POLITICAL ECONOMY

IN THE CAROLINAS

THE SHORT-RUN IMPACTS OF THE COVID-19 RECESSION IN NC

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This paper investigates how the 2020 COVID-19-induced recession impacted tourism in North Carolina counties. We first document differences in how the pandemic developed across the state's counties and how the state-mandated shutdowns had disparate impacts on unemployment rates and economic activity, as reflected in sales tax revenue. We then empirically investigate how the twelve-month changes in unemployment rate and sales tax revenue were impacted by the concentration of employment in the retail and leisure-hospitality sectors. We further test whether tourism-popular counties were disparately impacted by the concentration of employment in the leisure-hospitality sector. The empirical results suggest that greater concentration of employment in the leisure-hospitality sector corresponded with increased unemployment but no statistically significant decrease in sales tax revenue in the early weeks of the 2020 recession. The results suggest that certain portions of the state might consider ways to make their local economies resilient to future shocks in the tourism sector; the 2020 recession started during a lull in tourism activity in North Carolina, but future shocks might occur during more active tourism seasons.

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I. INTRODUCTION

On January 9, 2020, the first death attributed to COVID-19 was reported in Wuhan, China. On January 20, 2020, the first reported cases of COVID-19 appeared in South Korea and the United States. By the end of January 2020, almost all countries had reported at least one case within their borders. The pandemic had begun and for the most part was felt in most major Northern Hemisphere countries (*American Journal of Managed Care* 2021).

On February 6, 2020, the US experienced its first COVID-19 death in Santa Clara County, California. By the end of February, an additional 37 countries had reported their first case, bringing the total number of countries with reported cases to 64. On March 14, the World Health Organization declared the rapidly spreading outbreak a pandemic, with a total of 114 countries then reporting cases. By that date the US had reported almost 2,800 cases with at least fifty-seven deaths (Silverman 2020); North Carolina had reported 23 cases and zero deaths. By the end of March, the North Carolina case count had reached 1,498 with eight deaths.

While there will likely be many studies on COVID-19's impact and the public and private actions to combat the pandemic, this paper focuses on its impact on economic activity within North Carolina, with a particular focus on the leisure and hospitality (LH) industry. Specifically, we empirically test whether twelve-month changes in unemployment and in sales tax revenue were disparately impacted by concentration of employment in the LH sector in tourism-popular counties.

This research question is important for the North Carolina counties because several sections of the state are very popular tourism destinations, including the Western mountains, the central piedmont, and the eastern coast. To the extent that the COVID-19-induced state-mandated shutdowns and limitations had a disparate impact on tourism-focused counties, counties might influence public policy.[1] To aid in economic development policy and organizing data collection, North Carolina's Department of Commerce has identified eight clusters of counties that share similar geographic and economic structures. These so-called Prosperity Zones help us identify the regions of the state that are more popular with tourists. We empirically test whether counties located in four Prosperity Zones with popular tourism destinations experienced disparate impacts on changes in unemployment and changes in sales tax revenue during the COVID-19-induced recession.

The empirical results suggest that counties with a greater concentration of employment in the LH sector experienced statistically significant declines in unemployment but no statistically significant change in sales tax revenues. The latter finding might not be as encouraging as it seems. Counties that are more tourism focused may have avoided a major decrease in tourism-related economic activity only because April is a natural lull in tourism activity. Future shocks to the state economy might occur during the fall

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1. In September 2021, confirmed COVID-19 cases were greater in number than in September 2020, which was before vaccines became available in December 2020 (North Carolina Department of Health and Human Services 2021a). While the state has not instituted restrictions as stringent as in spring 2020, it is entirely possible that if the pandemic persists, more restrictions will be imposed. To the extent that that outcome is likely, counties that are heavily dependent on tourism might want to seek short- and medium-term ways to make their local economies resilient to shocks to the tourism sector.

or winter (when the Western mountains are popular with tourists) or summer (when the northeastern and southeastern regions are popular). Major sporting leagues and sports series such as the NFL, the NBA, and NASCAR that typically offer many events in the Southwestern Prosperity Zone were either not in season or offered relatively few events during this period, and this might have limited the impact on taxable activity even as unemployment increased early in the 2020 recession.

II. COVID-19 IN NORTH CAROLINA

In North Carolina, the prevalence of COVID-19 has been quite uneven across counties. Table 1 ranks the top twenty and bottom twenty North Carolina counties by infection rates as of November 30, 2020 (*New York Times* 2020). The overall infection rate in the state was 33.74 cases per 1,000 persons. Sampson County's infection rate was the highest at 57.15 cases per 1,000 persons. However, despite its high case rate, Sampson County's death rate per case was below the state average. Mecklenburg County, the state's largest county by population, had the highest case count at 43,380. However, it had the thirty-third-highest case rate per 1,000 persons at 39.15. Wake County, the state's second-largest county by population (1,089,579), had the eighty-third-highest case rate among the one hundred North Carolina counties.

Table 2 presents the ranking of North Carolina counties by COVID-19 death rates as of November 30, 2020 (*New York Times* 2020). It lists the top twenty and bottom twenty counties by death rate. The North Carolina death rate was 1.46 percent of cases, and county death rates ranged from a high of

5.43 percent in Jones County to a low of 0.26 percent in Alleghany County.

