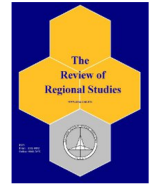




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# Labor Market Hollowing-Out in North Carolina: Measurement and Analysis\*

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**Abstract:** Hollowing-out of the labor force, meaning the relative decline in middle-paying jobs combined with the relative rise in both high-paying and low-paying jobs, has been a phenomenon observed and analyzed at the national level. This paper extends that work by analyzing job shifts in 46 regions of North Carolina during the 21<sup>st</sup> century. From 2001 to 2015, hollowing-out occurred in all but one of the regions, but to different degrees. An empirical analysis shows the relative decline of middle-paying jobs was stronger in regions with a larger share of employment in manufacturing and construction and in regions with slower population growth.

*Keywords:* labor market, income inequality, middle class

*JEL Codes:* I24, I31, J21

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## 1. INTRODUCTION

A popular term to describe changes in the U.S. labor market in recent decades is hollowing-out. The term refers to the relative reduction in middle-paying jobs compared to both high-paying and low-paying jobs (Alichi, 2016; Alichi et al., 2016). Hollowing-out of the labor market has been directly linked to the relative decline in the size of the nation's middle class and the rise in income inequality (Davidson, 2014).

Researchers have examined potential economic, social, political, and physical and psychological implications of this phenomenon (Madland, 2015). Economists and sociologists worry that a relative lack of middle-income jobs make the climb out of low-paying jobs and, in many cases, the climb out of poverty more difficult (Page, 2014). Researchers also argue that a strong middle-class contributes to stable spending in the economy which moderates the business cycle (Boushey and Hersh, 2012). Some political scientists see a linkage between hollowing-out and the splintering of the electorate, thereby resulting in a lack of political

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compromise, a stalemate in public decision-making, and even a threat to our form of government (McCarty et al., 2016; Sitaraman, 2017). Other analysts have found a correlation between hollowing-out and social issues like teenage pregnancies, obesity, drug use, high school dropouts, and lower life expectancies (Wilkinson and Pickett, 2009; Payne, 2017).

While labor market hollowing-out has been extensively examined for the national economy, little research on the topic has been done for state and local economies. A Pew Research Center study analyzed hollowing-out in U.S. metropolitan areas (Kochhar et al., 2016). Yet an examination of hollowing-out for sub-national economies could allow additional questions about the trend to be studied. Among these questions are the degree to which hollowing-out varies among geographical areas, whether patterns of hollowing-out are identifiable among geographical regions, and if factors related to the variation in hollowing-out can be identified. State and local policymakers can then be more aware about the meaning and measures of hollowing-out in local geographic regions as they consider policies for confronting the trend.

The purpose of this paper is to present the results of a study describing and examining labor market hollowing-out in the economic regions of one state, North Carolina, and to use these results to inform researchers and policymakers about the extent, relationships, and possible solutions to the labor market change. North Carolina is a suitable state for examining hollowing-out because it includes a range of development patterns, each of which can be found in numerous states. The state includes rapidly expanding metropolitan areas, struggling traditional small towns, and depopulating rural regions. Its economy has been dramatically transformed by the forces of the late 20<sup>th</sup> and early 21<sup>st</sup> centuries. In particular, the technology revolution and globalization have favored metropolitan regions but harmed many small towns and rural areas. Likewise, those same forces have created or expanded several economic sectors (technology, information, health care) but also decimated other sectors (textiles, apparel, furniture) in the state (Walden, 2008, 2017). An in-depth study of labor market hollowing-out in one state will enhance our understanding of a trend that can be argued to be the defining labor market feature of recent decades.

The key conclusion of the research is that hollowing-out has been pervasive in the regions of North Carolina, occurring in 45 of the state's 46 regions between 2000 and 2015. Even the fast-growing, dynamic regions of Charlotte and Raleigh have seen a relative shrinking of middle-pay workers. The slowest growth of middle-paying jobs occurred in regions with lower rates of population growth and with higher initial percentages of employment in the manufacturing and construction sectors. Regions with higher rates of population growth and higher initial percentages of employment in the manufacturing, construction, and information sectors were associated with faster growth of low-paying jobs. Regions with higher proportions of the adult population with a college degree were most closely linked to larger increases in high-paying employees.

The remainder of the paper is presented in five parts. Following the introduction, previous work on the topic of hollowing-out is reviewed. Next, a methodology section discusses the data used to measure hollowing-out, outlines the specific measures of hollowing-out, and identifies the regions in North Carolina for which hollowing-out is measured. The third section presents the results using the data to develop hollowing-out measures for the regions and then examines geographic characteristics of the findings. Section four gives the estimates of an empirical model designed to find structural factors associated with differing levels of

hollowing-out. The final section offers conclusions and implications for the prospects of further hollowing-out and for policies to address the labor market trend.

