates that tourists tend to move a maximum of 2 km from their accommodations (Shoval et al., 2011). Furthermore, considering the average neighborhood diameter is 1.2km, I opt for a larger distance to adequately account for any remaining spatial correlation. The result D confirms that the main results are robust to computing the standard errors at a larger level.

Alternative sample

So far, we have seen that the baseline results do not depend on adding new control variables, measuring the variable of interest, exploiting the temporal dimension through a panel data set, or potential spatial autocorrelation in the error term. In this section, I want to test the robustness of the results using different samples. First, I remove census tracts hosting tourist attractions to show the robustness of the results by excluding tourist areas. Then, I test whether the results hold by splitting the sample into different periods. Finally, I assess whether the baseline results are robust to the geographical aggregation of the data.

First, a possible violation of the exclusion restriction arises due to the non-random distribution of hotel openings, which are predominantly located in the city center, where most tourist points of interest are. This spatial bias presents a challenge in disentangling the impact of hotel room openings on the local economic activity from other influences, such as those originating from other tourist activities or resident consumption. For example, the increase in the number of establishments and employment can be attributed to city-centric characteristics (García-Palomares, Gutiérrez, and Mínguez, 2015; Salas-Olmedo et al., 2018; Aparicio et al., 2021). This situation is particularly relevant in Madrid, where tourists are predominantly concentrated in the city center. Although I address this issue to some extent by accounting for a large set of socio-demographic and spatial covariates, I cannot wholly dismiss other factors, such as shifts in resident consumption taste toward the city center or the surge of tourist-related activities such as convention centers or markets. To test

for this, I exclude all census tracts intersecting with the top ten points of interest in Madrid from Tripadvsor.[22] Result E in Table 12 show that the findings are not affected by the characteristics of the city center or confounding factors related to tourism.

Second, to further ensure the robustness of the results, I test whether they hold up under different sample periods. This is particularly relevant because the time frame covers the Spanish economic boom and the onset of the Great Recession. To assess the independence of the findings from the chosen period, I divide the sample into two distinct phases: the "Pre-crisis" period from 2001 to 2006 and the "Great Recession" period from 2007 to 2010. The results F and G show that hotel room openings similarly impact establishments regardless of the chosen period. If so, the estimate for the employment specification in the "Great Recession" period is insignificant. This could be attributed to Spain's labor market dynamics during recessions, where the country experiences a strong contraction in employment (**sanz2020labor**) and also to the decrease in hotel occupancy rate as can be seen in Figure 14.

Last, the decision to use census tracts as the observation unit is based on the need to identify local spillovers of hotel entry on economic activity while still capturing spatial spillovers. Although other aggregation units, such as commuting zones or neighborhoods, could have been used, census tracts balance being small enough to identify local effects and large enough to capture spatial influences. To demonstrate the robustness of the findings regarding the selected geography, I replicate the baseline observation by aggregating the data into these alternative administrative units. The results H and I reaffirm that the main findings remain consistent regardless of the chosen geography.

3.5 Heterogeneity and Extensions

Having explored the impact of tourism on the local economy and the robustness of the findings, I now explore other aspects of the urban landscape that may be affected by hotels in more detail. First, I analyze the

[22]Specifically, the top ten points of interest in Madrid according to Tripadvisor are: Santiago Bernabéu Stadium, Royal Palace, Gran Via Avenue, Plaza Mayor, Salamanca District, La Latina, Crystal Palace, Malasaña and Puerta del Sol.

heterogeneous effects of hotel openings on different economic activities. Then, I study whether the economic impacts of hotels are different across urban geography. To conclude, I explore whether tourism impacts the real estate market measured through rental prices and building renovation permits and whether that impact, at the same time, affects the configuration of establishments according to the business structure.

3.5.1 Heterogeneity

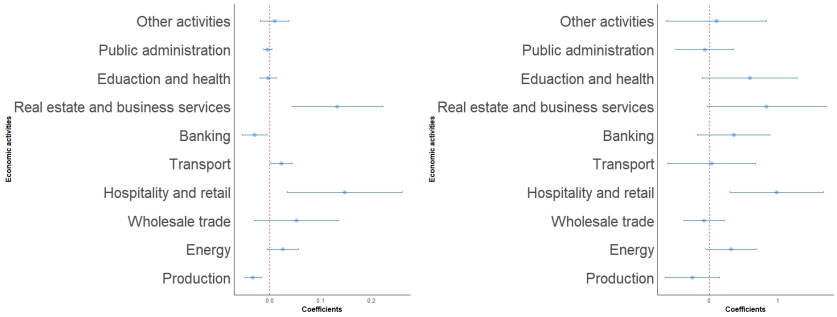
Sectoral composition heterogeneous effects

The opening of a hotel in a particular area can have a significant impact on various economic activities. This impact is attributed to the different consumption patterns of tourists and residents. Tourists, typically seeking accommodation and entertainment, contribute directly to the hotel industry and related sectors such as restaurants, bars, cafes, or souvenirs (Almagro and Dominguez-Iino, 2022; Hidalgo, Riccaboni, and Velázquez, 2024; Alyakoob and Rahman, 2022). On the other hand, residents often engage in different spending patterns, focusing more on daily necessities and services within their community. In addition, the fact that tourism consumption is mainly concentrated in the non-tradeable sector can contribute to fastening the transition from a production-based city toward a consumption city, displacing tradeable activities.

To test whether tourism has an even impact on economic activities, I turn to the narrower analysis of the effect of hotel openings on economic activity by focusing on its differential effects on establishment and employment depending on the activity sector.[23] Figure 13 shows how tourism has an unequal effect across the establishment sectors, primarily benefiting activities related to the hospitality and retail sectors and negatively impacting production activities. In this sense, the results are consistent with previous findings in the literature (Lanzara and Minerva, 2019; González, Surovtseva, et al., 2020; Hidalgo, Riccaboni, and Velazquez, 2023). As services cannot be traded, a surge in tourism boosts income in non-tradeable activities. Assuming that the cost of intermediate inputs remains constant in global markets, the economy reallocates

[23] I define nine activity sectors according to a NACE-based classification in Spain (CNAE-93). A list of economic activities within the industry can be found in Table 34 in Appendix C.

Figure 13: Heterogeneous effects on other economic activities



Notes: Figure reproduce the heterogeneous effects of hotel openings on establishments (left) and employment (right) across sectors using the main baseline specification (Columns 6 and 8 in Table 11), respectively.

resources towards the non-tradable sector and replaces the local production of intermediate inputs with imported goods (Lanzara and Minerva, 2019).

A potential concern may be that the category "hospitality and retail" includes a wide variety of tradeable and non-tradeable activities, potentially masking heterogeneous effects within this category. To check whether the main findings are driven by purely tourist-oriented and non-tradeable activities and not other economic activities, I perform an additional exercise where I define tourist or resident-oriented activities following the classification proposed by Hidalgo, Riccaboni, and Velazquez (2023). Mainly tourist-oriented establishments include consumption amenities, souvenirs, and clothing stores. At the same time, the resident-oriented category comprises grocery stores, hairdressers, nurseries, and other activities aimed at satisfying the daily needs of locals. Table 35 in Appendix C show that tourist-oriented activities, mainly non-tradeable activities, drive the creation of business and jobs in the analysis. However, I do not find evidence of a negative effect on resident-oriented activities. This could be attributed to the fact that hotel openings during the period were potentially concentrated in unused or newly constructed buildings, thus minimizing the displacement of local residents in the area.

In general, the negative impact on production-based activities, together with the positive effects on tourist-related activities, confirms that tourism contributes to explaining the transition from a production city to a consumption city (Glaeser, Kolko, and Saiz, 2001; Lanzara and Minerva, 2019). In this way, hotel-induced tourism leads the town to undergo a structural shift away from the tradeable sector, focusing on specializing in services, particularly those catering to tourists.

Spatial heterogeneous effects

Table 13: SPATIAL HETEROGENEOUS ANALYSIS.

	Inner areas		Business premises	Ring method	
Dependent Variables:	Δ Est.	Δ Emp.	Δ Business premises.	Δ Est.	Δ Emp.
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Δ Hotel rooms	0.239**	4.55*	0.168**	0.115**	1.18
	(0.109)	(2.45)	(0.080)	(0.057)	(1.07)
Observations	2322	2332	2332	1,889	1,889

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, **, and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010 in columns 1-2 and 4-5 and the change in business premises between 2001-2010 in 3. I use the number of protected buildings as an instrument for the variation in the number of hotel rooms. The number of observations varies across specifications. For columns 1-3, I exclude census tracts that are located outside the main driveway roads in Madrid. In columns 4-5, the focus shifts to removing those tracts that are adjacent to the areas where new hotels are established. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level.

The impact of hotel openings can vary widely across a city. To illustrate, hotels near airports or other accessibility areas may not yield as substantial economic spillover in hotel surroundings as in central areas. This difference can be attributed to the predominant clientele of airport-adjacent hotels, primarily business travelers rather than leisure tourists (Lee and Jang, 2011). Additionally, the increase in establishments and employment associated with new hotel developments may predominantly reflect the dynamics of urban expansion. This trend suggests a shift towards the extensive margin of economic activity, characterized by the development of new commercial spaces, rather than an intensive margin approach focused on reducing vacancy rates. To assess these hy-

potheses, I conduct two exercises. First, I restrict the analysis to areas of the city within the main ring road.[24] Then, I estimate the main IV baseline model to see whether the impact of hotel openings differs. Following this, I assess the effect of new hotel openings on the difference in the stock of business premises as a proxy for the floor space in the same areas.[25] The results are reported in Table 13.