III. THE IMPACT OF THE COVID-19 RECESSION ON EMPLOYMENT AND SALES TAX REVENUE IN NORTH CAROLINA

What North Carolina experienced during the first three quarters of 2020 was not much different from what the US economy experienced. Figure 1 presents US and North Carolina unemployment rates for 2020 (North Carolina Department of Commerce 2021a). Both the US and North Carolina started the year with unemployment rates at 3.6 percent. In April, after the mandatory shutdowns, the US unemployment rate rose to 14.7 percent while the North Carolina unemployment rate peaked at 12.9 percent. The North Carolina unemployment rate remained below the US rate through November 2020.

Figure 2 presents the April 2020 one-month job losses in the North Carolina economy by sector. The economy lost 571,500 jobs between March and April 2020. As with the US, the sector with the largest job loss was LH, which lost 245,300 jobs. Three other sectors saw significant job losses: educational and health services, down by 66,400 jobs; business and professional services, down by 53,400 jobs; and retail trade, down by 52,300 jobs. Together these four sectors accounted for 73.1 percent of the total jobs lost by the North Carolina economy in March and April 2020 (North Carolina Department of Commerce 2021a).

Figure 3 presents the change in county unemployment rates over the previous twelve months (North Carolina Department of Commerce 2021a). To make it easier to see the disparity in impacts across counties,

Table 1. North Carolina Counties Ranked by Infection Rate

RANK	COUNTY	POP	CASES	DEATHS	CASES/1,000	CASE DEATH RATE
	North Carolina	10,609,155	357,958	5,219	33.74	1.46%
1	Sampson	64,284	3,674	43	57.15	1.17%
2	Greene	21,050	1,195	25	56.77	2.09%
3	Robeson	131,056	7,394	110	56.42	1.49%
4	Duplin	59,736	3,367	62	56.36	1.84%
5	Scotland	35,732	1,955	39	54.71	1.99%
6	Avery	18,022	955	8	52.99	0.84%
7	Montgomery	27,666	1,399	41	50.57	2.93%
8	Wilson	82,282	4,041	81	49.11	2.00%
9	Columbus	56,290	2,754	71	48.93	2.58%
10	Edgecombe	52,586	2,543	71	48.36	2.79%
11	Stanley	63,727	2,968	78	46.57	2.63%
12	Nash	95,647	4,434	108	46.36	2.44%
13	Wayne	125,825	5,779	112	45.93	1.94%
14	Bertie	19,636	899	24	45.78	2.67%
15	Gaston	222,744	10,186	183	45.73	1.80%
16	Chowman	14,114	632	18	44.78	2.85%
17	Pitt	179,731	7,897	48	43.94	0.61%
18	Burke	91,810	3,965	64	43.19	1.61%
19	Catawba	159,494	6,886	87	43.17	1.26%
20	Cleveland	99,776	4,286	109	42.96	2.54%
81	Onslow	201,548	5,364	41	26.61	0.76%
82	Orange	147,093	3,889	62	26.44	1.59%
83	Wake	1,089,579	28,745	289	26.38	1.01%
84	Washington	12,071	315	8	26.10	2.54%
85	Macon	36,498	938	9	25.70	0.96%
86	Perquimans	13,639	345	4	25.30	1.16%
87	Stokes	46,420	1,164	16	25.08	1.37%
88	Person	40,370	982	11	24.32	1.12%
89	Carteret	71,163	1,728	14	24.28	0.81%
90	Clay	11,860	280	5	23.61	1.79%
91	Madison	22,602	525	17	23.23	3.24%
92	Polk	1,696	475	13	21.89	2.74%
93	Buncombe	264,056	5,612	140	21.25	2.49%
94	Brunswick	142,088	2,998	59	21.10	1.97%
95	Haywood	63,328	1,186	40	18.73	3.37%
96	Gates	12,132	217	6	17.89	2.76%
97	Dare	37,290	641	4	17.19	0.62%
98	Camden	10,611	182	4	17.15	2.20%
99	Transylvania	35,484	556	9	15.67	1.62%
100	Currituck	27,526	328	5	11.92	1.52%

Notes: Data sourced from the New York
Times. Calculations by the authors.

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Table 2. North Carolina Counties Ranked by Death Rate

RANK	COUNTY	POP	CASES	DEATHS	CASES/1,000	CASE DEATH RATE
	North Carolina	10,609,155	357,958	5,219	33.74	1.46%
1	Jones	10,196	276	15	27.07	5.43%
2	Hertford	24,037	986	41	41.02	4.16%
3	Graham	8,687	273	11	31.43	4.03%
4	Rutherford	68,908	2,445	85	35.48	3.48%
5	Haywood	63,328	1,186	40	18.73	3.37%
6	Madison	22,602	525	17	23.23	3.24%
7	Pasquotank	39,731	1,099	35	27.66	3.18%
8	Beaufort	47,480	1,709	54	35.99	3.16%
9	Vance	45,969	1,756	55	38.20	3.13%
10	Northampton	20,527	824	25	40.14	3.03%
11	Montgomery	27,666	1,399	41	50.57	2.93%
12	Chowan	14,114	632	18	44.78	2.85%
13	Edgecombe	52,586	2,543	71	48.36	2.79%
14	Gates	12,132	217	6	17.89	2.76%
15	Chatham	75,994	2,364	65	31.11	2.75%
16	Polk	12,696	475	13	21.89	2.74%
17	Hyde	5,181	185	5	35.71	2.70%
18	Bertie	19,636	899	24	45.78	2.67%
19	Stanly	63,727	2,968	78	46.57	2.63%
20	Columbus	56,290	2,754	71	48.93	2.58%
81	Union	237,287	7,802	73	32.88	0.94%
82	Yadkin	38,196	1,534	14	40.16	0.91%
83	Iredell	181,380	5,557	50	30.64	0.90%
84	Pender	63,406	1,898	17	29.93	0.90%
85	Avery	18,022	955	8	52.99	0.84%
86	Carteret	71,163	1,728	14	24.28	0.81%
87	Onslow	201,548	5,364	41	26.61	0.76%
88	New Hanover	235,560	6,961	53	29.55	0.76%
89	Pamlico	13,266	402	3	30.30	0.75%
90	Caswell	23,664	843	6	35.62	0.71%
91	Rockingham	91,788	3,092	22	33.69	0.71%
92	Dare	37,290	641	4	17.19	0.62%
93	Pitt	179,731	7,897	48	43.94	0.61%
94	Caldwell	83,417	3,552	21	42.58	0.59%
95	Lincoln	86,453	3,430	20	39.67	0.58%
96	Jackson	44,335	1,399	8	31.56	0.57%
97	Watauga	57,899	1,878	8	32.44	0.43%
98	Ashe	27,861	784	3	28.14	0.38%
99	Yancey	18,623	557	2	29.91	0.36%
100	Alleghany	11,466	390	1	34.01	0.26%