## 2. PREVIOUS WORK ON HOLLOWING-OUT

As the economy has transformed in recent decades by innovations in technology, automation, and the globalization of trade, the issue of the hollowing-out of the labor force and its impact on income inequality have received considerable attention from numerous perspectives. One set of studies examines the forces behind the labor market impact. The research of Autor (2014); Autor et al. (2013, 2015, 2016) have shown how automation and the reduction of international trade barriers have combined to reduce or remove from lower-wage countries routine-tasks jobs in the manufacturing and associated sectors that have typically paid middle-level wages. Additionally, Baily and Bosworth (2013) documented how the relative contraction of the construction sector following the Great Recession also reduced traditional middle-paying construction jobs. Concurrently, the expansion of cognitively focused occupations in the information and research-based sectors has expanded higher wage positions (Autor et al., 2003). Also, the increased spending on leisure activities and personal services by time-pressed households increased employment in these industries that typically pay low wages (Autor and Dorn, 2013).

A second group of studies directly measures hollowing-out, usually by calculating changes in the relative size of the middle class using a variety of definitions and measures. Florida (2016) calculated a reduction in the size of the middle class from 55 percent to 51 percent of households in metropolitan areas between 2000 and 2014. Over the same time period, Kochhar et al. (2016) found a shrinking share of adults living in middle-class households in 203 of 229 metropolitan regions. Between 2007 and 2012 Reardon and Bischoff (2016) estimated the portion of families living in middle-class neighborhoods dropped from 65 percent to 40 percent. Over a longer period of time (1979 to 2007), Boushey and Hersh (2012) showed the percentage of households in the middle three income quintiles shrunk from 50 percent to 43 percent. During a comparable time period, Pressman calibrated a nine percentage point drop (from 60 percent to 51 percent) in the share of households defined as middle class.

Studies linking labor market hollowing-out to rising income inequality and measuring the extent of the increasing concentration of income among higher-paid households constitute a third category of studies. Autor et al. (2006) argue skills-based technical change favoring college educated workers has driven the increased concentration of income among high wage workers. At the same time, the increase in the automation of routine factory tasks and the impact of globalization on the loss of middle wage manufacturing jobs have been major contributors to the reduction of aggregate middle wage incomes (Feenstra and Hanson, 2003). These explanations are consistent with empirical findings of a significant rise in income inequality in the U.S. in recent decades (Noah, 2013).

The fourth category of studies focuses on broad impacts of hollowing-out and the related rise in income inequality. Goodhart (2017) ties the rise of populism in politics and elections to the relative reduction in middle paying jobs and the increased dichotomy of the labor force. Caplan (2018) sees the increased motivation of young people to attend college, even if they have limited academic interest and talent, driven by a belief that there are only two

economic options: being rich or being poor. Even community and technical colleges are being increasingly used by students as a stepping stone to four-year colleges rather than for training in a trade or technical field (Jenkins and Fink, 2015). Krueger (2012) identified a link between income inequality and reduced social mobility. Kraus and Park (2014) found a relationship between higher levels of income inequality and lower self-esteem of individuals in lower economic classes. Last, Fry and Taylor (2012) suggests the upper and lower class polarization generated by hollowing-out has created complementary residential and social segregation, while Carr and Kefalas (2009) see it as creating a flight of the most capable households from rural regions.

While extensive, the existing literature on hollowing-out from various disciplines and perspectives omits some key aspects of the phenomenon. One is to compare the extent of hollowing-out in regional categories. While hollowing-out has been measured for metropolitan regions, there is a lack of attention of the trend for smaller regions, such as micropolitan and rural areas. Another omission is examining linkages of hollowing-out to changes in specific economic sectors, such as manufacturing, construction, and information technology. Doing so would assist policymakers in better understanding the structural forces associated with hollowing-out and possible policies for addressing the issue. The third gap in the literature is a failure to associate measures of hollowing-out to broader socio-economic factors, such as educational attainment levels and population change, with the objective of better understanding how and why the labor market trend varies across regions. A goal of this paper is to include these three omitted elements of past research in the analysis of hollowing-out in North Carolina.

### 3. METHODOLOGY OF MEASURING HOLLOWING-OUT

The initial steps in conducting a study of hollowing-out is to select a data set and measure. The U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) is the source of data used to construct annual data for categories of employment based on worker pay. This data set is preferred for two reasons. First, unlike most other geographically-based labor market information, it has a 95 percent coverage rate of all jobs. This is the most complete coverage of employment available from any data set. Second, QCEW is available at the state, county, metropolitan regional, and micropolitan regional levels (US Census, 2017b). At the time of the analysis, data were available for the years 2001 to 2015 using consistent economic sector classifications.

QCEW data are only subdivided by economic sector classification. This means that the incomes used to categorize workers into high-paying, middle-paying, and low-paying jobs are based on economic sector averages. There is precedent for such a classification, as Barany and Siegel (2018) found similar trends in hollowing-out when using income averages for occupations or for economic sectors. Also, a benefit of using the sector definitions is the ability to identify economic sectors related to hollowing-out, which can aid policymakers in addressing its impacts. However, a disadvantage of the data is the mixing of various occupations in the income averages of the economic sectors. Unfortunately, county level data with occupational information and with the same comprehensive coverage of jobs as the QCEW are not available.