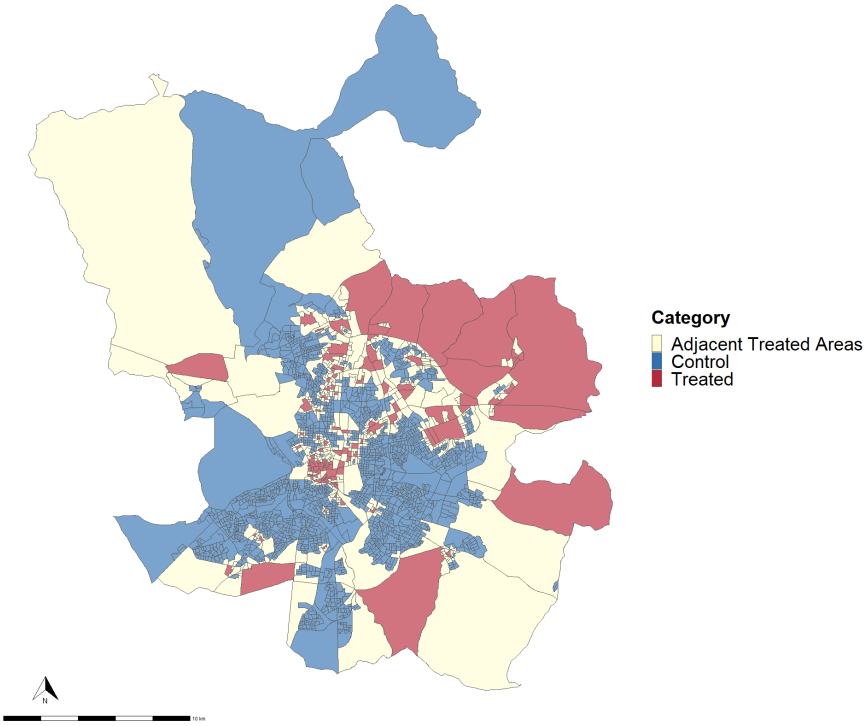
In columns 1 and 2, I examine the impact of hotel openings on business formation and employment in Madrid, filtering out mainly tracts near the airport and accessibility points. Both estimates, establishment and employment increase in magnitude, suggesting that the primary effects of hotel openings are observed in areas where business travelers are not the dominant user group. Moving to column 3, I find that part of the increase in establishments and employment led by hotel openings is attributable to new physical business premises. Therefore, hotel-induced tourism impacts the intensive margin by reducing vacancy rates and the extensive margin by constructing new physical stores.

It is important to explore whether the rise in businesses and jobs, sparked by new hotel openings, stems from the creation of new establishments or merely shifts resources from neighboring areas. This notion is particularly compelling when observing the potential clustering effects of these hotels, which might foster localized economic surges, influencing both the emergence of new establishments and the spatial redistribution of the existing ones. To test this, I estimate the IV baseline specification excluding tracts adjacent to these new hotels to clearly see the impact (see Figure 14). The main findings, shown in columns 4 and 5 from Figure 14, reveal that growth in businesses and employment is a combination of new creation and economic shifts from adjacent areas. This supports the idea that new hotels often form economic clusters, fostering growth while also redirecting existing economic activity toward these new hubs.

[24] The M-40 is the main ring road highway around Madrid, with a length of 61.1 km and an average radius of about 10.07 km from the Puerta del Sol, the city center of Madrid.

[25] I collect business premises information from the Spanish Cadastre that comprises detailed information and the precise geolocation of the universe of floor space in Spain. Here, a business premise refers to the physical property where an establishment conducts its activities.

Figure 14: Spatial Distribution of control, treated, and adjacent census treated areas.



Notes: Red areas represent census tracts where new hotels have opened. The white areas indicate tracts adjacent to those with hotel openings, while blue areas are not directly affected by or adjacent to the hotel developments.

3.5.2 Extensions

Housing market

The increase in amenities and building investment aesthetics driven by hotel openings may impact housing prices and contribute to urban revitalization. Previous research has consistently shown the influence of amenities and urban architectural aesthetics on the valuation of surrounding residences, with areas that possess distinct consumption amenities that often attract premium prices (Glaeser, Kolko, and Saiz, 2001; Carlino and Saiz, 2019). Additionally, repurposed residential buildings as accommodation facilities can also positively impact rental prices through a decrease in rental housing stock (Garcia-López et al., 2020). In contrast, hotels can bring other problems in terms of congestion and nuisance, potentially negatively impacting the housing market. To test the impact of hotels on the housing market, I collect data from rental prices to study whether hotel room openings contribute to real estate revitalization. To do so, I compute the difference in the mean rental price per square meter at each census tract between 2001 and 2010 and see whether hotel openings affect the rentals in the hotel's surroundings. The results, as shown in column 1 of Table 14, provide compelling evidence that hotel openings contribute to increased rental prices.

Table 14: THE IMPACT OF HOTEL ROOM OPENINGS ON THE REAL ESTATE MARKET.

Dependent Variables:	Δ Rental price	Δ Building renovation permits	Δ Rental houses	Δ Dwellings
Model:	(1)	(2)	(3)	(4)
Variables				
Δ Hotel rooms	0.03**	0.049***	-0.506	0.180
	(0.018)	(0.017)	(0.311)	(1.41)
Observations	1,407	1,207	2,358	2,358

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, ** and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the change in the mean rental price per square meter between 2001 and 2010 in column 1, the change in the number of building renovation permits between 2007 and 2013 in column 2, the change in the number of rental houses between 2001 and 2011 in column 3, and the change in the number of dwellings between 2001 and 2011 in column 4. Census tracts without rental information and building renovation information drop out from the analysis. I use the number of protected buildings as an instrument for the variation in the number of hotel rooms in each respective regression specification period. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level.

However, it is not clear whether the increase in rental prices prompted by hotel openings is due to a demand or supply driver. To better understand which channel explains the increase in housing rental prices, I perform three additional exercises, where I regress the difference in build-

ing renovation permits, the difference in the number of rental houses, and the number of dwellings against the change in the stock of hotel rooms.[26]. In this way, I can identify whether the positive effect on rental market prices is due to a reduction of the housing supply or residential investment. Unlike short-term rental platforms like Airbnb, which affect the real estate market by removing rental units from the stock of housing, thereby constraining supply, the results in columns 2-4 in Table 14 suggest a different mechanism for hotels. They confirm that urban regeneration is the most plausible channel driving the increase in rental prices, given that the opening of hotel rooms appears to have no impact on the stock of rentals or the number of dwellings, while it increases the number of building renovation permits. Essentially, hotels seem to enhance the overall attractiveness of an area, unlike the direct supply reduction effect observed with short-term rentals. In general, these results corroborate previous evidence on the role of tourism in neighborhood regeneration (Lanzara and Minerva, 2019; Xu and Xu, 2021b; Bekkerman et al., 2022; Vizek, Barbić, and Časni, 2023).

Establishments business structure

Having observed that hotel openings contribute to the appreciation of rental properties in nearby areas, it is crucial to investigate whether this effect unevenly affects economic activities due to the high correlation between residential and commercial rents (Cuestas and Monfort, 2021). In this regard, hotel openings may not only lead to changes in the sectoral composition of the local economy but also influence the business structures within those sectors. This could be particularly challenging for individual-owned companies, which may struggle to cope with rising rents. Individual-owned companies often operate on smaller budgets and may have limited financial resources compared to corporate-owned businesses. When commercial rents increase, individual-owned activities, such as small retail store owners or independent service providers, may face greater difficulties absorbing these costs. They may have limited bargaining power and less access to capital, making it challenging

[26]Due to data availability, the difference in building renovation permits is computed only using data from 2007 to 2013, as provided by the Madrid City Council. However, the change in the number of rental houses and dwellings is calculated using data spanning from 2001 to 2011, sourced from the Spanish Census (see Appendix C.1 for homogenization of census tract limits over time)

to continue their operations in areas where rents are rising rapidly and, therefore, more sensitive to local shocks (Bartik et al., 2020). On the contrary, corporate-owned businesses often have more substantial financial resources and may benefit from economies of scale that allow them to absorb cost increases more effectively than individual-owned companies.

To examine the unequal impact of hotel openings on the business structure of establishments near hotels, I estimate the baseline IV specification but differentiate between individual-owned companies and corporate-owned businesses.[27] The findings in columns 1-4 in Table 15 confirm that hotel openings displace individual-owned companies in favor of larger corporate-owned businesses, possibly due to the appreciation in the commercial real estate market. These results suggest that when hotels open in a census tract, there is a discernible trend toward consolidation within the business sector. Smaller, independent establishments may face challenges in competing with the increased demand and changing dynamics brought about by the presence of hotels. As a result, larger corporate-owned businesses may be better positioned to take advantage of the opportunities arising from the growth in tourism and the subsequent commercial real estate appreciation.

Table 15: THE IMPACT OF HOTEL ROOM OPENINGS ON ESTABLISHMENT BUSINESS STRUCTURE.

	Individual-owned		Corporate-owned	
Dependent Variables:	Δ Establishments	Δ Employment	Δ Establishments	Δ Employment
Model:	(1)	(2)	(3)	(4)
Variables				
Δ Hotel rooms	-0.101**	-0.240	0.362***	2.86**
	(0.041)	(0.157)	(0.104)	(1.31)
Observations	2358	2358	2358	2358

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, ** and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the number of establishments and employment change between 2001-2010 for individual-owned companies (columns 1-2) and corporate-owned businesses (columns 3-4). I use the number of protected buildings as an instrument for the variation in the number of hotel rooms in each regression specification period. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between specific years, and the distance from the city center. Fixed effects at the district level.

However, the negative impact on individual-owned businesses may

[27] Corporate-owned businesses refer to activities that involve multiple individuals and are structured as entities separate from their owners, such as limited liability companies, cooperatives, and partnerships.

be driven by composition effects where some economic activities are displacing others. To rule out the possibility that this unequal effect results from a composition effect across activities, I test whether hotel openings affect the number of establishments and employment across economic activities and business structures. Interestingly, Figure 24 and Figure 25 in Appendix C show that hotel openings do not have an uneven impact on business structures across economic activities but within activities. In this manner, we can see that hotels replace mainly hospitality and retail activities in individual-owned establishments for corporate-owned businesses within this sector. Again, this evidence reinforces the idea that the increase in rental prices led by hotel openings leads to a change in the composition of the local economy, where corporate-owned businesses with potentially stronger financial positions displace individual-owned activities.

3.6 Conclusions

The paper provides evidence that hotel openings positively affect the number of establishments and employment in the surrounding areas. These findings are robust in different samples and specifications. Interestingly, hotel openings have heterogeneous effects on other economic activities and city areas. While tourist-oriented establishments benefit greatly, production-oriented activities are negatively affected. This suggests that hotel openings play a crucial role in transitioning from a production-oriented city to a consumption-oriented one. Moreover, the growth in employment and the number of establishments resulting from new hotel openings can be attributed to three key factors: the net creation of economic activity, the redistribution of economic activity from nearby tracts, and overall urban development. Notably, hotels in tracts oriented towards leisure tourism exhibit more substantial increases in both employment and the number of establishments. Finally, hotel openings impact the real estate market, leading to appreciation in the rental market and boosting residential investment, ultimately leading to a displacement of individual-owned establishments in favor of corporate-owned businesses within the same economic activity.

The present study makes meaningful contributions to incipient literature about the economic impacts of tourism. Hotels provide a market-

driven solution to the conservation and restoration of historic buildings and, at the same time, foster overall economic activity in the vicinity. This is important due to the structural changes driven by remote working in urban areas after the COVID-19 outbreak. By repurposing vacant office spaces and empty protected buildings into mixed-use spaces, cities can leverage existing infrastructure to meet the growing demand for accommodation and housing. This not only addresses the issue of unused spaces but also presents an opportunity for economic growth and development. Since the IV approach I introduce in this paper is very general and can be applied to different cities, another possible future development is to extend the analysis to different urban areas other than Madrid.