Notes: Data sourced from the New York
Times. Calculations by the authors.

we group the one hundred North Carolina counties into quintiles of twenty counties each, where the first quintile is the twenty counties with the smallest change in the twelve-month April 2020 unemployment rate.
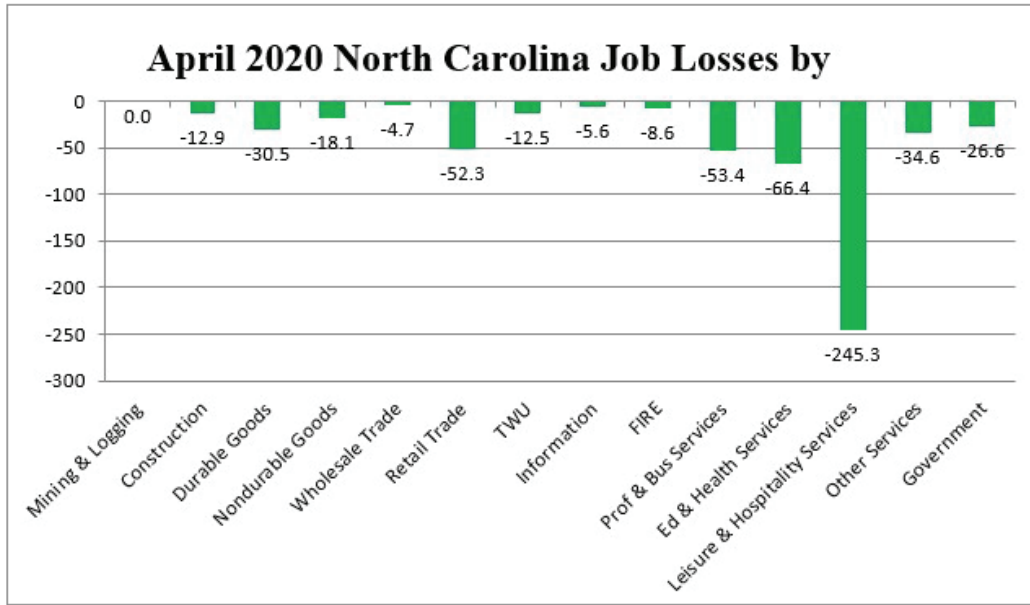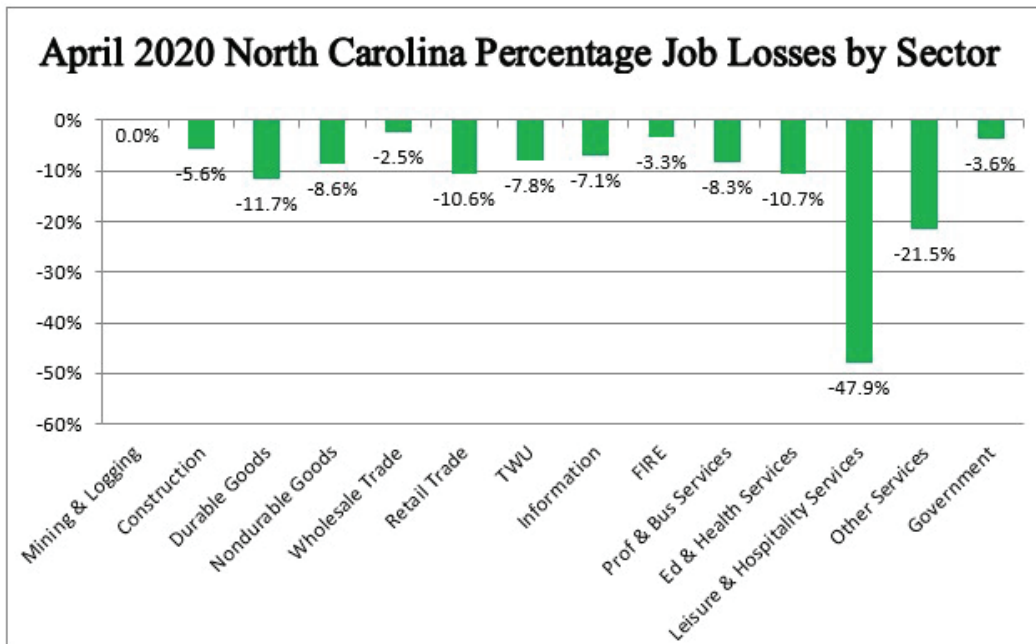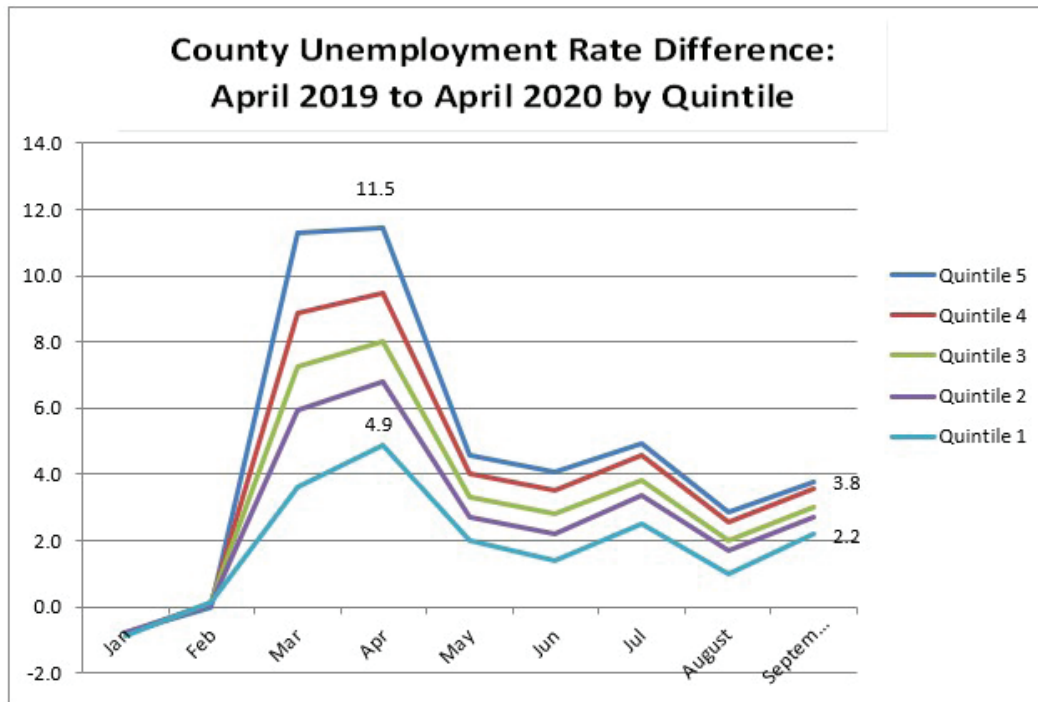
Figure 1

