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Town of Pagosa Springs

Short Term Rental Fee Study

PREPARED FOR:

Town of Pagosa Springs
551 Hot Springs Blvd
P.O. Box 1859
Pagosa Springs, CO 81147

CREATED

11/28/2022

INTRODUCTION

The object of this study is to quantify the relationship between the operation of homes in the Town as short-term rentals (STRs) and the supply and demand of workforce housing. The study is founded on a rigorous methodology such that the Town could base a fee on the results if desired.

In this report, the term "Short Term Rental" or "STR," is defined as a residential dwelling unit that is rented for a period of less than 30 consecutive days.

The study begins with an overview of the housing market and economic trends in Pagosa Springs, followed by an analysis of the Town's STR market to provide context for the impact analysis. The study concludes with a fee calculation based on the impact results.

SECTION I.
Housing Market and Short Term Rental Trends

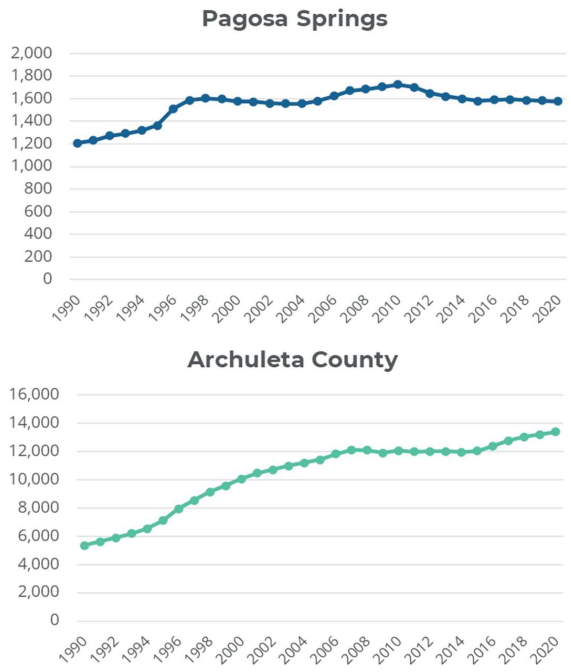
This section summarizes the socioeconomic and housing market trends in Pagosa Springs. The purpose is to put the short-term rental market in context of the surrounding area. Included in this summary is an outline of demographic trends, an overview of the housing market, and descriptive statistics of the short-term rental market. Key data sources that informed this analysis include the US Census Bureau's American Community Survey, the Colorado Department of Local Affairs (DOLA), AirDNA, and the Town of Pagosa Springs.

Demographic Profile

The population of Pagosa Springs has stagnated relative to Archuleta County. Pagosa has also seen the number of children living in the area decline and the number of seniors grow. This raises concerns about maintaining a sufficient workforce to staff local hospitals and uphold the tourism industry in Pagosa Springs.

Figure I-1.
Population Trends

Source:
DOLA and Root Policy Research.

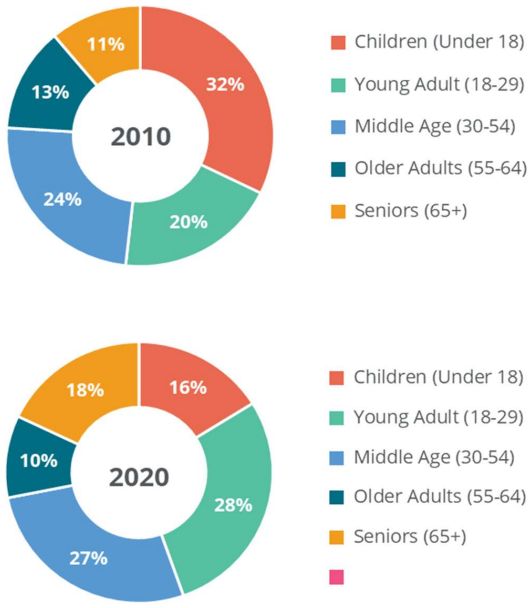


Above, Figure I-1 shows population trends in Pagosa Springs and Archuleta County. Data from DOLA indicates a slight increase in the Pagosa Springs population in the late 1990s that has since plateaued and stayed around 1,600 people. Archuleta County, however, has seen consistent growth. In 1990, the county had 5,345. This grew to 13,367 in 2020; a 150% increase.

Figure I-2 shows the population distribution in Pagosa Springs by age for 2010 and 2020. The age cohort with the largest decline is children (residents under 18). In 2010, one-third of the population was under age 18, but in 2020 this cohort dropped by half to 16%. The young adult population (18-29) overtook children as the biggest age cohort in 2020, accounting for 28% of the population, an 8 percentage point increase since 2010. The middle-aged cohort (30-54) stayed stable from 2010 to 2020 (24% and 27% respectively). The senior population (65+) saw substantial growth from 11% in 2010 to 18% (almost two-fifths of the population) in 2020.

Figure I-2.
Age Distribution, Pagosa Springs, 2010 and 2020

Source:
ACS 5-year estimates and Root Policy Research.

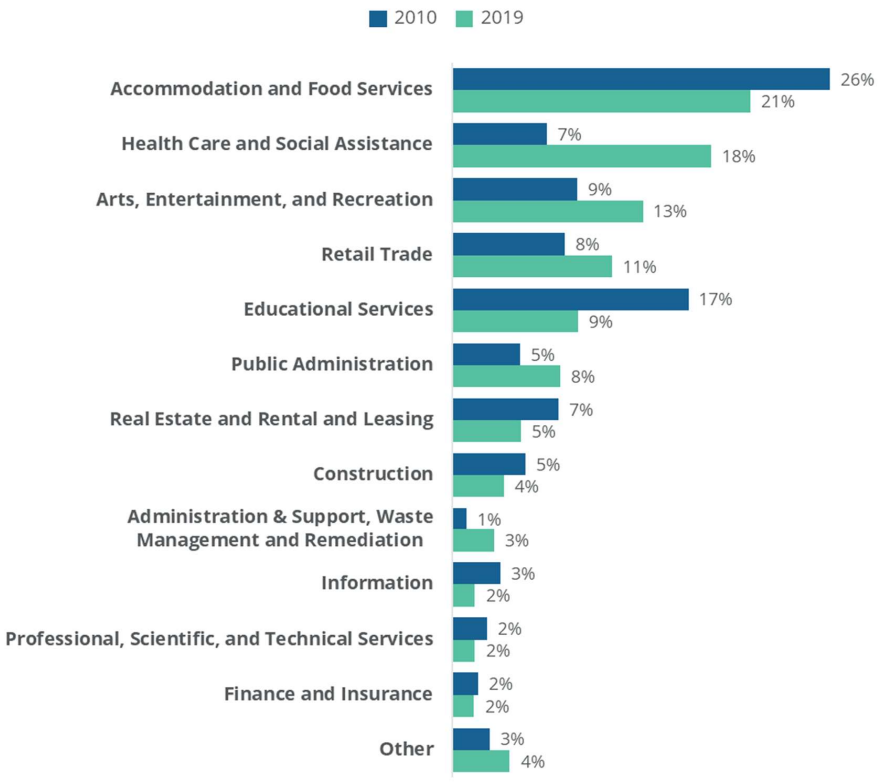


The growth of seniors, decline of children, and stagnation of the middle and older adult population may present a concern for the development of the future workforce. As the population ages, it may be harder to fill essential jobs in the community. The next subsection will detail employment trends in Pagosa Springs.