However, more research is needed. While hotels can contribute to economic growth and revitalization, there is concern that they may exacerbate gentrification processes by expelling long-term residents. Although homeowners might experience benefits from hotel expansion through property value capitalization effects, tenants could potentially face adverse consequences. This complex interaction requires a comprehensive welfare analysis to determine the overall impact. In addition, the congestion caused by tourism can adversely affect a place's overall livability. Local amenities, such as parks, cafes, and shops, which are essential for the well-being of residents, can become overcrowded and less accessible due to the influx of tourists. It is crucial to fully comprehend the impact of tourism in all its aspects, given its significant contribution to the global economy. By gaining a comprehensive understanding of the effects of tourism, we can promote its sustainable and responsible growth, particularly in urban areas where the concentration of activities can amplify both the positive and negative consequences.

Conclusion

This thesis significantly advances our understanding of urban economics and the role of platform economies, particularly focusing on the effects of Airbnb and hotel openings on the economic landscape of urban areas. Through a series of three papers, it provides a thorough analysis of how these entities reconfigure the economic dynamics of cities, with a specific focus on Madrid. This research not only sheds light on the causal effects of tourism on economic outcomes but also offers valuable methodological advancements that can be applied to contexts beyond Madrid.

This thesis introduces various identification strategies to assess the causal impact of tourism on urban outcomes. A key aspect is the use of Instrumental Variable (IV) strategies across its three chapters. These strategies are particularly noteworthy for being based on openly accessible information and not being confined to a specific context. This universal approach enables their application to diverse urban settings beyond the scope of the study's initial geographic focus.

Utilizing a unique, comprehensive, and finely detailed dataset encompassing a broad range of economic information specific to the Madrid Municipality, this study reveals insights previously unattainable. This dataset, spanning two decades, includes extensive establishment-level data, allowing for an in-depth exploration of employment patterns and the composition of tourist accommodations within the urban areas. The importance of this urban microdata compilation is immense, paving the way for a nuanced understanding of the complex interactions between local economies, employment trends, and the tourism sector. This data is invaluable for policymakers, urban planners, and researchers, enabling informed decision-making and the formulation of targeted strategies for sustainable urban development. Furthermore, it serves as a benchmark

for other cities aiming to leverage detailed, localized data for comprehensive urban planning and economic growth.

The findings of this dissertation present a nuanced view of the economic impact of tourism in urban areas. It reveals that tourism, measured through both short-term rentals and hotel accommodations, generally contributes to market expansion, positively influencing employment levels and the number of establishments, particularly in less frequented areas. This suggests that tourist accommodations when strategically managed, can effectively redistribute tourism consumption across a city. Nevertheless, these positive effects on employment and establishment growth obscure more complex, sector-specific impacts. The research uncovers a trend of sectoral displacement, with resident-oriented and production-based businesses being overshadowed by those catering to tourists.

Despite its contributions, this thesis acknowledges certain limitations. While it effectively maps the economic impact of tourism on urban landscapes, a comprehensive understanding of the welfare effects of tourism in these areas requires a more holistic, general equilibrium framework. Additionally, the study primarily views the effects through the lens of business establishments. Future research could benefit from a more resident-centric perspective, examining how changes in economic activity composition affect local populations. Understanding whether residents benefit from or are adversely impacted by these shifts is crucial for designing public policies aimed at mitigating any negative externalities generated by tourism. This thesis thus sets the stage for further exploration and serves as a call to action for more inclusive and holistic urban economic studies.

Appendix A

Appendix to Chapter 1

This chapter is based on the work The Effect of Short-Term Rentals on Local Consumption Amenities: Evidence from Madrid in collaboration with Massimo Riccaboni and Francisco Javier Velazquez Angona and published in the Journal of Regional Science (see Hidalgo, Riccaboni, and Velázquez (2024))

A.0.1 Intensive and extensive margin:

The effect of Airbnb on food and beverage employment can be decomposed as follows:

$$\delta_L \times \Delta Airbnb = \underbrace{N_t \times \Delta S}_{IntensiveMargin} + \underbrace{\delta_N \times \Delta Airbnb \times (S_t + \Delta S)}_{ExtensiveMargin} \quad \text{(A.1)}$$

where δ_L represents the effect of Airbnb on employment (overall effect), $\Delta Airbnb$ the variation in the number of Airbnb rooms, N_t the number of food and beverage establishments, ΔS the variation in the average employment of the establishment, δ_N the effect of Airbnb on the number of food and beverage companies, and S_t the average employment of the establishment. The underlying assumption in the decomposition above is that both current restaurants and new restaurants vary the employment equally. We know all the parameters with the exception of the variation in the average employment of the establishment, ΔS. In turn, it can be

computed with the other parameters as follows:

$$\Delta S = \frac{\Delta Airbnb \times (\delta_L - \delta_N \times S_t)}{N_t + \delta_N \times \Delta Airbnb} \tag{A.2}$$

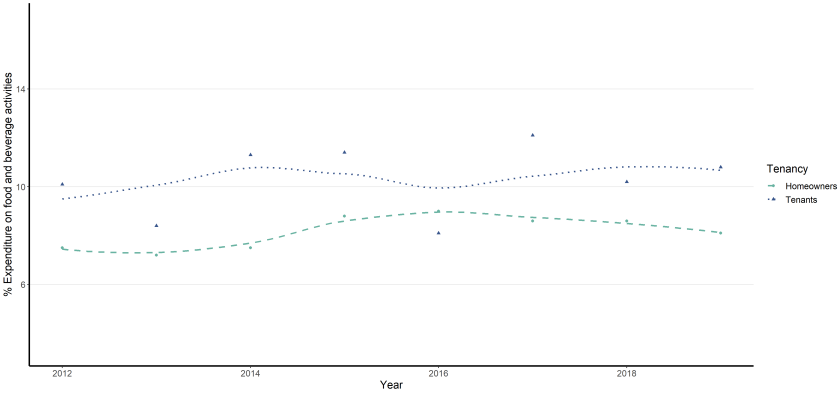
Table 17: VARIABLE DEFINITION AND SOURCE.

Variable	Definition	Source
Dependent variables:		
Food and beverage establishments	Nº of food and beverage establishments	Madrid City Council's census
Employment food and beverage	Nº of employees in the food and beverage establishments	Madrid City Council Statistics department
Explanatory variables:		
Airbnb rooms	Nº of Airbnb rooms	Inside Airbnb
Population	Nº of inhabitants	*Padrón Municipal*
% Foreign population	Nº of foreign inhabitants divided by total number of inhabitants	*Padrón Municipal*
Average household income	Average household income	Spanish Household Income Distribution Atlas
Distance	Euclidean distance in meters to the city center from census tract centroid	Spanish National Geographic Institute
Hotel rooms	Nº of hotel and hostel rooms	Madrid City Council Statistics Department and Expedia
Instrument:		
Worldwide Airbnb Google searches	Index of the worldwide Airbnb Google searches	Google trends
Rental houses	% Rental houses in 2011	Spanish Census 2011

Table 16: Literature review for short-term rental studies.

Topic	Reference	Country/City	Period	Geographical unit	Dependent variable	Technique
Local economy and neighborhood amenities	Xu and Xu (2021a)	USA (Chicago)	2015-2018 (quarterly)	Census tract (800)	Residential renovation project	Bartik instrument
	Bekkerman et al. (2022)	USA (15 cities)	2008-2019 (monthly)	ZIP code (608)	Residential permit	DiD
	Alyakoob and Rahman (2019)	USA (New York)	2007-2016 (yearly)	ZIP code (121)	Restaurant employment	DiD
	Basuroy, Kim, and Proserpio (2020)	USA (Texas)	2005-2018 (monthly)	ZIP code (1009)	Restaurant revenue	DiD
Housing	Batalha et al. (2022)	Portugal (Lisbon)	2018-2020 (quarterly)	Parish (24)	Housing price and Listings	DiD and IV
	Barron, Kung, and Proserpio (2021)	USA (100 CBSAs)	2011-2016 (monthly)	ZIP code (221)	Rental and housing price	Shift-share instrument
	Franco and Santos (2021)	Portugal (whole country)	2012-2016 (quarterly)	Municipalities (106) and civil parish (31)	Rental and Housing price	Shift-share instrument and DiD
	Valentin (2021)	USA (New Orleans)	2010-2018(monthly)	Individual data	Housing price	Difference-in-discontinuity
	Duso et al. (2021)	Germany (Berlin)	2016-2018 (monthly)	Building blocks	Number of long-term rental and rentals price	IV
	Bibler, Teltser, and Tremblay (2021)	USA (San Francisco and Chicago)	2014-2019 (monthly)	County (192)	Housing price	DiD
	Garcia-López et al. (2020)	Spain (Barcelona)	2009-2017 (yearly)	Basic Statistical Area (221)	Rental and housing price	Shift-share instrument
	Chen, Wei, and Xie (2022)	USA (10 cities)	2014-2017 (monthly)	ZIP code (417)	Rental and housing price	DiD and Synthetic Control Method
	Garcia, Miller, and Morehouse (2022)	USA (LA county)	2014-2019 (yearly)	ZIP code (1360)	Housing price	Shift-share instrument and DiD
	Filippas and Horton (2020)	USA (New York)	2017	Individual data	Rental price	Structural model
	Hill, Pfeifer, Steurer, et al. (2020)	Australia (Sydney)	2015-2018 (yearly)	Individual	Airbnb rent premia	IV
	Koster, Ommeren, and Volkhausen (2021)	USA (Los Angeles County)	2014-2018 (monthly)	ZIP code (114)	Rental and housing price	Spatial Regression Discontinuity and DiD
	Horn and Merante (2017a)	USA (Boston)	2015-2016 (weekly)	Census tracts (178)	Number and rental price	Hedonic modeling
Welfare and distributional impact	Farronato and Fradkin (2022)	USA (50 cities)	2011-2015 (monthly)	City (50)	Hotel performance outcome	IV
	Calder-Wang (2019)	USA (New York)	2010-2017 (monthly)	PUMA (55)	Housing rental and income	Structural model
	Almagro and Domınguez-Iino (2019)	Netherlands (Amsterdam)	2008-2019 (yearly)	Households and ZIP code (100)	Rents, amenities, and within-city migration	Structural model
Tourism	**London**	UK (London)	2002-2019 (yearly)	Ward (624)	Discontent with tourism measures	Shift-share instrument
	Schaefer and Tran (2021)	France (Paris)	2017-2018 (daily)	District and hotel-level (20)	Hotel occupancy	Nested logit model
	Li and Srinivasan (2019)	USA (eight cities)	2014-2015 (monthly)	ZIP code–based subarea (51)	Hotel performance measures	Structural model
	Zervas, Proserpio, and Byers (2017)	USA (Texas)	2008-2014 (monthly)	City	Hotel revenue	DiD

Figure 15: Percentage of expenditure on food and beverage by tenancy regime as percentage of overall expenditure.