April 2020 North Carolina Job Losses by

Figure 2

April 2020 North Carolina Percentage Job Losses by Sector

Figure 3

The bottom twenty counties saw their twelve-month April 2020 unemployment rate change by 11.5 percentage points on average. The top twenty counties saw the rate change by an average of just 4.9 percentage points. By September 2020, much of the disparity had dissipated; however, the bottom twenty counties still had an average twelve-month September 2020 change in unemployment that was 73 percent higher than that of the top twenty counties.

In addition to localized differences in job losses, North Carolina's counties also suffered from disparate financial burdens. Figure 4 presents the monthly year-over-year percentage change in sales tax revenue for the five quintiles, where counties are sorted by the percentage change in sales tax revenue between April 2019 and April 2020. The upper quintile experienced increases in year-over-year sales tax revenue throughout 2020,

with the slowest growth occurring in May 2020. On the other hand, the bottom quintile experienced negative year-over-year sales tax growth from March through June 2020. On average, in April 2020 the bottom twenty counties saw a twelve-month percentage decline of 14.6 percent in April 2020 and a 15.6 percent decline in May 2020 compared with their collection levels in April and May 2019. On average, the bottom twenty counties experienced lower sales tax collection in April and May 2020 compared with the same months in 2019.

IV. AN ECONOMETRIC ANALYSIS OF NORTH CAROLINA COUNTIES

North Carolina has three distinct regions: the East (along the Atlantic Ocean), the central piedmont, and the Western mountains. Counties within these regions are rather similar in their geographic profiles but often differ in the structure