Employment

Figure I-3 shows the distribution of jobs in 2010 and 2019 in Pagosa Springs. In both 2010 and 2019[1] several of the major sectors in the town—Accommodation and Food Services; Health Care and Social Assistance; Arts, Entertainment, and Recreation; and Retail Trade—are tourism related. Combined, these industries accounted for 43% of total jobs in 2010 and 45% in 2019. The share of jobs in the Health Care and Social Assistance sector has grown substantially since 2010 while the share in the Educational Services sector has contracted.

Figure I-3.
Pagosa Springs Jobs Distribution, 2010 and 2019

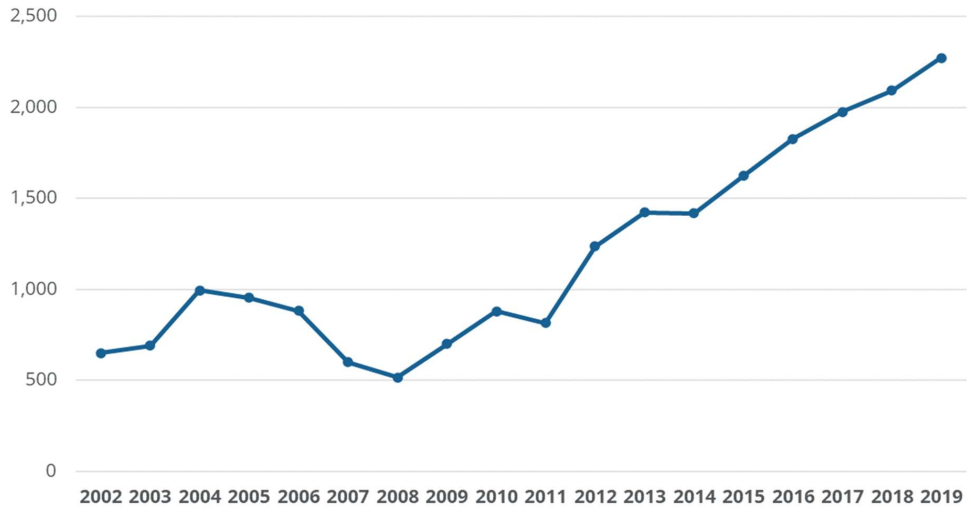


Source: LEHD and Root Policy Research.

[1] LEHD data for 2020 at the town level are not available yet.

Figure I-4 shows the net inflow of workers[2] to Pagosa Springs from 2002 to 2019. This is calculated by subtracting the number of workers living in Pagosa Springs from the number of workers employed in Pagosa Springs, a positive number indicates that more workers are commuting into Pagosa Springs than commuting out. The figure shows that overtime, the number of resident workers is not keeping up with the increase in jobs, which has led to an increase in in-commuting.

Figure I-4.
Pagosa Springs Net Inflow of Workers



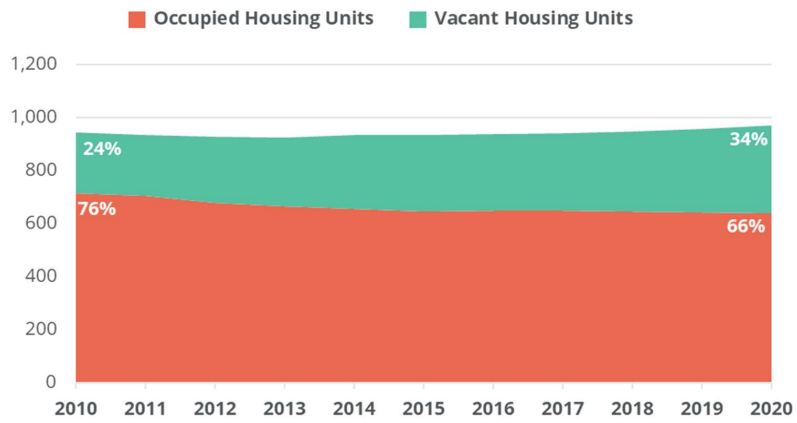
Source: LEHD and Root Policy Research.

Housing Profile

Data shows there has been a growth in vacant units in Pagosa Springs. Figure I-5 shows the number and distribution of units by occupancy from 2010 to 2020, according to DOLA estimates. The total number of units has remained relatively flat but the share of units that are vacant has increased, between 2010 and 2020 the share of units that are vacant increased by 10 percentage points.

[2]Data represent primary jobs.

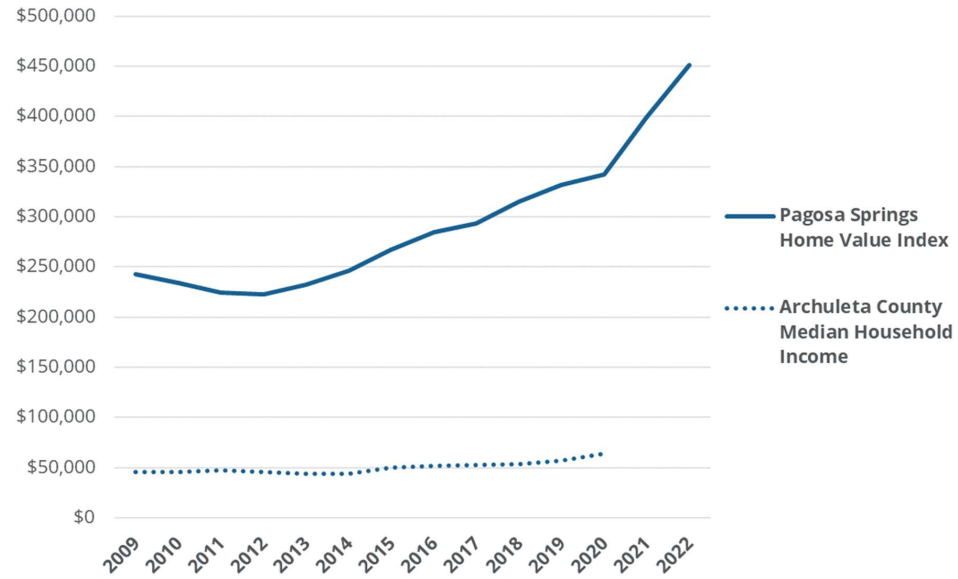
Figure I-5.
Housing Units and Occupancy, 2010 to 2020



Source: DOLA, and Root Policy Research.

Figure I-6 shows home value trends in Pagosa Springs and Archuleta County median household income over time. Home values have increased substantially since 2012 and the trend rapidly accelerated in 2020. Between 2009 and 2022, home values increased by 85%. Median income in the county, however, has only increased 39% between 2009 to 2020.