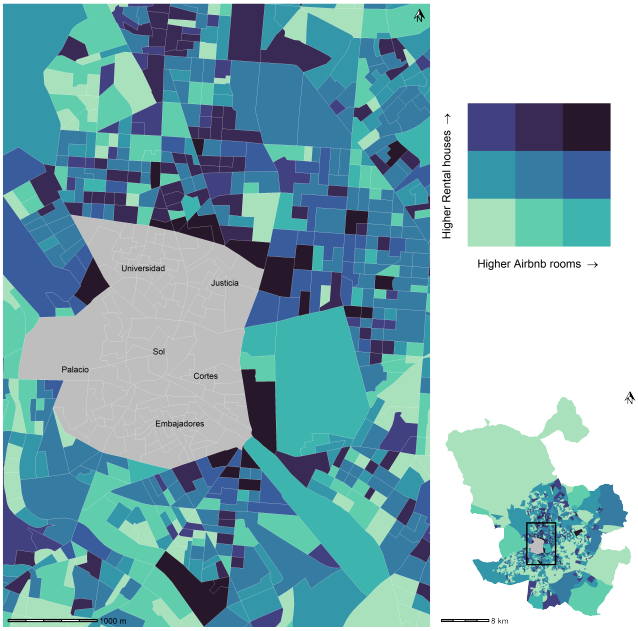


Notes: % of overall expenditure on food and beverage by tenancy regime over the period 2012-2019. Microdata obtained from the Household Budget Survey (Spanish Statistical Office). Food and beverage activities comprise the following activities according to the Household Budget Survey: day menu in bars and restaurants (11111), lunches and dinners in bars and restaurants (11112), expenditure on bars and cafes (11113), and expenditure on fast and take-away food establishments (11116). Homeowners with and without mortgage are included in the homeownership category.

Table 18: Sensitivity analysis

Variable	Mean	Coefficient	Avg. Effect
Supply Bedrooms	5	0.071	0.335
Supply Listings	3	0.152	0.456
Supply Review	214	0.002	0.428

Figure 16: Bivariate map of the distribution of rental houses in 2011 and the change in the number of Airbnb rooms during the period 2014-2019.



Notes: Lighter colors reflects census tracts areas where the number of rentals houses were low in 2011 and the change in the number of Airbnb rooms during the period 2014-2019 was also low. Darker colors reflects census tracts where both the number of rentals in 2011 and the change in the number of Airbnb rooms were high. We do not show Airbnb and rental house information for city center neighborhoods for the sake of exposition.

Table 19: Equivalence between gentrification businesses as in Behrens et al. (2018) and establishments in the Madrid City Council's census of business premises database

Pioneer business	Madrid Activity codes	Madrid Activity description
Motion Picture, and Video Production	591001	Motion picture, video and television activities (production, distribution, and exhibition)
Architectural Services/ Engineering Services	710001, 710002	Architectural and engineering technical services; technical testing and analysis; professional architectural and engineering offices
Musical Groups and Artists/ Sound Recording Studios	592001	Sound recording and music editing activities
Periodical Publishers/ Book Publishers	581001	Publishing of books, periodicals, and other publishing activities
Advertising Agencies/Public Relations Agencies	730001	Advertising, public relations, and market research
All Other Amusement and Recreation Industries	932007	Amusement and recreation halls and other recreational activities
Industrial Design Services/Graphic Design Services/ Interior Design Services	741001	Specialist design activities
Commercial Photography	477805	Retail trade in photographic and photographic equipment
Museums	910001	Activities of libraries, archives, museums. and galleries and exhibition halls without sale
All Other Speciality Food Stores	472910	Retail trade of cafe, tea, and chocolate
Computer Systems Design Services	582001	Software editing
Other Management Consulting Services	702001	Business management consultancy activities
Employment Placement Agencies	782001	Activities of temporary work agencies

Notes: We do not include consumption amenities present in Behrens et al. (2018) classification as they are part of our main dependent variable.

Appendix B

Appendix to Chapter 2

This chapter is based on the work 'When Local Business Faded Away: The Uneven Impact of Airbnb on the Geography of Economic Activities' in collaboration with Massimo Riccaboni and Francisco Javier Velazquez Angona and published in the Cambridge Journal of Regions, Economy and Society (see Hidalgo, Riccaboni, and Velazquez (2023)).

B.0.1 Madrid City Council's census of business premises database

The Madrid Statistical Department has recently made available a dataset that includes information on all business premises in Madrid. A business premise refers to the physical location where an establishment carries out its activities. Each establishment is classified into one or more categories based on 21 sections, 87 divisions, and 448 codes. The dataset also includes details such as the name, location, accessibility, and current status of each establishment. The data is available from March 31, 2014, to December 31, 2014, in quarterly updates, and from January 1, 2015 onward in monthly updates. In this study, we consider data only from October 2014 to October 2019 to evaluate any changes in the status or activities of each establishment over a five-year period. We excluded observations related to establishments that entered or left the dataset during this period, as these may be influenced by factors such as urban expansion rather than local consumer demand driven by Airbnb.

In our study, we are primarily interested in the types of services offered by each establishment and whether they are targeted towards tourists or residents. We classify establishments as belonging to one of these two groups if they offer any of the services listed in Table 6. To avoid overlap, if an establishment offers both tourist and local services, we do not classify it as either tourist- or resident-oriented. For example, a butcher who opens a lunch counter would not be classified as either tourist- or resident-oriented. We consider an establishment to have undergone a change if it has altered its service offerings or changed its name. As we do not have information on the ownership or management of each establishment, we use a change in name as an indicator of a change in the establishment.

Table 20: Variable definition and source

Variable	Definition	Source
Dependent variables:		
Birth	1 if an establishment opened during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Birth, tourist	1 if a tourist-oriented establishment opened during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Birth, resident	1 if a resident-oriented establishment opened during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Death	1 if an establishment closed during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Death, tourist	1 if a tourist-oriented establishment closed during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Death, resident	1 if a resident-oriented establishment closed during the period 2014-2019, 0 otherwise	Madrid Statistical Department
Transition	1 if an establishment was open during the period 2014-2019 but changed activity, 0 otherwise	Madrid Statistical Department
Transition, tourist	1 if an establishment was open during the period 2014-2019 but changed activity towards tourist services, 0 otherwise	Madrid Statistical Department
Transition, resident	1 if an establishment was open during the period 2014-2019 but changed activity towards local services, 0 otherwise	Madrid Statistical Department
Transition, resident-tourist	1 if an establishment was a tourist business in 2019 conditional on being a local business in 2014, 0 otherwise	Madrid Statistical Department
Transition, tourist-resident	1 if an establishment was a resident-oriented business in 2019 conditional on being a tourist business in 2014, 0 otherwise	Madrid Statistical Department
Explanatory variables:		
Airbnb	Absolute change in the number of Airbnb listings within a 150-meter radius buffer around each establishment between 2014 and 2019	Inside Airbnb
Population	Number of inhabitants in a given census tract	Municipal Register
Average household income	Average household income in a given census tract	Ministry of Development
Distance	Euclidean distance in meters to the city centre from census tract centroid	Spanish National Geographic Institute
Accessibility	1 if the business premises is a street-level establishment	Madrid Statistical Department

Table 21: DESCRIPTIVE STATISTICS

	ΔOctober 2019 - October 2014		
Dependent variables	Sum	Mean	Sd
Birth	6565	0.05	0.22
Birth, tourist	1184	0.008	0.09
Birth, resident	1459	0.010	0.10
Death	2236	0.016	0.12
Death, tourist	364	0.003	0.06
Death, resident	489	0.003	0.06
Transition	9762	0.074	0.26
Transition, tourist	2352	0.017	0.13
Transition, resident	2105	0.015	0.14
Transition, resident-tourist	284	0.002	0.04
Transition, tourist-resident	403	0.003	0.05

	October 2014			**October 2019**		
Explanatory variables	Sum	Mean	Sd	Sum	Mean	Sd
Airbnb buffer	765908	5.796	15.086	2780702	21.043	47.37
Population	3130308	3243940	1319.691	508.4846	1387.485	654.0428
Avg. Household Income	85488590	36040.72	14782.41	85488590	36040.72	14782.41

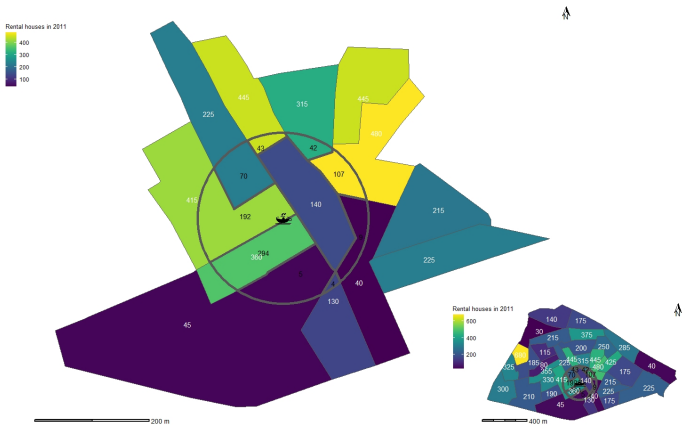


Figure 17: Instrumental variable construction

Notes: Rental houses imputation for a particular establishment in Embajadores neighbourhood. The imputed number of rental houses, represented by the black numbers, is calculated by multiplying the area of the census tract touched by the buffer by the actual number of rental houses in 2011 (white numbers).