Figure 4
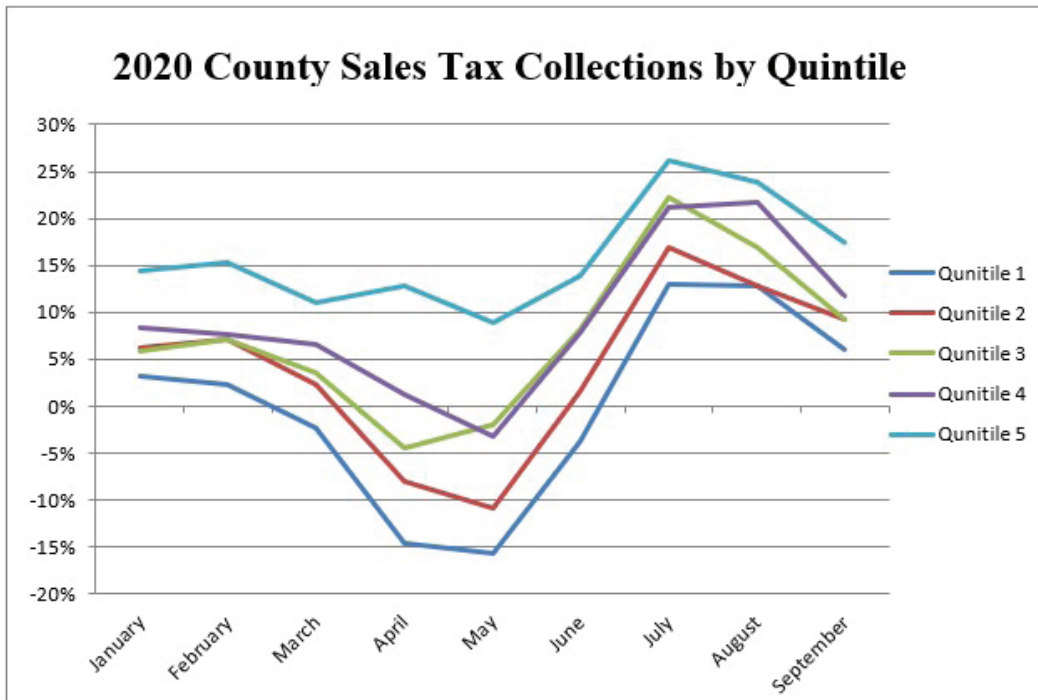
of their underlying economy, population centers, and, ultimately, how the COVID-19 pandemic evolved during 2020. Rather than arbitrarily sorting counties by our own criteria, we use the North Carolina Prosperity Zones that were developed by the North Carolina Department of Commerce. Each county is sorted into one of eight zones that help the state direct resources to a

"one stop" physical location for purposes of economic development, transportation, and interacting with the state government. The eight Prosperity Zones roughly align with the three-region taxonomy, but the zones are more granular. Figure 5 presents the Prosperity Zones (North Carolina Department of Commerce, 2001b), and table 1 lists the counties by Prosperity Zone.

Figure 5
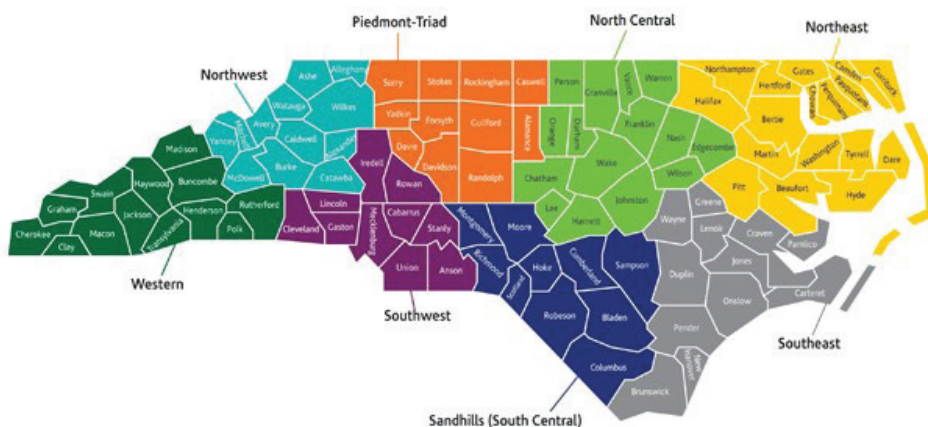
Our empirical specification is as follows:

$$DEP_i = \beta_0 + \beta_1 \ DENSITY_i + \beta_2 \ RETAIL_i + \beta_3 \ LH_i + \beta_4 \ LHxTOURISMZONE_i + \beta_5 \ COVIDCASES_i + \beta_6 \ COVIDDEATHS_i + + \emptyset ZONE_i + \sum_i.$$

DEP_i is either the twelve-month change unemployment rate or the twelve-month change in sales tax revenues from April 2019 to April 2020 for county i; the ß's and the vector Ø are the parameters to be estimated; and $\sum$ is a zero-mean error term.

The various control variables include population density (*DENSITY*), the percentage of the county's employment in the retail sector (RETAIL), the percentage of a county's employment in the LH sector (*LH*), the number of COVID-19 cases (*COVIDCASES*) and deaths (*COVIDDEATHS*) through November 2020, and a vector of indicator variables for the various Prosperity Zones (*ZONE*). We include the percentage employed in the retail and LH sectors because those were the two sectors that, anecdotally, were the hardest hit by the initial shutdowns. We include the number of COVID-19 cases and deaths through November 2020 to measure the intensity of the pandemic in each county before the first vaccines became available to the public in December 2020. Using data from the very beginning of the pandemic would not be ideal, as the number of cases was relatively low in April 2020 and therefore there was little variance across counties. Including COVID-19-related cases and deaths allows us to control for differences in pandemic intensity across North Carolina counties.

We identify four Prosperity Zones that contain popular tourism attractions: Western (with the North Carolina mountains and Asheville), Southwestern (with the Charlotte region and its professional sports teams, NASCAR events, and Charlotte-Douglas International Airport), and Southeastern and Northeastern (with the Outer Banks, Kitty Hawk, Wilmington, and other ocean attractions). We create an indicator variable *TOURISMZONE* that takes a value of 1 for these four Prosperity Zones and 0 otherwise. We interact this indicator variable with the share of unemployment in the LH sector to test for differences in how the recession influenced unemployment and sales tax revenues.