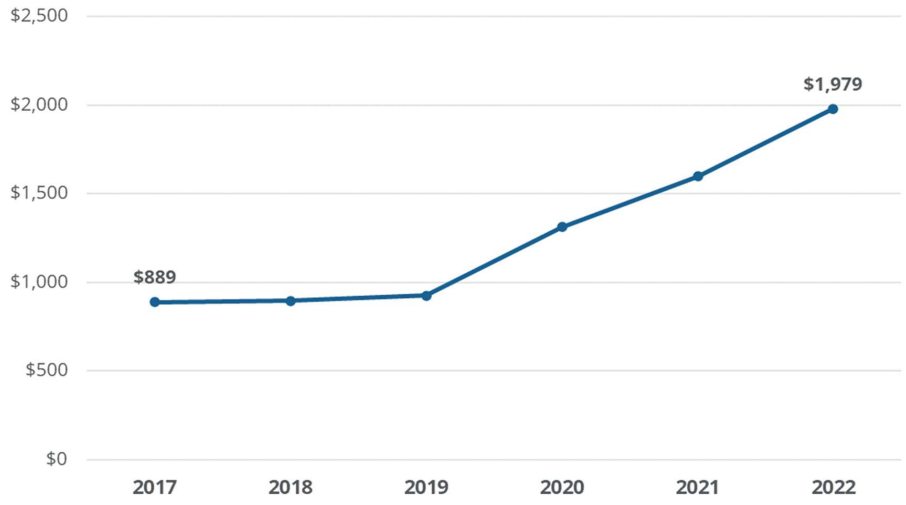
Figure I-6.
Home Value and Income Trends



Note: 2022 average includes January to July 2022.
Source: Zillow Home Value Index, and Root Policy Research.

Figure I-7 shows rent trends from 2017 to 2022. From 2017 to 2019, there was relatively little change in rent prices. They stayed around $900 during this period. However, as with home values, rent prices have increased dramatically since 2020. Overall, rent has grown 122% since 2017.

Figure I-7.
Pagosa Springs Rent Index



Source: Zillow and Root Policy Research.

Short Term Rentals

There are currently 124 licensed short term rentals (STRs) in Pagosa Springs. About half of the STR stock is composed of single family homes. Figure I-8 details the number listings and the number of bedrooms by home type.

Figure I-8.
Licensed Short Term Rentals by Type and Number of Bedrooms

Note:
As of August 2022.

Source:
Town of Pagosa Springs.

	Units	Bedrooms
All Active STRs	**124**	**308**
ADU	9	13
Apartment	4	8
Condominium	18	39
Duplex/Triplex	1	4
Single Family Home	66	175
Townhome	26	69

According to AirDNA data, listings of short term rentals have been rising since 2014, but the trend accelerated following 2020. Figure I-9 shows the cumulative listings over time and the number of listings added by year.

Figure I-9.
Active June 2022 Listings, by Year of Entry

Note:
2022 average includes data from January to July 2022.

Source:
AirDNA and Root Policy Research.

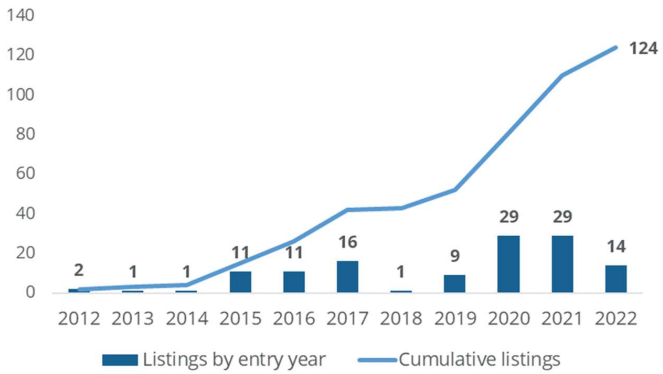


Figure I-10 shows the number of active listings in Pagosa Springs and the average number of bedrooms, bathrooms, guest capacity, and daily rate as of June 2022, according to AirDNA data. On average, STRs in Pagosa Springs have 2 bedrooms and 2 bathrooms with a guest capacity of six people. The average daily rate is $240 per night. The typical STR in Pagosa Springs is rented 131 days per year and generates $31,464 in revenue annually.

Figure I-10.
Pagosa Springs STR Characteristics

Note:
As of June 2022.

Source:
AirDNA and Root Policy Research.

	Average Characteristics
Number of Active Listings	**124**
Bedrooms	2.1
Bathrooms	1.8
Guest capacity	5.8
Booked nights	131
Daily rate	$240
Annual Revenue	$31,464

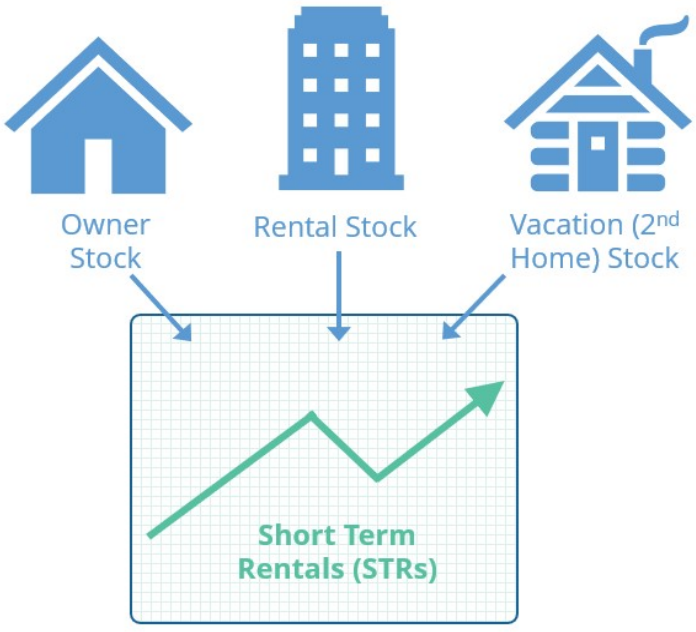
SECTION II.
Impact Analysis

This section provides an overview and results of the supply and demand impact models estimated. Specifically:

- On the supply side: This section explains and presents the results of the econometric model based on academic research to identify housing market impacts directly caused by STR activity.
- On the demand side: This section presents an overview and the results of the input-output model used to quantify the impacts of spending by STR visitors on employment and the distribution of wages in the town.

Housing Supply Impact Analysis

Potential negative supply impacts to the local housing market involve reallocation of resources from locals to nonlocals. When supply for locals declines, availability of workforce housing diminishes, and rents/prices increase.



The housing profile and STR market analysis presented in the prior section highlights recent trends that reveal an increase in vacation home stock, declining permanent resident occupancy, rising rents and home prices, and an increase in STR registration and activity in Pagosa Springs.

This section uses a regression analysis to determine whether there is a *causal relationship* between these trends. Specifically, the impact analysis is designed to isolate and quantify the effect of STRs in Pagosa Springs on the availability of housing for the local resident workforce.

The methodology used to quantify STR impacts on the supply of housing uses the methodology used by the Town of Estes Park.[1] The town recently passed a fee ordinance to mitigate the impact of STR on the availability of workforce housing units. The methodology builds on the work of a national, peer reviewed study published in 2021: "The Effect of Home-Sharing on House Prices and Rents: Evidence from Airbnb."[2] The econometric model built for the national study:

- Controls for local demographic trends including changes in population, income, employment, and education—over time and across geographies.
- Uses a fixed effects specification that controls for shocks to housing market conditions that are common across geographies, as well as controlling for the average differences across geographies in any unobservable amenities; and
- Uses an instrumental variable (IV) approach that measures **causal** impacts of growth in STR's on different measures of housing supply.

In addition, the study reflects a national analysis, which is broadly applicable, and has the credential of being published in a well-respected academic journal with extensive peer-review vetting.