Table 22: LINEAR PROBABILITY MODEL FOR ESTABLISHMENTS BIRTH AND DEATH DYNAMICS (IV)

Dependent Variable:	(1) Pr(Birth = 1)	(2) Pr(Birth, tourist = 1)	(3) Pr(Birth, resident = 1)	(4) Pr(Death = 1)	(5) Pr(Death, tourist = 1)	(6) Pr(Death, resident = 1)
ex1 Airbnb buffer	0.004***	0.004***	-0.0004	0.0007**	-0.004	0.006*
	(0.001)	(0.001)	(0.001)	(0.0003)	(0.002)	(0.003)ex1
Mean dependent variable	0.792	0.193	0.238	0.0233	0.195	0.262
Marginal percentage effect	1.120	7.756	5.036	4.298	2.052	05.730
Observations	7,732	6,123	6,123	74,227	1,868	1,868

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. Cluster standard errors at the neighbourhood level. The Airbnb buffer is the absolute change in the number of short-term rentals around a 150-meter radius ring for each establishment between 2014 and 2019. The coefficient is scaled by 15, representing the average Airbnb listing change within the buffer. We have instrumented that variable with the number of rental houses in 2011. Control variables included in each specification are the logarithm of the population and average household income measured at the census tract level, a dummy variable to identify establishment accessibility (grouped or storefront) and distance to the city centre. Neighbourhood fixed effects are included in each specification. Activities codes fixed effects are included only in the first and fourth columns. The number of observations varies across each specification depending on the reference comparison group. The birth group comprises only inactive establishments that were present between 2014 and 2019, and establishments that were born in 2019 and closed in 2014. The death group includes all establishments that were open in both 2014 and 2019, and those that were closed in 2019 but open in 2014. When examining the impact of being a tourist-oriented or resident-oriented business on birth or death probabilities, we use only establishments in the respective category (establishments that were born in 2019 and closed in 2014 for births and establishments that were closed in 2019 but open in 2014) for deaths as the comparison group.

Table 23: LINEAR PROBABILITY MODEL FOR ESTABLISHMENTS TRANSITIONS DYNAMICS (IV)

Dependent Variable:	(7) Pr(Transition = 1)	(8) Pr(Transition, tourist = 1)	(9) Pr(Transition, resident = 1)	(10) Pr(Transition, resident-tourist = 1)	(11) Pr(Transition, tourist-resident = 1)
ex1 Airbnb buffer	0.013**	0.028	-0.010	0.138**	-0.013
	(0.006)	(0.019)	(0.013)	(0.067)	(0.024)ex1
Mean dependent variable	0.109	0.244	0.219	0.217	0.197
Marginal effect	0.110	0.217	0.262	0.151	0.175
Observations	85,791	9,334	9,334	1,518	1,600

Notes: Statistical significance at the 1, 5 and 10% levels is indicated by ***,** and *, respectively. Cluster standard errors at the neighbourhood level. The Airbnb buffer is the absolute change in the number of short-term rentals around a 150-meter radius ring for each establishment between 2014 and 2019. The coefficient is scaled by 15, representing the average Airbnb listing change within the buffer. We have instrumented that variable with the number of rental houses in 2011. Control variables included in each specification are the logarithm of the population and average household income measured at the census tract level, a dummy variable to identify establishment accessibility (grouped or storefront) and distance to the city centre. Neighbourhood fixed effects are included in each specification. Activities codes fixed effects added in all specifications. The number of observations varies across each specification depending on the reference comparison group. The transitions group is comprised of all establishments that were open in both 2014 and 2019 with no change and establishments that were open in both 2014 and 2019 and change activity and storefront name. The transition-tourist and transition residents group is comprised only of transition establishments, The transition resident-tourist (transition tourist-resident) group is comprised only of transition establishments whose previous activity was local-oriented (tourist-oriented).

Table 24: Equivalence between gentrification businesses as in Behrens et al. (2018) and establishments in the Madrid City Council's census of business premises database

Pioneer business	Madrid Activity codes	Madrid Activity description
Motion Picture and Video Production	591001	Motion picture, video and television activities (production, distribution and exhibition)
Architectural Services/ Engineering Services	710001, 710002	Architectural and engineering technical services; technical testing and analysis Professional architectural and engineering office
Musical Groups and Artists/ Sound Recording Studios	592001	Sound recording and music editing activities
Full-Service Restaurants	561001,561004	Restaurant, Bar restaurant
Periodical Publishers/ Book Publishers	581001	Publishing of books, periodicals and other publishing activities
Advertising Agencies/Public Relations Agencies	730001	Advertising, public relations and market research
All Other Amusement and Recreation Industries	932007	Amusement and recreation halls and other recreational activities
Industrial Design Services/Graphic Design Services/ Interior Design Services	741001	Specialist design activities
Commercial Photography	477805	Retail trade in photographic and photography equipment
Museums	910001	Activities of libraries, archives, museums and galleries and exhibition halls without sale
All Other Speciality Food Stores	472910	Retail trade of coffee, tea and chocolate
Computer Systems Design Services	582001	Software editing
Other Management Consulting Services	702001	Business management consultancy activities
Employment Placement Agencies	782001	Activities of temporary work agencies

B.0.2 Sensitivity analysis

Results F, G, and H in Table 12 provide evidence that our results are not driven by confounders related to lifestyles, gentrification and the e-commerce process. However, the way to rule out the existence of those unobserved confounders might be wrong whenever they are not manifested through either the proposed list of gentrification businesses or tradable services. To assess that our results are not biased because of the presence of those unobserved confounders, we employ sensitivity analysis tools for regression models developed by Cinelli and Hazlett (2020).

Cinelli and Hazlett (2020) proposed two measures to check the extent to which any unobserved confounders are likely to bias our results:

- The *Robustness Value* (RV): It provides a convenient reference point for assessing the overall robustness of a coefficient to confounders. Suppose the association of our coefficient of interest β and our dependent variable *transition tourist local* (measured as partial R^2) are both assumed to be less than RV. In that case, the confounders cannot explain away the observed effect.

- $R^2_{Transition\ tourist\ local \sim Airbnb\ buffer|X}$: It is the proportion of the variation in the outcome (*Transition tourist local*) explained exclusively by the treatment (*Airbnb buffer*). It reveals how strongly a confounder that explains 100% of the residual variance of (*Transition tourist local*) would have to be associated with (*Airbnb buffer*) in order to eliminate the effect.

To make some meaningful sense of the magnitude of the value for

those two measures, Cinelli and Hazlett (2020) suggests using some covariate to bound the strength of unobserved confounders. In our setting, we choose the average household income variable related to either gentrification or the rise in e-commerce. Table 29 reports that information. As we can observe, a confounder as strong as average household income can at most explain 0.9% of the residual variation of our outcome variable (transition tourist-local) and 4.6% of the treatment (Airbnb buffer). As both numbers are below the robustness value of 8.2%, we can conclude that our point estimate is robust to a confounder(s) as strong as average household income.

Table 25: SENSITIVITY ANALYSIS

Outcome: *Transition, tourist-resident*

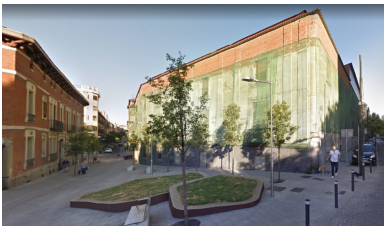
Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Airbnb buffer	0.002	0.001	3.048	0.9%	8.9%	3.3%
df = 1073				*Bound (1x income)*: $R^2_{Y\sim Z\|\mathbf{X},D}$ = 1.2%, $R^2_{D\sim Z\|\mathbf{X}}$ = 4.6%		

Notes: Y refers to our outcome variable, transition tourist-resident, D, our variable of interest, Airbnb buffer, X the set of controls, and finally, Z the unobserved confounder(s).

Appendix C

Appendix to Chapter 3

This chapter is based on the work 'Your Room is Ready: Tourism and Urban Revival' (see Hidalgo (2024). In particular, this chapter is my Job Market paper (solo-coauthor paper, Alberto Hidalgo) and extends the analysis of the economic impact of tourism in Hidalgo, Riccaboni, and Velázquez (2024) and Hidalgo, Riccaboni, and Velazquez (2023) to the case of hotel openings.



Before old palace dwelling

After hotel boutique

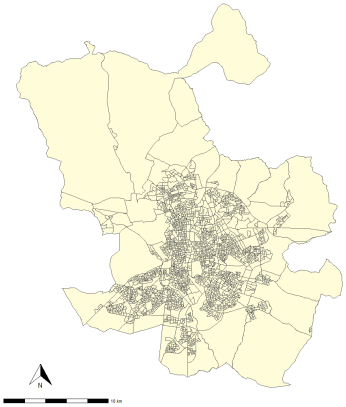
Before office building

After 5-star hotel

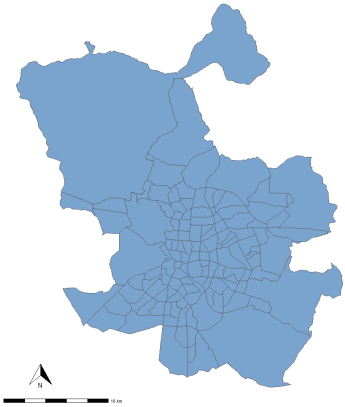
Figure 18: Conversion of protected buildings into accommodation facilities in Madrid

Table 27: VARIABLE DEFINITION AND SOURCE

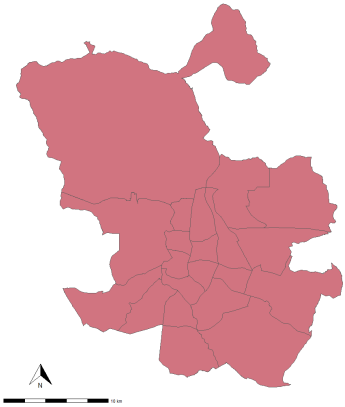
Variable	Definition	Source	Time Period
Establishment	# of establishments	Directorio de Actividades Economicas	2010-2001
Employment	Employment level (categories)	Directorio de Actividades Economicas	2010-2001
Rental price	Meter square rental price	Madrid Regional Housing Department	2010-2001
Building renovation permits	Stock building renovation permits	Madrid City Council	2013-2007
Hotel opening rooms	Stock of hotel rooms	Spanish Official Hotel Guide	2010-2001
Protected Buildings	# of protected buildings	Madrid City Council	1997
Population	# of inhabitant	Padron Municipal	2013-2001
Share college	% of people who hold a Bachelor's degree	Spanish Census	2001
Dwellings	# dwellings	Spanish Census	2001 and 2011
Rental houses	# rental houses	Spanish Census	2001 and 2011
Unemployment rate	% of people unemployed	Spanish Census	2001
Flickr images	# photos taken by a tourist	Flickr	2013-2007



Census tracts (2358)



Neighborhoods (128)



Districts (21)