We expect the following to be true: The twelve-month change in a county's unemployment rate is positively related to population density, percentage of employment in retail, percentage of employment in LH, and COVID-19 cases and deaths. The impact of LH employment on the twelve-month change in county unemployment rate is greater in tourism-popular Prosperity Zones. The twelve-month change in a county's sales tax revenue is positively related to population density but, if the recession impacted retail and LH disproportionally, negatively related to the percentage of employment in those sectors. The twelve-month change in sales tax revenue is negatively related to COVID-19 cases and deaths. Finally, the impact of LH employment on the twelve-month change in county sales tax revenue is greater in tourism-popular Prosperity Zones.

Table 4 reports the descriptive statistics of the sample. On average, the twelve-month decrease in county unemployment rates was 8.12 percentage points with a standard deviation of 2.4, a minimum of 3.5 (Bertie and Chowan Counties), and a maximum of

Table 3. North Carolina Property Zones

WESTERN	NORTHWESTERN	SOUTHWESTERN	CENTRAL	NORTH CENTRAL	SOUTH CENTRAL	SOUTHEASTERN	NORTHEASTERN
Buncombe	Alexander	Anson	Alamance	Chatham	Bladen	Brunswick	Beaufort
Cherokee	Alleghany	Cabarrus	Caswell	Durham	Columbus	Carteret	Bertie
Clay	Ashe	Cleveland	Davidson	Edgecombe	Cumberland	Craven	Camden
Graham	Avery	Gaston	Davie	Franklin	Hoke	Duplin	Chowan
Haywood	Burke	Iredell	Forsyth	Granville	Montgomery	Greene	Currituck
Henderson	Caldwell	Lincoln	Guilford	Harnett	Moore	Jones	Dare
Jackson	Catawba	Mecklenburg	Randolph	Johnston	Richmond	Lenoir	Gates
Macon	McDowell	Rowan	Rockingham	Lee	Robeson	New Hanover	Halifax
Madison	Mitchell	Stanly	Stokes	Nash	Sampson	Onslow	Hertford
Polk	Watauga	Union	Surry	Orange	Scotland	Pamlico	Hyde
Rutherford	Wilkes		Yadkin	Person		Pender	Martin
Swain	Yancey			Vance		Wayne	Northampton
Transylvania				Wake			Pasquotank
				Warren			Perquimans
				Wilson			Pitt
							Tyrrell
							Washington

Notes: Data sourced from the North Carolina Department of Commerce.

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Table 4. Summary Statistics of the Data

VARIABLES	MEAN	ST. DEV.	MIN
ΔUNEMPLOYMENT	8.14	2.392	3.500
ΔSALES TAX ($m)	14.19	14.24	-14.71
DENSITY	210.9	302.8	8.535
LH	9.492	3.285	2.394
RETAIL	12.50	3.351	4.774
COVID CASES (100s)	36.50	56.79	1.400
COVID DEATHS (100s)	0.530	0.646	0.010
WESTERN ZONE	0.130	0.338	0
NORTHWEST ZONE	0.120	0.327	0
SOUTHWEST ZONE	0.100	0.302	0
PIEDMONT-TRIAD ZONE	0.110	0.314	0
SOUTH CENTRAL ZONE	0.100	0.302	0
NORTH CENTRAL ZONE	0.150	0.359	0
SOUTHEAST ZONE	0.120	0.327	0
NORTHEAST ZONE	0.170	0.378	0

Notes: ΔUNEMPLOYMENT and ΔSALESTAX measured as twelve-month changes in unemployment rate and monthly sales tax revenue from April 2019 through April 2020, respectively. DENSITY measures population per square mile. RETAIL and LH measure the percentage of a county's employment in the retail and leisure-hospitality sector, respectively, in 2020 as reported by the North Carolina Division of Employment Security. COVIDCASES and COVIDDEATHS are total COVID-19 cases and deaths through November 2020 as reported by the North Carolina Department of Health and Human Services.

15.3 (Swain County). On average, the twelve-month decrease in county sales tax revenue was $14.2 million with a standard deviation of $14.2 million, with a minimum of −$14.7 million (Jones County) and a maximum of $53.3 million (Perquimans County). On average, 12.5 percent of counties' employment was in the retail sector, with a standard deviation of 3.35, a minimum of 4.77 (Bertie County), and a maximum of 21.26 (Onslow County). On average, 9.5 percent of counties' employment was in the LH sector with a standard deviation of 3.3, a minimum of 2.4 percent (Northampton County), and a maximum of 20.8 percent (Dare County). On average, counties experienced 3,649 cases through November 2020 with a standard deviation of 5,679, a minimum of 140 (Tyrrell County), and a maximum of 43,689 (Mecklenburg County). On average, counties experienced approximately 53 deaths through November 2020 with a standard deviation of 64.5, a minimum of 1 death (Alleghany County), and a maximum of 456 deaths (Mecklenburg County).

Table 5 reports the estimation results for

the twelve-month change in unemployment rates, and table 5 reports the estimation results for the twelve-month change in sales tax revenue. In each table, we report standard OLS results in specification (1), Huber-White adjusted standard errors in specification (2), and standard errors clustered by Prosperity Zone in specification (3). These additional two specifications are included to see how sensitive the standard errors and statistical significance may be to alternative methods of calculating the standard errors. For specification (2), the White test for heteroscedasticity is reported.