The study uses a dataset of Airbnb listings at the zip code level from the entire United States merged with U.S. Census data to assess the impact of home-sharing on residential house prices and rents, and the reallocation of homes from the long term rental (LTR) to the short term rental (STR) market. The findings indicate that Airbnb has an upward impact on house prices and rents: a 1% increase in Airbnb listings leads to a 0.018% increase in rents and a 0.026% increase in house prices. Formal statistical tests show the Airbnb effect is driven by the reallocation of the housing supply and that the total supply of housing is

[1] https://dms.estes.org/weblink/0/edoc/193327/PACKET%20Town%20Board%20Special%20Study%20Session%202022-03-01.pdf

[2] Barron, K., Kung, E., & Proserpio, D. (2021). The effect of home-sharing on house prices and rents: Evidence from Airbnb. Marketing Science, 40(1), 23-47.

not affected by the entry of Airbnb, but that Airbnb listings decrease the supply of long-term rental units.

Following the findings from the Estes Park study, Root Policy Research adapted the methodology to the Pagosa Springs context in two ways:

1. Applied the coefficients of the national regression analysis to Pagosa Springs input data on housing stock and tenure; and

2. Uses a Colorado-specific regression analysis following the methodology and econometric specifications of the national study using updated local datasets and expanding the time period covered.[3] This model also allows us to focus on results specific to areas with an above-average share of tourism-driven economic activity.

Applying coefficients from both the national model and state model to Pagosa Springs data allows us to extrapolate a robust estimate of the local impact. Model results are discussed below; please see Technical Appendix for additional details.

Model results. The results from applying the coefficients of the national model and state models to Pagosa Springs are shown in Figure II-1. These estimates measure the impact of a 1% increase in STRs on the supply of specified housing types.

The figure shows the results of the IV model for the national analysis (which isolates the causal impact of STRS). Results of the state model show both the baseline model (without instrumental variables) and the IV model (which uses the instrumental variable to pinpoint the causal impact). It is common practice to review both baseline and IV models when replicating an analysis as the baseline model helps to confirm the underlying approach and the precision of the model structure; however, the IV model reflects a causal representation of the impact created by the presence of STRs.[4]

Note that the national model does not estimate the impacts on the owner stock; however, the estimates of on the rental stock and vacant homes are similar enough to our Colorado model, implying the owner stock coefficients are probably similar to what would be estimated at the national level.

[3] The national study covers the years 2011 to 2016; the Colorado model covers the years 2011-2019.

[4] Coefficient bias is reduced by the IV specification, although the estimates have larger standard errors which result in lower statistical significance—a common statistical outcome of IV models.

Figure II-1.
Model Results Applied to Pagosa Springs: Supply Impacts of a 1% Increase in Short Term Rentals in Pagosa Springs

	National	Colorado Model		
	General Model (IV)	Baseline Model	Baseline with Causal Instrument (IV)	Above-Average Tourism (IV)
Supply Impacts				
Rental Stock	-0.0148% *	-0.0210% *	-0.0286%	-0.0408%
Owners Stock	n/a	-0.0118% *	-0.0230%	*high error*
Vacancy Impacts				
Vacant for Rent	-0.0300% *	-0.0232%	-0.0544%	-0.2248%
Vacant for Seasonal Use	0.0708% *	0.0758% *	0.1560% *	*high error*
Price Impact				
Rents	0.0296% *	*not quantifiable with current data*		
Home Price	0.0486% *	*not quantifiable with current data*		

Note: * indicates a statistically significant result. Coefficients applied to zip code 81147. National model covers years 2011 to 2016. Colorado model restricts sample to Colorado only and extends the time period to 2019.

Source: Barron, K., Kung, E., & Proserpio, D. (2021). The effect of home-sharing on house prices and rents: Evidence from Airbnb. Marketing Science, 40(1), 23-47, AirDNA, U.S. Census, Google Trends, and Root Policy Research.

Results presented in the Figure can be interpreted as follows:

- According to the general model, a doubling in the number of STRs decreases the rental stock by approximately 1.5%; according to the estimates produced by the Colorado model a doubling in the number of STRs can decrease the rental stock by as little as 2.1% and as much as 2.9%.
- On the ownership market, according to the estimates produced by the Colorado model, doubling the number of STRs decreases the ownership stock by as little as 1.1% and as much as 2.3%. (The general model does not estimate the impacts on the owner stock; however, the estimates of on the rental stock and vacant homes are similar to enough to our Colorado model, implying the owner stock coefficients are probably similar to what would be estimated at the national level).
- An increase in STRs leads to a tighter rental market with lower vacancies. In the general model, a doubling in the number of STRs decreases the number of vacant units for rent by 3% and in the Colorado model, a doubling of the number of STRs can decrease the number of vacant units for rent by 2.3% and up to 5.4%.
- In the general model, a doubling in the number of STRs increases the number of vacant units for seasonal and recreational purposes by 7%, while in the Colorado model the impact ranges from a 7.6% to a 15.6% increase in vacant units for seasonal and recreational purposes.

Summary of supply STR impacts. The model output above highlights the housing market impacts caused directly by the home sharing economy. Home sharing can create a reallocation of the rental stock from the long-term rental to the short term rental market. This can increase rental rates and house prices, decrease vacancy rates in the long-term market, and create a tighter market for long-term renters.

The direct impact of STRs in Pagosa Springs on the supply of housing is estimated by converting the percentage impacts identified in the model into unit-level impacts based on current STR and market data for Pagosa Springs. Results are presented in a range of impacts where the national model (with Pagosa Springs inputs) reflects a lower bound.

Figure II-2.
Direct Impact of Pagosa Springs STRs on Housing Supply

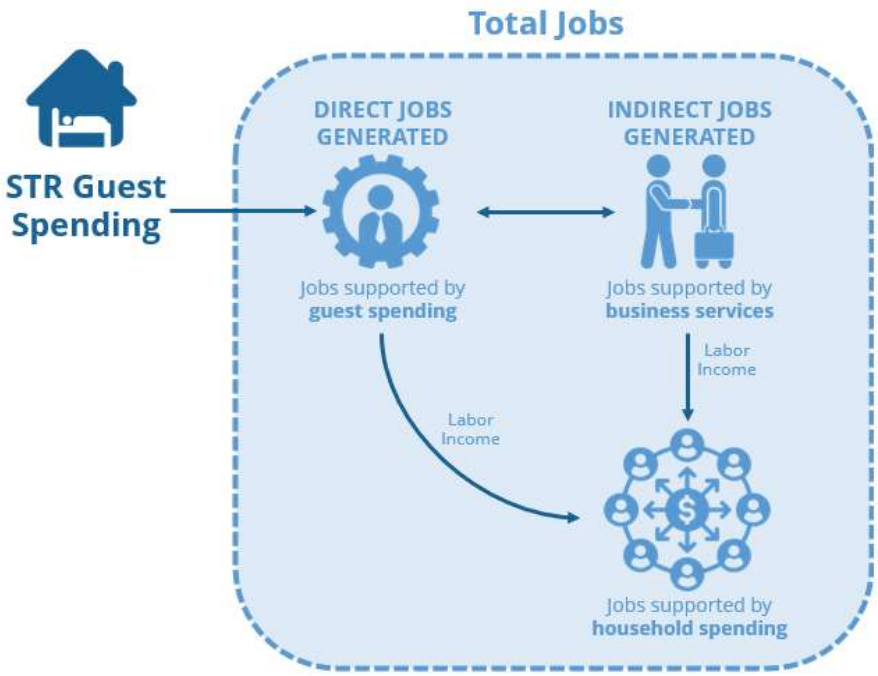
	National Model	Colorado Model	Colorado Tourist Model
Units Lost from Rental stock per 100 STRs	3.3 units	6.5 units	9.2 units
Units Lost from Owner stock per 100 STRs	3.4 units	6.6 units	n/a

Source: Barron, K., Kung, E., & Proserpio, D. (2021). The effect of home-sharing on house prices and rents: Evidence from Airbnb. Marketing Science, 40(1), 23-47, AirDNA, U.S. Census, Google Trends, Town of Pagosa Springs, and Root Policy Research.