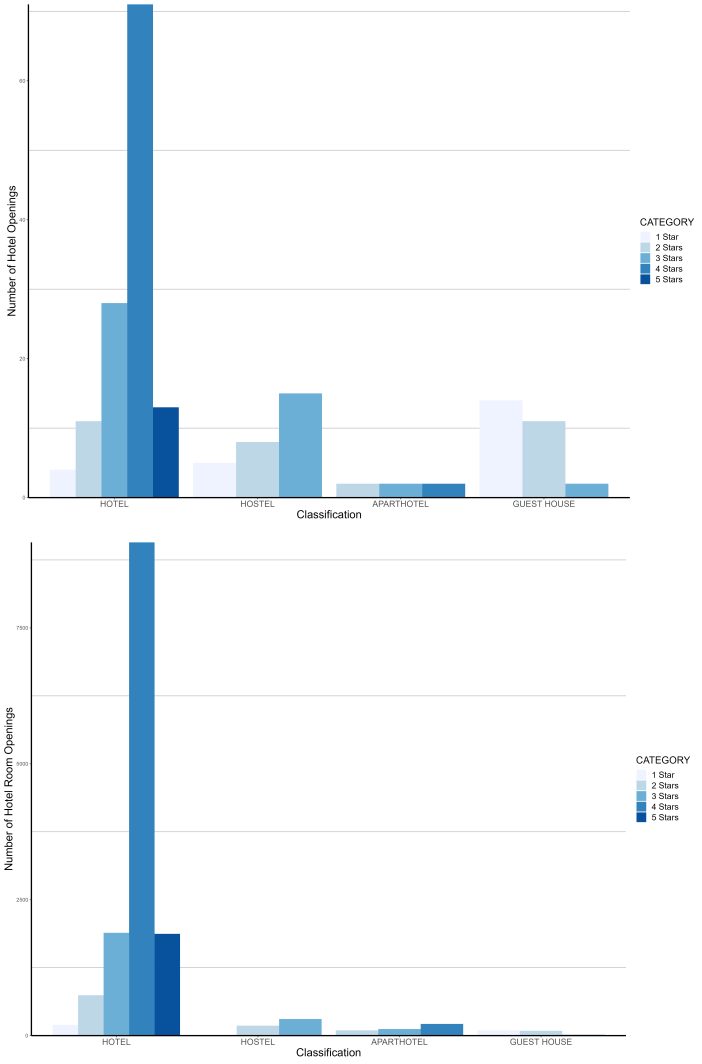
Figure 19: Administrative units in Madrid

Table 28: IV VALIDITY EXERCISES

	No hotel opening areas.		Pre-trends		Gentrifiers		Headquarters		Flickr images
Dependent Variables:	Est.	Emp.	Est.	Emp.	Est.	Emp.	Est.	Emp.	Tourist images
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables									
Δ Hotel rooms			0.064	5.98	-0.003	-0.105	-0.014	0.273	11.1***
			(0.152)	(4.42)	(0.004)	(0.092)	(0.012)	(0.257)	(4.68)
Protected buildings	0.074	2.08							
	(0.048)	(1.30)							
Observations	2,088	2,088	2358	2358	2358	2358	2358	2358	2358

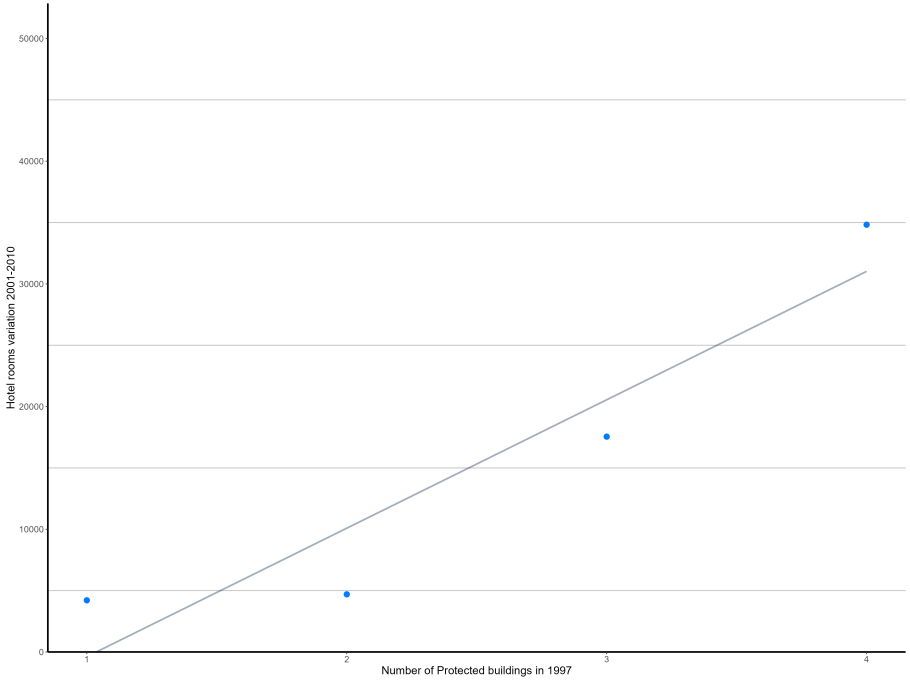
Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, ** and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010 columns 1-2 and between 1970 and 1980 in columns 3-4. Columns 5-6 and 7-8 capture the long differences in the number of economic activities related to gentrification as in Behrens et al. (2022) and headquarters and employment, respectively. Finally, the dependent variable in column 9 is the long difference in the number of tourist photos between 2007-2013. I use the number of protected buildings as an instrument for the variation in the number of hotel rooms in columns 3-9. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level. In columns 1-2 I remove all census tracts with hotel facilities in 2001-2010. In columns 3-4, I change the dependent variable and measure the number of establishments and employment change in 1970-1980. Finally, in column 9, I regress the changes in the number of hotel rooms predicted between 2007 and 2013 by the number of photos taken by tourists predicted by the instrument.

Figure 20: Hotel openings classification and ratings



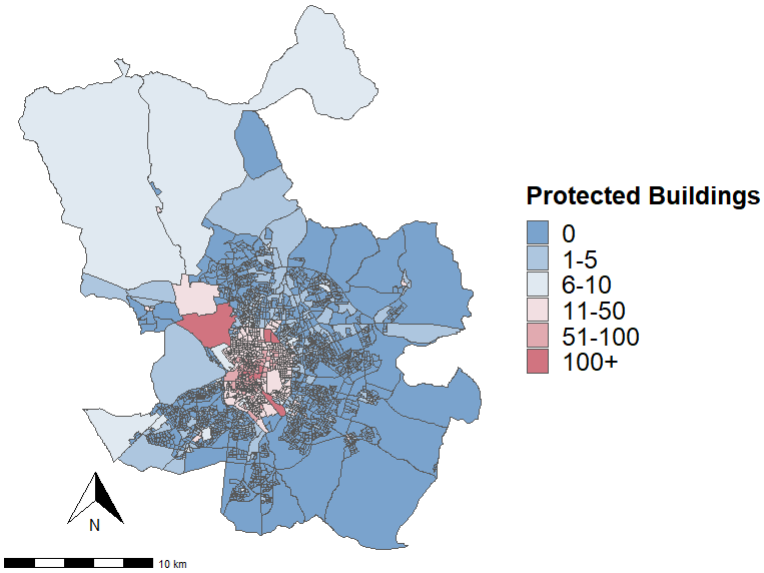
Notes: The graphs show the distribution of the types and categories of hotels that opened during 2001-2010 in Madrid (up) and taking into account the size of each hotel opening through the number of rooms (bottom). Boarding houses (17) are not included as they do not have a star rating.

Figure 21: Instrument relevance

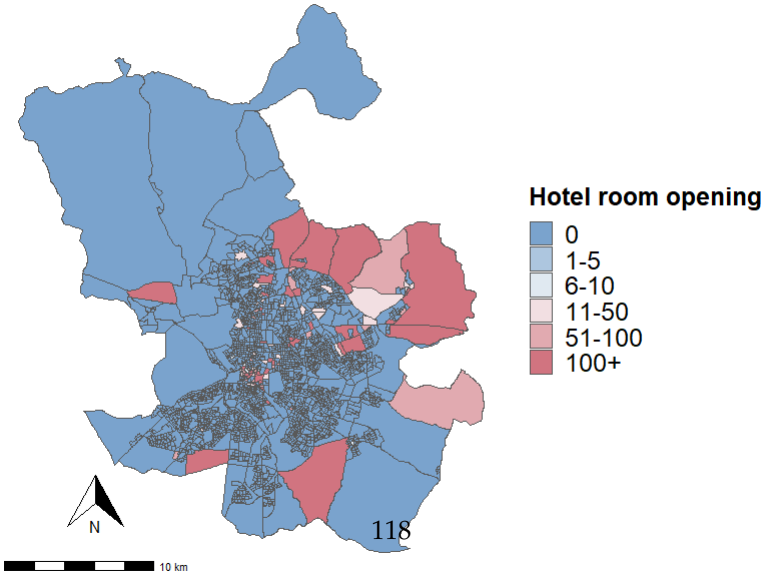


Notes: Figure illustrates the relationship between census tracts' hotel openings and the number of protected buildings. The data is categorized into quartiles based on the distribution of protected buildings across the city.

Figure 22: Geographic variation in treatment and instrument.



(a) Protected buildings in Madrid



(b) Hotel room opening 2001-2010

C.0.1 Sensitivity analysis

Table 28 provides evidence that the main results are not driven by confounders related to gentrification, other economic activities, and temporal trends. However, the way to rule out the existence of those unobserved confounders might be wrong whenever they are manifested through other processes not taken into account in this analysis. To assess that our results are not biased because of those unobserved confounders, I employ sensitivity analysis tools for regression models developed by Cinelli and Hazlett (2020) and Cinelli and Hazlett (2022).

Cinelli and Hazlett (2022) introduced a method to assess the level of association required with the error term to make the coefficient of the treatment variable null (change in the number of hotel rooms) in the 2SLS (Two-Stage Least Squares) estimation. This is especially straightforward for the null hypothesis $H_0 : \beta_{IV} = 0$ because the IV estimator is essentially the ratio of the reduced-form estimate (obtained by regressing the dependent variable on the instrument along with control variables) divided by the first-stage estimate (obtained by regressing the treatment variable on the instrument along with control variables): $\beta_{IV} = \frac{\beta_{RF}}{\beta_{FS}}$.

Therefore, examining how rapidly β_{RF} approaches zero in the presence of unobserved confounding is simultaneously a test for $\beta_{IV} = 0$. Since the reduced-form regression is a standard OLS regression, I can conveniently apply existing tools for sensitivity analysis in linear models, as discussed by Cinelli and Hazlett (2020).

Cinelli and Hazlett (2020) proposed two measures to check the extent to which any unobserved confounders are likely to bias our results:

- The *Robustness Value* (RV): It provides a convenient reference point for assessing the overall robustness of a coefficient to confounders. Suppose the association of our coefficient of interest β and our dependent variable Δ *Establishments* (measured as partial R^2) are both assumed to be less than RV. In that case, the potential existence of some confounders cannot explain away the observed effect.