Looking at the empirical results in table 5, the twelve-month change in unemployment rate is positively and statistically significantly related to population density. On average, a one–standard deviation increase in population density corresponds with a one-percentage-point increase in the twelve-month change in a county's unemployment rate. In contrast, the twelve-month change in unemployment rates is not statistically related to the percentage of a county's employment in either the retail or LH sector. The twelve-month change in a county's unemployment rate is negatively and statistically significantly related to COVID-19 cases but positively, if weakly, statistically significantly related to COVID-19-related deaths through November 2020. A one–standard deviation increase in COVID-19 cases corresponds with a decrease of 1.36 percentage points in the twelve-month change in unemployment rates, on average, whereas a one–standard deviation increase in COVID-19-related deaths corresponds with an increase of approximately 0.95 points, on average. The Prosperity Zones all have different intercept terms, suggesting that the pattern of changes in unemployment differed across the state. For instance, the Western Prosperity Zone saw an average twelve-month change in unemployment of 6.26 percentage points, ceteris paribus, whereas the Northeastern Prosperity Zone saw an average twelve-month change in the unemployment rate of 3.29, ceteris paribus. The OLS model has an R-squared of 0.985.

The parameter of interest is that on the interaction of *LH* and *TOURISMZONE*, which tests whether the four Prosperity Zones identified as the most popular for tourism experienced a disparate impact through the proportion of employment in the LH sector. The evidence suggests that, on average, counties in the Prosperity Zones with greater tourism experienced a greater increase in their twelve-month change in unemployment and the impact is statistically significant. Coupled with the lack of significance of the LH variable alone, this suggests that the counties where tourism is the most common experienced the greatest decreases in employment during the recession.

The White test for heteroscedasticity suggests that the Huber-White sandwich standard errors might be superior to the OLS standard errors. As can be seen, in general the statistical significance is not dramatically altered in specification (2) when compared with specification (1); only COVID-19-related deaths are weakly statistically significant in specification (2), whereas they are not statistically significant in specification (1). Specification (3) reports standard errors clustered at the Prosperity Zone level; they are close to those obtained in specification (2). Overall, the standard errors appear to be relatively stable across the different methods of calculation.

Table 5. Estimation Results Using 12-Month Change in County Unemployment

VARIABLES	(1) OLS	(2) HUBER-WHITE SANDWICH STANDARD ERRORS	(3) CLUSTERED STANDARD ERRORS
DENSITY	0.003* (0.002)	0.003*** (0.001)	0.003*** (0.001)
RETAIL	-0.010 (0.074)	-0.010 (0.094)	-0.010 (0.135)
LH	0.024 (0.116)	0.024 (0.092)	0.024 (0.130)
LH x TOURISMZONE	0.266** (0.132)	0.266* (0.156)	0.266* (0.137)
COVID CASES	-0.024* (0.014)	-0.024** (0.010)	-0.024* (0.010)
COVID DEATHS	1.432 (0.911)	1.432* (0.808)	1.432 (0.786)
WESTERN ZONE	6.265*** (1.136)	6.265*** (2.095)	6.265*** (1.370)
NORTHWEST ZONE	8.196*** (1.231)	8.196*** (1.196)	8.196*** (1.540)
SOUTHWEST ZONE	5.262*** (1.126)	5.262*** (1.525)	5.262*** (1.203)
PIEDMONT-TRIAD ZONE	8.737*** (1.261)	8.737*** (1.056)	8.737*** (1.469)
SOUTH CENTRAL ZONE	7.381*** (1.191)	7.381*** (1.156)	7.381*** (1.309)
NORTH CENTRAL ZONE	7.127*** (1.193)	7.127*** (1.117)	7.127*** (1.420)
SOUTHEAST ZONE	3.270*** (1.096)	3.270** (1.544)	3.270** (1.476)
NORTHEAST ZONE	3.299*** (0.952)	3.299*** (1.228)	3.299*** (1.353)
H0: No Heteroscedasticity		78.61***	

Notes: Dependent variable is the twelve-month change in county unemployment rate from April 2019 to April 2020. LH is the percentage of a county's employment in the leisure-hospitality sector. *TOURISMZONE* is an indicator variable for a county being in a Prosperity Zone that contains popular tourism destinations: Western, Southwestern, Southeastern, or Northeastern. Each Prosperity Zone indicator variable is a separate intercept term for that zone. Each specification contains one hundred observations and has an R-squared of 0.958. Specification (1) assumes spherical error terms, specification (2) uses Huber-White sandwich standard errors. Specification (3) uses standard errors clustered by Prosperity Zone. Specifications (2) and (3) are included to demonstrate the sensitivity of standard errors and statistical significance. Standard errors reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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Repeating this process using the empirical results in table 6, greater population density is negatively related to the change in sales tax revenue. Higher measures of employment in the retail and LH sectors are not statistically related to changes in sales tax revenue. While COVID-19 cases are not statistically related to changes in sales tax revenue, COVID-19-related deaths are negatively and statistically related to changes in sales tax revenue. Every hundred COVID-19-related deaths correspond with a decrease in sales tax revenue of approximately $11 million. This suggests that counties where the pandemic hit hardest experienced greater decreases in sales tax revenue during the recession. This is consistent with the intuition that the greater the impact of the pandemic, the greater the individual response. The individual Prosperity Zones did not differ so dramatically in the revenue effect as they did in the model using twelve-month change in unemployment rate. The OLS model has an R-squared of 0.685.