Every 100 STRs in Pagosa Springs leads to a loss of 3 to 9 rental units and 3 to 7 ownership units that would otherwise be occupied by local residents, for a total resident housing loss of 6 to 16 units.

Housing Demand Impact Analysis

Potential positive demand impacts to the local housing market involve increased demand for housing from economic activity related to STR spending. This activity creates and supports jobs—typically in the tourism and service industries—which in turn creates additional demand for workforce housing.



This section uses an input-output model to measure the number of jobs supported by economic activity derived from STRs. Input-output models are commonly used to measure impacts of changes in a local or regional economy—including employment impacts from changes in personal income and spending.

This study uses a model developed by IMPLAN, one of the leading software packages for modeling economic impacts. The IMPLAN model quantifies the direct jobs generated at establishments that serve visitors directly—such as restaurants and supermarkets— plus the indirect jobs generated by increased demand at firms that service these establishments, and the indirect (also called induced) jobs generated when the employees spend their wages in the local economy and generate additional jobs. Thus, the IMPLAN model estimates the direct and indirect impact combined.

Spending data that feeds the IMPLAN model comes from the Colorado Tourism Office. Using data from their report "Economic Impact of Travel in Colorado 2010 to 2021[5]" we estimate STR visitor spending by industry in Archuleta County and obtain IMPLAN estimates of the number of direct and indirect jobs by industry generated by STR visitor spending. These are calibrated to represent the impact in Pagosa Springs based on the share of employment in the county that the town accounts for.

We estimate that STR visitors spent over $9,000,000 in goods and services other that lodging in Archuleta County in 2021. According to the visitor spending pattern provided by the report, this spending was captured by businesses providing food services; food stores; local transportation and gas; arts, entertainment, and recreation establishments; and retail sales. These establishments were then matched to NAICS industry codes which were then translated into the input side of the IMPLAM model. Figure II-3 shows the spending input and employment (output) results provided by the model—where an estimated 175 jobs are supported by STR visitor spending in Archuleta County.

Figure II-3.
Archuleta County STR Spending by Establishment Type and Total Employment Derived by the Spending

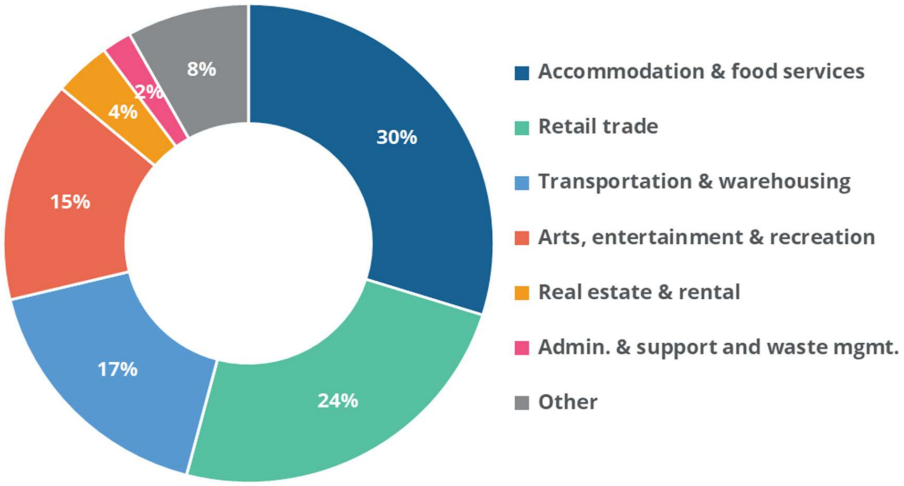
Source:
Colorado Tourism Office, IMPLAN, and Root Policy Research.

	IMPLAN Inputs - Outputs
Spending (Input):	**$9,269,959**
Food Service	$3,576,052
Food Stores	$909,636
Local Tran. & Gas	$1,569,296
Arts, Ent. & Rec.	$1,590,128
Retail Sales	$1,624,847
Employment (Output):	**175**
Direct	150
Indirect	26

The model also provides the distribution of jobs by industry, which is shown in Figure II-4. As expected, the vast majority of jobs (86%) belong to tourism related industries—accommodation and food services; retail trade; transportation and warehousing; and arts, entertainment, and recreation.

[5] https://oedit.colorado.gov/sites/coedit/files/documents/Dean%20Runyan%20Associates_Colorado%20Economic%20Impact%20Report_2021.pdf

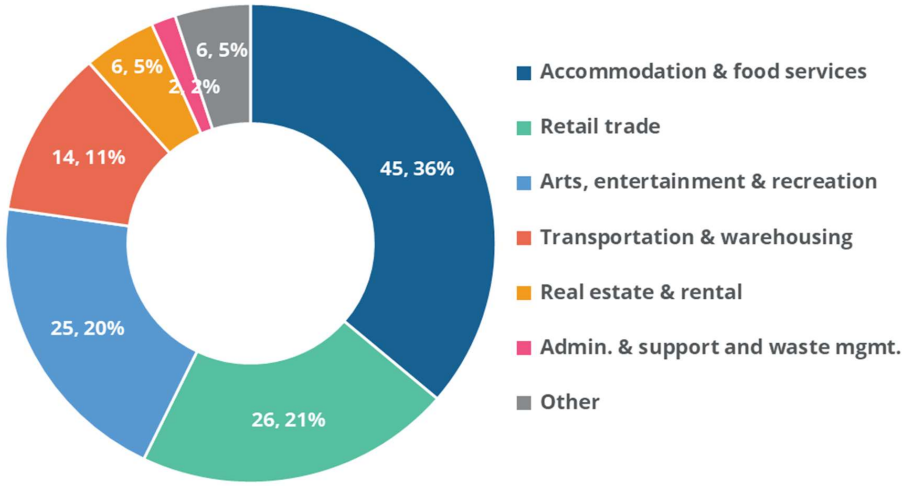
Figure II-4.
Distribution of Jobs Generated by STR Visitor Spending, Archuleta County



Source: Colorado Tourism Office, IMPLAN, and Root Policy Research.

Pagosa Springs is the employment center of the county, and accounts for 70% of jobs in the county. Using the share of jobs by industry that the town accounts for in the county, STR visitor spending generated 124 jobs in the town. The distribution by industry is shown in Figure II-5.

Figure II-5.
Distribution of Jobs Generated by STR Visitor Spending, Pagosa Springs



Source: Colorado Tourism Office, IMPLAN, LEHD, and Root Policy Research.