- $R^2(_{\Delta Establishments \sim \Delta Protectedbuildings|X})$: It is the proportion of the variation in the outcome (Δ *Establishments*) explained exclusively by the treatment (Δ *Protected buildings*). It reveals how strongly a confounder that explains 100% of the residual variance of (Δ *Establishments*) would have to be associated with (Δ *Protected buildings*)

to eliminate the effect.

To make some meaningful sense of the magnitude of the value for those two measures, Cinelli and Hazlett (2020) suggests using some covariate to bound the strength of unobserved confounders. In this setting, I consider that population is the covariate that helps to explain the most the variation in the change in the number of establishments. Table 29 reports that information. As we can observe, a confounder as strong as the population can at most explain 0.6% of the residual variation of our outcome variable (Δ Establishments) and 0.5% of the treatment (Δ Protected buildings). As both numbers are below the robustness value of 7.3%, we can conclude that our point estimate is robust to a confounder(s) as strong as the population.

Table 29: SENSITIVITY ANALYSIS

Outcome: Δ *Establishments*

Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Protected buildings	0.131	0.036	3.641	0.6%	7.3%	3.4%
df = 2331		*Bound (1x population)*: $R^2_{Y\sim Z\|\mathbf{X},D}$ = 1.3%, $R^2_{D\sim Z\|\mathbf{X}}$ = 0.5%				

Notes: Y refers to the outcome variable, Δ Establishments, D, our variable of interest, the number of protected buildings, X the set of controls, and finally, Z the unobserved confounder(s).

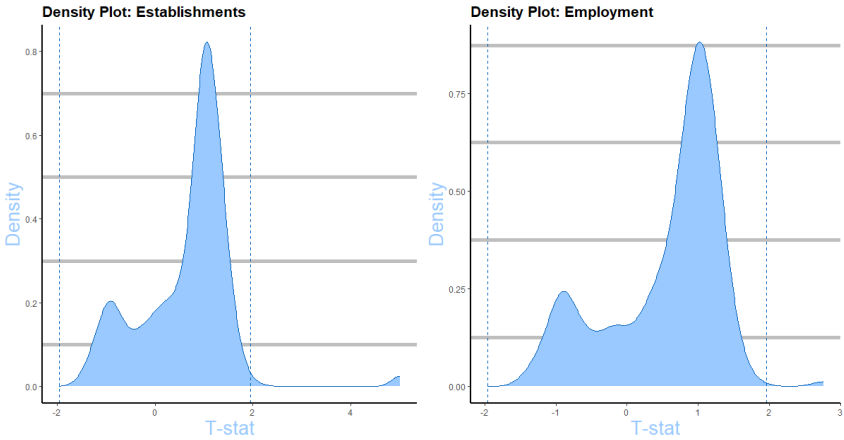
C.0.2 Randomization test

Here I follow an approach inspired by Christian and Barrett (2017) and Barron, Kung, and Proserpio (2021) to assess the instrument's exogeneity and determine whether incidental time trends primarily influence it. I randomize the change in the number of hotel room openings across census tracts that experimented with a variation in the number of hotel rooms between 2001 and 2010. To illustrate, we randomly assign the variable $\Delta Hotel\ rooms_i$ (representing changes in the stock of hotel rooms for census tract i) to census tract j. In this way, this randomization retains the overall temporal trends in the change in the number of hotel rooms while altering the allocation of hotel room openings among different census tracts.

Suppose the results are primarily driven by spurious time trends interacting with the extensive margin pertaining to the presence or absence of hotel openings. In that case, this exercise should yield IV estimates that remain positive and statistically significant. Otherwise, the first stage will become notably weak when regressing the randomized regressor on the instrument. Consequently, this will result in statistically insignificant estimates, coupled with an exceedingly high variance due to the weakness of the first stage.

I estimate the IV specification on this dataset for 1,000 random allocations of hotel openings among census tracts that possessed positive hotel openings. Remarkably, it can be seen in Figure 23 that the measured effect of hotel room openings is statistically insignificant for over 98% of the randomized allocations, considering the change in the number of establishments and employment.

Figure 23: Randomization



Notes: Figure presents the distribution of estimated t-statistics for the main effect (β) across the two dependent variables. Vertical dashed lines identify 1.96 critical values. Out of 1000 estimates, only thirteen t-statistics from the establishment specification and five from the employment specification are significant at the 5% level.

Table 30: THE IMPACT OF HOTEL ROOM OPENINGS ON EMPLOYMENT (IV, DIFFERENT EMPLOYMENT MEASURES)

Dependent Variable:	First Stage	Reduced Form	Reduced Form	Δ Employment				
	Δ Hotel rooms.	Δ Est.	Δ Employ.	Min	Mean	Max	All classes (Min)	No hotel employ.
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Protected Buildings	0.591***	0.131***	2.47**					
	(0.180)	(0.050)	(0.947)					
Δ Hotel rooms				4.18*	6.83*	9.41*	6.62*	3.82*
				(2.12)	(3.47)	(4.80)	(3.65)	(2.12)
Covariates	x	x	x	x	x	x	x	x
Observations	2358	2358	2358	2358	2358	2358	2358	2358

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, ** and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in hotel room stock between 2001 and 2010 in column 1, the number of establishments and employment between 2001 and 2011 in columns 2-4, and employment only in columns 4-8. I use the number of protected buildings as an instrument for the variation in hotel rooms. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level. Columns 4-6 use different imputation measures to assign employment at the establishment level, column 7 includes all employment-establishment size classes without removing the two largest categories, and column 8 removes direct hotel employment.

Table 31: THE IMPACT OF HOTEL ROOM OPENINGS ON EMPLOYMENT (IV, DIFFERENT INSTRUMENTS)

Dependent Variables:	Protected buildings level I		Protected buildings level II		Protected buildings level III		All Protected buildings	
	Δ Est.	Δ Emp.	Δ Est.	Δ Emp.	Δ Est.	Δ Emp.	Δ Est.	Δ Emp.
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Δ Hotel rooms	0.192**	3.44***	0.143	3.10**	0.277**	4.63*	0.217**	4.20*
	(0.077)	(1.07)	(0.089)	(1.44)	(0.108)	(2.52)	(0.095)	(2.13)
Number of protected buildings	991	991	2537	2537	8998	8998	19476	19476
F Stat, Excluded instru.	14.408	14.408	10.747	10.747	7.801	7.801	10.445	10.445
Observations	2358	2358	2358	2358	2358	2358	2358	2358

Notes: Statistical significance at levels 1, 5, and 10% is indicated by ***, **, and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010. I use the number of protected buildings with protection level I in columns 1-2, protection level II in columns 3-4, protection level III in columns 5-6, and all levels in columns 7-8 as an instrument for the variation in the number of hotel rooms. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level.

Table 32: THE HETEROGENEOUS IMPACT OF HOTEL ROOM OPENINGS ON ESTABLISHMENT AND EMPLOYMENT (OLS AND IV)

	Establishments		**Employment**		**Observations**
	OLS	**IV**	**OLS**	**IV**	
Depriving tracts	-0.009	0.181*	0.673*	2.39**	536
	(0.022)	(0.098)	(0.355)	(1.09)	
Non depriving tracts	0.124***	0.245**	1.30***	4.73	1,822
	(0.123)	(0.023)	(0.384)	(2.93)	
All census tracts	0.118***	0.222**	1.28***	4.18*	2,358
	(0.021)	(0.094)	(0.361)	(2.12)	

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, **, and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010. I use the number of protected buildings as an instrument for the variation in hotel rooms. Census tracts are classified between depriving and non-depriving according to the Catalog of Vulnerable Neighborhoods developed by the Spanish Ministry of Development. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments and employment between 1990-1997, and the distance from the city center. Fixed effects at the district level.

Table 33: THE IMPACT OF HOTEL ROOM OPENINGS ON CONSUMPTION AMENITIES (IV)

Dependent Variables:	Consumption amenities	Consumption amenities (Hidalgo, Riccaboni, and Velázquez, 2024)
	Δ Establishments	Δ Establishments
Model:	(1)	(2)
Variables		
Δ Hotel rooms	0.057***	0.064***
	(0.015)	(0.013)
Observations	2358	2301

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, **, and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of consumption amenities between 2001 and 2010. I measure consumption amenities as in Hidalgo, Riccaboni, and Velázquez (2024). Mainly, consumption amenities comprise food and beverage establishments such as restaurants, bars and cafes. I use the number of protected buildings as an instrument for the variation in hotel rooms. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level.

Table 34: THE IMPACT OF HOTEL ROOM OPENINGS ON EMPLOYMENT (IV, DIFFERENT EMPLOYMENT MEASURES)

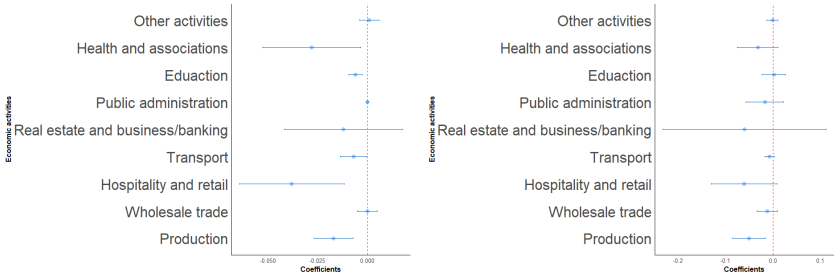
Category	Economic Activity
Production	Agriculture, livestock, hunting, and related service activities
	Forestry, logging, and related service activities
	Fishing, aquaculture, and related service activities
	Mining of coal and lignite; extraction of peat
	Extraction of crude petroleum and natural gas; services related to oil and gas extraction, except exploration
	Uranium and thorium ore mining
	Mining of metal ores
	Mining and quarrying of non-metallic minerals, except fuels
	Food and beverage industry
	Tobacco products manufacturing
	Textile industry
	Clothing and fur product manufacturing
	Tanning and dressing of leather; manufacture of luggage, handbags, and the like; saddlery, harness, and footwear manufacturing
	Wood and cork industry, except furniture; basketry and wickerwork
	Paper and paper products manufacturing
	Publishing, printing, and reproduction of recorded media
	Coke, refined petroleum products, and nuclear fuel processing
	Chemical industry
	Rubber and plastic products manufacturing
	Other non-metallic mineral products manufacturing
	Metallurgy
	Manufacture of fabricated metal products, except machinery and equipment
	Manufacture of machinery and equipment n.e.c.
	Office machinery and computer equipment manufacturing
	Machinery and equipment manufacturing
	Electronic and optical equipment manufacturing; manufacturing of radio, television, and communication equipment and apparatus
	Medical and dental instrument manufacturing, precision optical instruments, and watches
	Motor vehicle, trailer, and semi-trailer manufacturing
	Other transport equipment manufacturing
	Furniture manufacturing; other manufacturing industries
	Recycling
	Production and distribution of electricity, gas, steam, and air conditioning
Wholesale trade	Wholesale trade and commission trade, except motor vehicles and motorcycles
Hospitality and retail	Retail trade, except motor vehicles and motorcycles; repair of personal and household goods
	Accommodation and food service activities
Transport	Land transport; transport via pipelines
	Water transport, coastal and transoceanic
	Air transport
	Supporting and auxiliary transport activities; travel agencies
Real estate and business/banking	Financial intermediation, except insurance and pension funding
	Insurance and pension funding, except compulsory social security
	Activities auxiliary to financial intermediation
	Rental and leasing of machinery and equipment without operator, personal and household goods
	Computer programming, consultancy, and related activities
	Research and development
	Other business activities
Public administration	Public administration, defense, and compulsory social security
Education	Education
Health and associations	Human health and veterinary activities; social work activities
Other activities	Various personal services activities.