As before, the parameter of interest is the interaction of *LH* and *TOURISMZONE*, which tests whether counties in the Prosperity Zones with heavy tourism experienced greater twelve-month changes in sales tax revenue. The results suggest that there was no statistically significant difference between counties that are in tourism-popular Prosperity Zones and those that are not. This might be consistent with April not being the most active month for tourism, especially on the coast. Thus, while firms may have shed jobs in the tourism-popular Prosperity Zones, there may have been a nominal impact on sales tax revenues. Future research could focus on whether this impact changed over

the 2020 and 2021 tourist seasons—summer for the ocean region and fall and winter for the mountain region.

Unlike in the case of county unemployment, when investigating sales tax revenues there does not appear to be any heteroscedasticity, as evidenced by the statistically insignificant White test for heteroscedasticity. This, in turn, is reflected in standard errors in specification (2) that are not that different from those in specification (1). Specification (3) reports standard errors that are clustered at the Prosperity Zone level; they are close to those obtained in specifications (1) and (2). Overall, the standard errors appear to be relatively stable across the different methods of calculation.

V. CONCLUSIONS

This paper studied the impact of the COVID-19 pandemic and the subsequent government-induced recession that the national and state economies experienced from March through December 2020. The incidences of COVID-19 cases, hospitalizations, and deaths were not evenly distributed across the counties in North Carolina, and this corresponds with a disparate impact of COVID-19-induced mandates about essential businesses, school closings, and limited indoor and outdoor gatherings as measured by county unemployment rates and county sales tax revenues.

We estimated two econometric models that relate the year-over-year change in county unemployment rate and the year-over-year change in sales tax revenue from April 2019 to April 2020. We related these two measures of economic activity to population density in the county, the percentage of employment in the county's retail sector and LH sector, COVID-19

Table 6. Estimation Results Using 12-Month Change in County Sales Tax

VARIABLES	(1) OLS	(2) HUBER-WHITE SANDWICH STANDARD ERRORS	(3) CLUSTERED STANDARD ERRORS
DENSITY	-0.021* (0.012)	-0.021** (0.009)	-0.021** (0.008)
RETAIL	-0.298 (0.500)	-0.298 (0.667)	-0.298 (0.558)
LH	-0.965 (0.783)	-0.965 (0.712)	-0.965* (0.495)
LH x TOURISMZONE	0.559 (0.892)	0.559 (0.997)	0.559 (0.439)
COVID CASES	0.116 (0.092)	0.116 (0.070)	0.116 (0.067)
COVID DEATHS	-11.215* (6.142)	-11.215** (5.041)	-11.215* (5.791)
WESTERN ZONE	29.633*** (7.662)	29.633*** (8.484)	29.633*** (5.138)
NORTHWEST ZONE	32.393*** (8.297)	32.393*** (8.498)	32.393*** (5.326)
SOUTHWEST ZONE	33.230*** (7.589)	33.230*** (7.707)	33.230*** (6.283)
PIEDMONT- TRIAD ZONE	32.378*** (8.504)	32.378*** (7.717)	32.378*** (5.319)
SOUTH CENTRAL ZONE	32.434*** (8.033)	32.434*** (9.516)	32.434*** (5.420)
NORTH CENTRAL ZONE	38.652*** (8.044)	38.652*** (7.859)	38.652*** (5.555)
SOUTHEAST ZONE	18.229** (7.388)	18.229** (9.213)	18.229** (5.475)
NORTHEAST ZONE	25.754*** (6.416)	25.754*** (8.345)	25.754*** (4.989)
H0: No Heteroscedasticity		66.20	

Notes: Dependent variable is the twelve-month change in county unemployment rate from April 2019 to April 2020. LH is the percentage of a county's employment in the leisure-hospitality sector. *TOURISMZONE* is an indicator variable for a county being in a Prosperity Zone that contains popular tourism destinations: Western, Southwestern, Southeastern, or Northeastern. Each Prosperity Zone indicator variable represents a separate intercept term for that zone. Each specification contains one hundred observations and has an R-squared of 0.658. Specification (1) assumes spherical error terms, specification (2) uses Huber-White sandwich standard errors. Specification (3) clusters the standard errors by Prosperity Zone. Specifications (2) and (3) are included to demonstrate the sensitivity of standard errors and statistical significance. Standard errors reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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cases and related deaths in the county through November 2020, and identifiers for the Prosperity Zone of each county.

The evidence suggests that greater employment concentration in LH contributed to an increase in the year-over-year change in unemployment but not in the year-over-year change in sales tax revenue. Population density contributed to an increase in year-over-year change in unemployment and a decrease in year-over-year sales tax revenues. COVID-19 cases were negatively related to changes in unemployment and positively, though not statistically significantly, related to changes in sales tax revenue. In contrast, COVID-19-related deaths were positively, if not statistically significantly, related to changes in unemployment but negatively and statistically significantly related to changes in sales tax revenue. Finally, we found larger differences in average changes in unemployment rates across the eight Prosperity Zones in North Carolina than in average sales tax revenues.

While we do not draw any immediate policy conclusions from our econometric results, Connaughton and Depken (2021) do offer some policy suggestions to consider as the recovery from the recession continues. Primarily, given the empirical evidence that unemployment is especially sensitive to mandated closures in the LH sector, counties might consider strategies to make this sector more robust to any future or ongoing state-mandated closures and perhaps pivot away from dependence on this sector for employment and sales tax revenue. Such policies might also be prudent because the 2020 recession began before the heavy tourism seasons for the four Prosperity Zones modeled here. Future shocks to the tourism sector through COVID-19-related policy changes might occur during popular tourism seasons, potentially leading to greater decreases in employment in the LH sector and a more significant decrease in sales tax revenues.

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