Figure II-6 shows the average annual wage for the jobs supported by STR visitors. Wages in these industries tend to fall in the lower end of the wage distribution and contribute to demand for workforce affordable housing.

Figure II-6.
Average Annual Wage of Jobs Generated by STR Visitors

Source:
2021 Quarterly Census of Employment and Wages, and Root Policy Research.

Industry	Average Annual Wage
Accommodation & food services	$26,896
Retail trade	$31,122
Arts, entertainment & recreation	$24,226
Transportation & warehousing	$39,230
Real estate & rental	$46,493
Admin. & support and waste mgmt.	$29,813

According to employment data, there are on average 1.4 jobs per household in Archuleta County. Using this ratio, the 124 jobs generated in the town of Pagosa Springs translate to 88 households.

The estimated 88 households in the town of Pagosa Springs are supported by spending in the entire county. STRs in Pagosa Springs account for 15% of all STRs in the county. Using this share, STRs in Pagosa Springs support demand for 13 households.

SECTION III.
Supportable Fee Calculation

This section calculates a potential STR fee according to the impacts quantified in the previous section. The fee is derived directly from the units lost from supply (both rental and owner) as well as the units needed for jobs created. Fee calculation relies on the "affordability gap" methodology to measure the cost of units (both lost and needed). The affordability gap is an industry standard methodology, commonly used in nexus studies that calculate affordable housing linkage fees and impact fees. It is the same methodology used in other recent Short Term Rental Impact Fees in Colorado (for the Town of Breckenridge, 2021; and Estes Park, 2022).

The affordability gap methodology fee is based on the difference in price between market-rate units and units affordable to the workforce, weighted by the actual income distribution of residents and workers. The fee is calculated separately for supply impacts and demand impacts; the following section details the methodology and results for both components of the final, combined fee.

Fee Calculation for Supply Impacts

The fee calculation for supply impacts reflects the affordability gap applied to the direct impact of STRs on current housing supply (i.e., loss of units available to permanent residents), and is calculated with the following components:

1. **Causal supply impact of STRs:** the number of housing units lost from Pagosa Springs' workforce housing inventory as a direct result of STRs (see Figure II-2). The impacts summarized in Figure II-2 are derived from Pagosa Springs data applied to national, state, and substate econometric models which effectively and reliably isolate the direct supply impacts created specifically by STRs. The fee calculation focuses on the results most applicable to the Pagosa Springs market: the Colorado and the Colorado Tourist models.

2. **Affordability gap per household** of both renter and owner housing in Pagosa Springs (shown in Figure III-1, on the following page). This reflects the difference in market rate housing and what is affordable to workforce, weighted by the income distribution of existing residents. Incomes are shown as a percentage of Area Median Income (AMI) to be consistent with standardized income limits for housing programs. Affordability gaps are evaluated up to incomes of 120% of AMI, consistent with the typical definition of affordable workforce housing and in alignment with the actual affordability gaps present in Pagosa Springs. Max rent and home prices assume 30% of gross income is spent on housing. Home price calculations assume a fixed rate 30-year mortgage with a 10% down payment and 5.5% interest rate; mortgage costs are

assumed to account for 75% of total monthly household expenses (the remaining 25% is property tax, insurance, HOA fees, utilities, etc.). The ownership affordability gap is annualized over a period of 30 years, the standard term of a home mortgage.

3. **The supportable fee calculation** multiplies the affordability gap per household by the number of households lost from rental and ownership stock as a direct result of STRs.

Figure III-1, on the following page, shows the affordability gap calculations for both renter and owner households as well as the application of those gaps to the supply impacts quantified in Section II. The resulting justifiable fee to account for supply impacts is $1,196-$1,500 per STR per year.

Figure III-1.
Potential Short Term Rental Fee Calculation for Supply Impacts

MARKET RATE HOUSING PRICES

2022 Average Sales Price, Pagosa Springs:	**$450,911**
2022 Average Rent, Pagosa Springs:	**$1,979**

AFFORDABILITY GAP CALCULATION: DIFFERENCE IN AFFORDABLE TO WORKFORCE AND MARKET RATE

Owner Households by Income Range	% of owners	2022 Income Limit	Max Affordable Home Price	Affordability Gap	Annualized Affordability Gap
0-30% AMI	13%	$19,750	$71,742	$379,169	$12,639
30-60% AMI	33%	$39,480	$143,412	$307,499	$10,250
60-80% AMI	12%	$52,600	$191,070	$259,841	$8,661
80-100% AMI	10%	$65,800	$239,019	$211,892	$7,063
100-120% AMI	10%	$78,960	$286,823	$164,088	$5,470
120% AMI or more	22%	n/a	n/a	n/a	n/a
			Weighted Annual Gap per Owner Household		***$7,307***

Renter Households by Income Range	% of renters	2022 Income Limit	Max Affordable Rent	Monthly Affordability Gap	Annualized Affordability Gap
0-30% AMI	37%	$19,750	$494	$1,485	$17,823
30-60% AMI	29%	$39,480	$987	$992	$11,904
60-80% AMI	8%	$52,600	$1,315	$664	$7,968
80-100% AMI	7%	$65,800	$1,645	$334	$4,008
100-120% AMI	6%	$78,960	$1,974	$5	$60
120% AMI or more	12%	n/a	n/a	n/a	n/a
			Weighted Annual Gap per Renter Household		***$10,971***

AFFORDABILITY GAP APPLIED TO STR SUPPLY IMPACTS

STR Impacts	CO Model	CO Tourist Model
Units Lost from Rental stock per 100 STRs	6.5	9.2
Units Lost from Owner stock per 100 STRs	6.6	6.6
Fee Application		
Annual Rental Affordability Gap created by 100 STRs	$ 71,106	$ 101,438
Annual Owner Affordability Gap created by 100 STRs	$ 48,518	$ 48,518
Agregate Annual Affordability Gap per 100 STRs	$ 119,624	$ 149,956
Supportable Annual Fee per STR	**$ 1,196**	**$ 1,500**

Note: The tourist owner impact defers to state model results as the owner tourist metric did not meet statistical reliability standards.
Source: Root Policy Research.

Fee Calculation for Demand Impacts

The fee calculation for demand impacts reflects the affordability gap applied to the direct impact of STRs on housing demand resulting from net job creation to support STR activities and is calculated with the following components:

4. **Causal demand impact of STRs:** the increased demand for housing from economic activity related to STR spending was derived from estimates of direct and indirect employment supported by STR spending obtained through an input-output model developed by IMPLAN, one of the leading software packages for modeling economic impacts (see Figure II-5).

5. **Affordability gap per household** of both renter and owner housing in Pagosa Springs (shown in Figure III-2, on the following page). This reflects the difference in market rate housing and what is affordable to workforce, weighted by the wage distribution of jobs created by STR activity. Jobs are converted to household using a ratio of 1.4 workers per household and the resulting household incomes are shown as a percentage of AMI to be consistent with standardized income limits for housing programs. Affordability gaps are evaluated up to incomes of 120% of AMI, consistent with the typical definition of affordable workforce housing and in alignment with the actual affordability gaps present in Pagosa Springs. Max rent and home prices assume 30% of gross income is spent on housing. Home price calculations assume a fixed rate 30-year mortgage with a 10% down payment and 5.5% interest rate; mortgage costs are assumed to account for 75% of total monthly household expenses (the remaining 25% is property tax, insurance, HOA fees, utilities, etc.). The ownership affordability gap is annualized over a period of 30 years, the standard term of a home mortgage.