Table 35: THE IMPACT OF HOTEL ROOM OPENINGS ON ESTABLISHMENTS AND EMPLOYMENT (IV, TOURIST AND RESIDENT-ORIENTED ACTIVITIES

	Tourist-oriented		Resident-oriented	
Dependent Variables:	Δ Establishments	Δ Employment	Δ Establishments	Δ Employment
Model:	(1)	(2)	(3)	(4)
Variables				
Δ Hotel rooms	0.109***	0.925***	0.0008	-0.084
	(0.029)	(0.268)	(0.011)	(0.131)
Observations	2358	2358	2358	2358

Notes: Statistical significance at levels 1, 5 and 10% is indicated by ***, **, and *, respectively. Cluster standard errors at the neighborhood level. The dependent variables are the long difference in the number of establishments and employment between 2001 and 2010 in tourist activities in columns 1-2 and resident-oriented business in columns 3-4, according to the classification proposed by Hidalgo, Riccaboni, and Velazquez (2023). I use the number of protected buildings as an instrument for the variation in hotel rooms. Covariates include the population, the share of educated people, the unemployment rate, the change in the number of establishments between 1990-1997, and the distance from the city center. Fixed effects at the district level.

Figure 24: Heterogeneous effects on individual-owned companies.



Notes: Figure reproduces the heterogeneous effects of hotel openings on establishments (left) and employment (right) across sectors for individual-owned companies using the main baseline IV specification (Columns 6 and 8 in Table 11), respectively.

C.1 Appendix - Data source and description

B.1 Hotel information

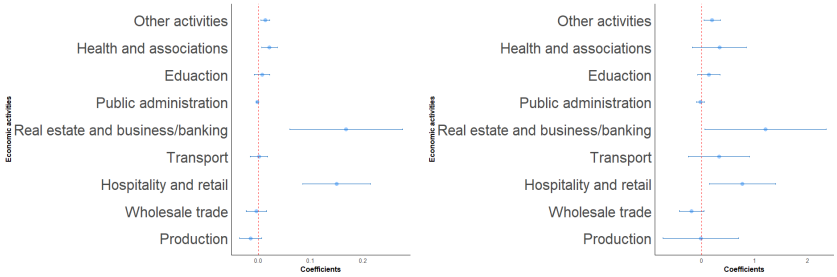
Hotel information comes primarily from the Official Hotel Guide, an annual publication by Tourspain, a Spanish government agency responsible for promoting tourism. This guide was published from 1936 to 2010. Since these data exist solely in physical format, I digitized the Madrid section covering the years 2001 to 2010. From this digitized data, I extracted key details such as the name of the accommodation, classification, category, year of inauguration, and the number of rooms. I supplemented this data set with information from Expedia web scraping and the Touristic Accommodation Register (Registro de Establecimientos Turísticos) provided by the Madrid Region Statistic Department.

It is worth noting that the term "hotel" in this context encompasses various types of accommodations, including hotels, hostels, guest houses, and boarding houses. This broader categorization is used for clarity and to provide a comprehensive view.

Here are specific definitions for each type:

- **Hotel:** These are establishments that occupy an entire building or a distinct part. They have facilities that create a cohesive unit with

Figure 25: Heterogeneous effects on corporate-owned businesses



Notes: Figure reproduces the heterogeneous effects of hotel openings on establishments (left) and employment (right) across sectors for corporate-owned businesses using the main baseline specification (Columns 6 and 8 in Table 11), respectively. Corporate-owned businesses refer to businesses that involve multiple individuals and are structured as entities separate from their owners, such as limited liability companies, cooperatives, and partnerships.

exclusive entrances, elevators, and staircases. If they also offer facilities for food preservation, preparation, and consumption within each lodging unit, they are known as Apartment Hotels. Hotels are classified with star ratings ranging from 1 to 5 stars.

- **Hostel:** They provide lodging in rooms, with or without dining areas or additional services. They must have a minimum of 10 rooms and 20 beds. Hostels are categorized with star ratings of 1, 2, or 3.

- **Guesthouse:** These lodging establishments offer accommodation in rooms, with or without dining areas or extra services. However, they do not meet all the requirements for the hotel classification. Guesthouses are rated 1, 2, or 3 stars.

- **Boarding Houses:** These accommodations may or may not have dining areas and typically offer basic services. They are not categorized with star ratings.

In this paper, I use hotels as a proxy for tourism to assess the influence of tourism in an area. To do this, I calculate a measure of tourism penetration as follows:

$$\triangle Hotel\ rooms_i = Stock\ hotel\ rooms_{i,2010} - Stock\ hotel\ rooms_{i,1998}$$

This equation computes the absolute difference in the number of hotel rooms between the start and end of the sample period in each census tract. This approach considers hotel entries and departures and their size, providing a comprehensive view of tourism's impact.

B.2 Establishment and employment by workplace

Data related to employment and establishments are obtained from the *Directorio de Unidades de Actividad Económicas*. This dataset from the business registry includes essential details such as establishment name, location, business status, category, activity, tenure, and employment category for all establishments in Madrid. There are nine employment categories: 1-4, 5-9, 10-19, 20-49, 50-99, 100-199, 200-499, 500-999 and +999 employees. To attribute employment at the establishment level, I take the minimum value within each category. Notably, the results remain consistent regardless of whether I use the mean, minimum, or maximum values. Additionally, companies with more than 500 employees were excluded from the sample to mitigate the influence of employment imputation on larger businesses. Once again, the results are robust, even when considering potential outliers. I also include only establishments with physical premises that were operational each year.

This dataset for business records spans 1997 to 2010, with annual updates. However, within this time frame, I can identify two distinct stages: 1) **1997-2000**: The directory was updated only through administrative processes. 2) **2001-2010**: In this later period, in addition to administrative updates, fieldwork was conducted to validate information for establishments that were deemed less reliable. Consequently, I have chosen to restrict the time frame to 2001-2010 for better data reliability.

B.3 Housing sector

Housing data is collected from three different sources. First, I obtain rental price information from the Madrid Regional Housing Department, covering 2001 to 2010. In Madrid, tenants must provide landlords a security deposit equal to one month's rent. This deposit must be submitted

to a regional government agency within one month of officially signing the rental agreement. The agency safeguards the deposit until the lease agreement is concluded, at which point it becomes eligible for a refund to the tenant. I combine this dataset with the cadastre data to determine the floor size of each apartment. Then, I calculate the difference in the mean rental price per square meter between 2001 and 2010 for each census tract.

Then, I collect data on residential permits from the Madrid City Council covering 2007 to 2013. This dataset includes licenses for various types of building construction and conservation works. I calculate the absolute difference in the stock of building permits between the start and end of the sample period in each commuting zone.

B.4 Protected buildings

The protected building information is sourced from the *"Plan General de Ordenación Urbana de Madrid de 1997"* dataset. This dataset serves as a regulatory document that outlines the urban development guidelines for Madrid, Spain. It covers aspects such as land use, density, infrastructure, building conservation, and more to achieve balanced and sustainable growth.

Within the *Plan General de Ordenación Urbana de Madrid de 1997*, there is a list of protected buildings. This list includes structures of cultural, historical, or architectural significance, legally protected to ensure their preservation within the urban development framework. These protected buildings are categorized into three levels: Global protection (Level 1), partial protection (Level 2), and element-specific protection (Level 3). Within each protection level, various grades determine the specific areas of a building that require special attention. In this paper, I consider all protected buildings in my instrumental strategy, regardless of their protection level, except for monuments, museums, and other non-lodging facilities, which have been excluded from the analysis. In this way, I keep 18047 protected buildings out of 19476.

When it comes to the adaptive reuse of historic buildings for accommodation facilities, approval from the Madrid City Council is necessary through a legal mechanism known as a "Plan Especial". In 2005, the Regional Government of Madrid revised the regulations to streamline this process, mainly to increase the availability of high-quality hotel accom-

modations to strengthen Madrid's position as a candidate city to host the 2012 and 2016 Olympic Games (Timón, 2010). The new regulation removes this requirement except for protected buildings classified as levels 1 and 2. Creating a specific plan to allow lodging and preserve their cataloged elements will be necessary.

B.5 Flickr images

I collect data from the Madrid photography Flickr web community between 2001 and 2011. I specifically looked for pictures with location tags and categorized users based on their behavior. Users who posted pictures consistently for at least one week during this period were considered tourists, while others were considered residents. This approach uses the timing of photos to distinguish between residents and tourists, a method used in previous research studies (Ahlfeldt, 2012; Saiz, Salazar, and Bernard, 2018; Gaigné et al., 2022).

B.6 Area homogenization

Census tract boundaries are not immutable; they can change due to urban expansion, leading to the creation of new tracts or the modification of existing ones. This variability presents a challenge when analyzing data like the number of rental units and dwellings, which is only available at the census tract level. To accurately compute variations in rentals and dwellings within these tracts, it is essential to standardize the boundaries of the census tracts. To achieve this, I will undertake the following steps:

1. **Spatial Intersection:** Determine the overlapping areas between the census tracts of different years. This is represented as:

$$A_{\text{overlap}} = A_{2001} \cap A_{2011} \tag{C.1}$$

   where A_{2001} and A_{2011} are the areas of tracts in 2001 and 2011, respectively.

2. **Area Calculation:** Compute the area of each intersection:

$$\text{Area}_{\text{overlap}} = \text{Area}(A_{\text{overlap}}) \tag{C.2}$$

3. **Data Imputation:** For variables such as the number of dwellings and rental units, impute data from 2011 to 2001 tracts proportionally based on the area of overlap:

$$\text{Population}_{\text{imputed, 2001}} = \left(\frac{\text{Area}_{\text{overlap}}}{\text{Area}(A_{2011})} \right) \times \text{Dwellings}_{2011} \quad \text{(C.3)}$$

This methodology facilitates accurate data comparison across time despite changes in census tract boundaries.

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