6. **The supportable fee calculation** multiplies the affordability gap per worker household by the number of households supported from the jobs created as a direct result of STR visitor spending.

Figure III-2, on the following page, shows the affordability gap calculations for worker households as well as the application of those gaps to the demand impacts quantified in Section II. The resulting justifiable fee to account for demand impacts is $1,188 per STR per year.

Figure III-2.
Potential Short Term Rental Fee Calculation for Demand Impacts

MARKET RATE HOUSING PRICES	
2022 Average Sales Price, Pagosa Springs:	**$450,911**
2022 Average Rent, Pagosa Springs:	**$1,979**

AFFORDABILITY GAP CALCULATION: DIFFERENCE IN AFFORDABLE TO WORKFORCE AND MARKET RATE

Indusry	% of Jobs Created by STRs	Household Income (1.4 workers per HH)	Annualized Affordabiltiy Gap
Arts, entertainment & recreation	20%	$34,157 (52% AMI)	$12,041
Accommodation & food services	36%	$37,921 (58% AMI)	$11,289
Administrative and Support	2%	$42,034 (64% AMI)	$10,467
Retail trade	21%	$43,880 (67% AMI)	$10,098
Transportation & Warehousing	12%	$55,311 (84% AMI)	$7,815
Real estate & rental	5%	$65,552 (100% AMI)	$5,769
Other	5%	$69,128 (105% AMI)	$5,837
		Weighted Annual Gap per Household	***$10,233***

AFFORDABILITY GAP APPLIED TO STR DEMAND IMPACTS

STR Impacts	
Pagosa Jobs Created per 100 STRs	16.3
Pagosa Households Supported per 100 STRs	11.6
Fee Application	
Annual Affordability Gap created by 100 STRs	$118,775
Supportable Annual Fee per STR	**$ 1,188**

Note: The tourist owner impact defers to state model results as the owner tourist metric did not meet statistical reliability standards.
Source: Root Policy Research.

Combined Fee: Supply and Demand Impacts

As illustrated in the previous figures, this STR impact study supports a fee of up to $1,550 per unit per year to mitigate the quantifiable supply impact of STRs on local workforce housing and a fee of up to $1,188 per unit per year to mitigate the quantifiable demand impact of STRs on local jobs created by STR visitor spending. As shown in Figure III-3, the aggregate **quantifiable impact of both supply and demand supports an annual fee of $2,687 per STR unit**.

It is important to note that the methodology described above reflects a conservative approach to fee calculation as the fee only captures the marginal difference between

market-rate home costs and workforce affordable home costs (as opposed to capturing the full cost to construct "replacement" units) and because it assumes displaced households have the same income representation as current residents.

Figure III-3.
Potential Short Term Rental Fee for Supply + Demand Impacts

AFFORDABILITY GAP APPLIED TO STR IMPACTS

STR Impacts	Housing Unit Impact per 100 STRs	Annual Affordability Gap Per HH	Annual Affordabilty Gap per STR
Units Lost from Rental stock	9.2	$10,971	**$1,014**
Units Lost from Owner stock	6.6	$7,307	**$ 485**
Units Needed for Jobs Created	11.6	$10,233	**$1,188**
Supportable Annual Fee per STR			**$2,687**

Source: Root Policy Research.

Figure III-4 shows the supportable fee in the context of average STR characteristics—both as an annual per bedroom fee and a nightly fee (based on average number of bedrooms and average number of booked nights).

Figure III-4. Supportable Fee in Context

Note:
Nightly rate calculation based on average number of rented nights per year; typical Pagosa Springs STR characteristics discussed in detail in Section I of this report.

Source:
Root Policy Research.

	Supply Impact Fee	Demand Impact Fee	Total Fee
Supportable Annual Fee per STR	**$1,500**	**$1,188**	**$2,687**
As a % of average annual revenue for typical Pagosa Springs STR ($31,464)	4.8%	3.8%	8.5%
Supportable Annual Fee per Bedroom (based on average of 2.48 bedrooms per STR)	**$604**	**$478**	**$1,082**
Supportable Nightly Fee (based on average of 131 rented nights/yr)	**$11.45**	**$9.07**	**$20.51**
% increase to average daily rate for typical Pagosa Springs STR ($240)	4.6%	3.6%	7.9%

TECHNICAL APPENDIX.

DETAILED SPECIFICATION OF SUPPLY AND DEMAND MODELS

TECHNICAL APPENDIX

Supply Side Model

This section provides the methodology used to derive the estimates of reallocation of homes from the LTR to STR market. The methodology follows the analysis conducted in "The Effect of Home-Sharing on House Prices and Rents: Evidence from Airbnb"[1] and applies the same model to Colorado and expands the time period covered from 2011 through 2016 to 2011 through 2019.

Methodology

The main econometric specification used is:

$$LnHousingUnits_{it} = \beta\ LnAirbnb_{it} + \gamma\ LnAirbnb_{it} \times OwnerOccRate_{i,2010} + X_{it} + \mu_i + \theta_t + \varepsilon_{it}$$

Where $Ln\ Housing\ Units_{it}$ is the natural log of different measures of housing supply in each zip code area, including: the number of rental units (occupied plus vacant for rent), the number of ownership units (occupied plus vacant for sale), the number of vacant units for rent, the number of vacant units for seasonal and recreational purposes, and the total number of housing units. $Ln\ Airbnb_{it}$ is the natural log of the total number of cumulative listings in each zip code and year. The total number of Airbnb listings is also interacted with the share of total housing units that were owner occupied in 2010. X_{it} is a vector of zip level controls including: the natural log of population and median household income, and the employment rate of the population over 16 and the share of population over 25 with a college degree. Zip code level fixed effects μ_i are included to account for differences in fixed amenities across zip codes, and time fixed effects θ_t to control for time varying factors that impact all zip codes equally.

Given that there may still be unobserved factors in the error term that are correlated with Airbnb activity, an instrumental variable is used. This variable needs to be uncorrelated with local housing markets and be correlated with the number of Airbnb listings. The instrument used follows Barron et al. (2019) and measures the volume of Google searches which is then interacted with the number of tourism related establishments in each zip code in 2010. This instrument is chosen because Google trends data represent a measure of the extent to which awareness of Airbnb has diffused to the public and is not likely to be reflective of growth in overall tourism demand therefore the predicted change in short

[1] Barron, K., Kung, E., & Proserpio, D. (2021). The effect of home-sharing on house prices and rents: Evidence from Airbnb. Marketing Science, 40(1), 23-47.

term housing is driven only by Airbnb penetration. The Google trends measure is interacted with a measure to tourism activity because it is assumed that potential hosts are more likely to rent their property in the short-term market in response to learning about Airbnb. This instrument therefore interacts an exogenous variable with an endogenous exposure variable. Extensive evidence of the validity of the instrument used is presented in the Barron et al. (2019) study.

Data

Data for Airbnb listings come from two sources, the Colorado data used in Barron et al. (2019)[2] merged with AirDNA, an analytics company that scrapes data from Airbnb. Data used are the number of listings in each Zip code, and the number of listings used is restricted to entire home listings, which are more likely to impact the housing supply versus private and shared rooms. For calculating the number of Airbnb listings by year, this study follows Barron et al. (2019) and assumes the listing enters the short term rental supply the year the listing it is posted in Airbnb and assumes that listings never exit. Although this is likely to overestimate listings, this would only cause biases if this is correlated with the error term after controlling for several zip code characteristics.

Data on housing supply and local controls come from the American Community Survey (ACS) annual estimates at the zip code level. ACS data at the zip code level are reported on five-year running averages to smooth out annual fluctuations from sampling error of smaller areas. To account for this serial correlation in the dependent variable, standard errors are clustered at the zip-code level.

The instrumental variable is constructed using the Google trends index data from the state of Colorado. Google Trends data are normalized so that the date with the highest search volume is given the value of 100, data are available at the monthly level which is then averaged to construct annual observations. The annual Google trends index is interacted with the zip code level number of establishments in the food services and accommodations industry (NAICS 72) in 2010 from the Census Bureau Business Patterns data.

Results

Figure A-1 shows results from the coefficients of interest— β and γ —for the different regression models. The coefficients are interpreted in the following fashion: In the instrumental variable regression coefficients for β and γ measure the impact on the rental stock found in Barron et al. (2019) and are -0.036*** and 0.053***; meaning that using Pagosa Spring's owner occupancy rate of 40%, a 1% increase in listings leads to a 0.0148% (0.053 × 0.40 -0.036) decrease in the rental stock.

[2] Data was gathered through web scrapping by authors of the study.

Figure A-1.
Regression Coefficient Results

	β Coefficient	γ Coefficient	Impact
Rental Stock			
Barron et al.	-0.036***	0.053***	(0.053*0.40)-0.036= **-0.0148**
Colorado Baseline	-0.059**	0.095**	(0.095*0.40)-0.059= **-0.0210**
Colorado IV	-0.041	0.031	(0.031*0.40)-0.041= **-0.0286**
Colorado Tourism IV	-0.022	-0.047	(-0.047*0.40)-0.022= **-0.0408**
Vacant for Rent			
Barron et al.	-0.048*	0.045*	(0.045*0.40)-0.048= **-0.0300**
Colorado Baseline	-0.042	0.047	(0.047*0.40)-0.042= **-0.0232**
Colorado IV	-0.020	-0.086	(-0.086*0.40)-0.020= **-0.0544**
Colorado Tourism IV	-0.24^{+}	0.038	(0.038*0.40)-0.024= **-0.2248**
Vacant for Seasonal Use			
Barron et al.	0.078*	-0.018	(-0.018*0.40)+0.078= **0.0708**
Colorado Baseline	0.087**	-0.028	(-0.028*0.40)+0.087= **0.0758**
Colorado IV	0.128*	0.070	(0.070*0.40)+0.128= **0.1560**
Owner Stock			
Colorado Baseline	-0.023*	0.028	(0.028*0.40)-0.023= **-0.0118**
Colorado IV	-0.029^{+}	0.015	(0.015*0.40)-0.029= **-0.0230**

Note: Significance levels: +=p<0.15=85% confidence, *=p<0.1=90% confidence, **=p<0.05=95% confidence, ***=p<0.01=99% confidence.

Source: Barron, K., Kung, E., & Proserpio, D. (2021). The effect of home-sharing on house prices and rents: Evidence from Airbnb. Marketing Science, 40(1), 23-47, and Root Policy Research.

Demand Side Model

This section provides the methodology used to estimate the number of jobs supported by economic activity derived from STRs. The methodology combines data on tourism spending from the Colorado Tourism Office and an input-output software package developed by IMPLAN.

IMPLAN Model

IMPLAN utilizes an economic modeling technique called input-output analysis, which is a type of applied economic analysis that tracks the interdependence among various producing and consuming industries of an economy. It measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands.

IMPLAN was created by academics to serve the needs of the United States Forest Service in the 1970's. It has been transformed today to serve as a solution-provider for anyone interested in better understanding their economy. IMPLAN is the leading provider of economic impact data and analytical applications, and IMPLAN's economic data set and economic impact estimates have been widely published both in professional publications as well as peer-reviewed academic journals. Many of these methods are considered standard best practices in a wide variety of applied economic fields today.

The IMPLAN model quantifies the direct jobs generated at establishments that serve visitors directly—such as—restaurants, supermarkets— plus the indirect jobs generated by increased demand at firms that service these establishments, and the indirect (also called induced) jobs generated when the employees spend their wages in the local economy and generate additional jobs. Thus, the IMPLAN model estimates the direct and indirect impact combined.

Data

We use the latest report titled "The Economic Impact of Travel" prepared by Dean Runyan Associates for the Colorado Tourism Office[3] to analyze tourism spending trends in Archuleta County and the Mountains & Mesas region, which is composed of Archuleta, Delta, Dolores, Garfield, Gunnison, Hinsdale, La Plata, Mesa, Montezuma, Montrose, Ouray, San Juan, and San Miguel counties.

In 2021, travel spending in the Mountains & Mesas region was an estimated $2.15 billion, and visitor spending by travelers staying in Hotel, Motel, and STRs was an estimated $1.4 billion. The report indicates that 28% of the 1.4 billion in visitor spending was accounted for by STR visitors ($392 million). Based on trends from lodging tax data by property type

[3] https://oedit.colorado.gov/sites/coedit/files/documents/Dean%20Runyan%20Associates_Colorado%20Economic%20Impact%20Report_2021.pdf

provided by the Town of Pagosa Springs, we estimate that the level of spending generated by STRs that accounts for new demand—not demand displaced from hotels— is 17% ($241 million) of visitor spending by travelers staying in Hotel, Motel, and STRs. These estimates at the regional level indicate that the percent of travel spending by STRs in the Mountains & Mesas region is 11.2%. Applying this share to total travel spending in Archuleta County—which was $129.8 million—an estimated $14.5 million in spending was generated by increased tourism activity generated by STRs in Archuleta County.

The report also provides data on the distribution of spending by commodity purchased by region. Applying the Mountains & Mesas region the distribution provides estimates of spending by category.

Estimates on spending by non-lodging category and their NACIS code[4] equivalents are shown in Figure A-2. We used these codes to match spending into IMPLAN's spending categories using IMPLAN's industry to NAICS crosswalk.

Figure A-2.
Archuleta County STR Spending by NAICS Industry

	Spending Category (IMPLAN Input)	NAICS Code
Spending (Input):	**$9,269,959**	-
Food Service	$3,576,052	72 - Accommodation and Food Services
Food Stores	$909,636	44-45 - Retail Trade
Local Transportation & Gas	$1,569,296	48-49 - Transportation and Warehousing
Arts, Entertainment, & Recreation	$1,590,128	71 - Arts, Entertainment, and Recreation
Retail Sales	$1,624,847	44-45 - Retail Trade

Source: Colorado Tourism Office, IMPLAN, Bureau of Labor Statistics, and Root Policy Research.

Results

Finally, after calibrating the spending to IMPLAN's categories, the employment contribution by industry is used to estimate the number of jobs supported by STR spending in Archuleta County. Figure A-3 shows IMPLAN's estimated employment impact by type of impact and by industry. An estimated 175 jobs are supported by STR visitor spending in Archuleta County.

[4] NAICS is the North American Industry Classification System and is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. Two digit NAICS codes are the highest level classification for industries while 6-digit NAICS codes are the most specific classification.