Employment is grouped into three categories, high-pay, middle-pay, and low-pay, using the average annual salary in economic sectors in 2001. High-pay employment is in the management, professional and technical services, financial services, and information economic sectors. Middle-pay jobs include positions in the construction, manufacturing, education and health care, wholesale trade and transportation, and public administration sectors. Low-pay jobs are employment in natural resources, administrative services, leisure and hospitality, retail trade, and other services sectors. Average annual earnings in high-pay jobs is above \$76,575 and average annual earnings in low-pay jobs is below \$34,705. These cutoffs imply a middle-pay annual earnings range of above \$34,705 and below \$76,575. This range captures the earnings of approximately 41 percent of workers in the middle of the earnings distribution in 2015 (US Census, 2017a). This is a share consistent with the middle class definitions from Boushey and Hersh (2012) and Reardon and Bischoff (2016).

To examine regional differences in employment composition in North Carolina, the U.S. Census Bureau's latest (2015) definitions of metropolitan, micropolitan, and rural regions are used. A metropolitan region is a collection of economically and socially interrelated counties with an urban core (city) of 50,000 or more population. A micropolitan region is a collection of economically and socially interrelated counties with an urban core (city) of at least 10,000 but less than 50,000 population (US Census, 2017b). For purposes of this study, counties meeting neither of these conditions are termed rural. Where metropolitan areas cross state lines, only the North Carolina component counties are used in the analysis. Counties in metropolitan and micropolitan regions are contiguous. Rural counties can be contiguous or non-contiguous, although in the latter case, the counties are in the same broader geographic areas of the state. Using these definitions, there are a total of 46 metropolitan, micropolitan, and rural regions in the state. Table 1 lists the member counties of each region.

Two measures of hollowing-out are developed for the analysis. The first calculates percentage changes in employment between 2001 and 2015 in each of the three pay categories for the North Carolina regions. The second measure reports the change in the percentage point share of the three pay categories between 2001 and 2015. The sum of the percentage point changes equals zero for each region.

#### 4. RESULTS FOR HOLLOWING-OUT MEASURES

Table 2 shows the results for the two hollowing-out measures for the nation, North Carolina, and the 46 North Carolina regions. There are major differences between the job category changes in the nation and in North Carolina. The percentage changes are expected to be larger for North Carolina due to the state's more rapid growth during this period.<sup>1</sup>

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<sup>1</sup>Between 2001 and 2015, North Carolina's population grew 22.5 percent compared to 12.6 percent for the nation (U.S. Bureau of the Census, 2017b), the state's nonfarm employment increased 11.8 percent versus 9.2 percent in the nation (U.S. Bureau of Labor Statistics, 2017b), and North Carolina's real GDP rose 27.2 percent while the nation's real GDP increased 26.4 percent (U.S. Bureau of Economic Analysis, 2017a).

**Table 1:** North Carolina Regions and Member Counties

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A. Metro Regions	
Asheville:	Buncombe, Haywood, Henderson, Madison
Boone:	Watauga
Brunswick:	Brunswick
Burlington:	Alamance
Charlotte:	Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Union
Currituck-Gates:	Currituck, Gates
Durham:	Chatham, Durham, Orange, Person
Fayetteville:	Cumberland, Hoke
Greensboro:	Guilford, Randolph, Rockingham
Greenville:	Pitt
Hickory:	Alexander, Burke, Caldwell, Catawba
Jacksonville:	Onslow
Raleigh:	Franklin, Johnston, Wake
Rocky Mount:	Edgecombe, Nash
Wilmington:	New Hanover, Pender
Winston-Salem:	Davidson, Davie, Forsyth, Stokes, Yadkin
B. Micro Regions	
Albemarle:	Stanly
Brevard:	Transylvania
Cullowhee:	Jackson
Dunn:	Harnett
Elizabeth City:	Camden, Pasquotank, Perquimans
Forest City:	Rutherford
Goldsboro:	Wayne
Henderson:	Vance
Kill Devil Hills:	Dare, Tyrell
Kinston:	Lenoir
Laurinburg:	Scotland
Lumberton:	Robeson
Marion:	McDowell
Morehead City:	Carteret
Mt. Airy:	Surry
New Bern:	Craven, Jones, Pamlico
N. Wilkesboro:	Wilkes
Oxford:	Granville
Pinehurst:	Moore
Roanoke Rapids:	Halifax, Northampton
Rockingham:	Richmond
Sanford:	Lee
Shelby:	Cleveland
Washington:	Beaufort

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Wilson: Wilson
C. Rural Regions
Downeast: Bladen, Columbus, Duplin, Sampson
Mountain: Alleghany, Ashe, Avery, Mitchell, Yancey
Northeast: Bertie, Chowan, Greene, Hertford, Hyde, Martin, Washington
Piedmont: Anson, Caswell, Montgomery, Warren
West: Cherokee, Clay, Graham, Macon, Polk, Swain

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These differences between the nation and North Carolina continue when measured by percentage point changes in the job category shares. For each of the three categories the percentage point changes were much larger, in absolute value, for the state than for the nation. Although hollowing-out did occur for the nation with a 1.2 percentage point drop in the middle-pay category, the reduction was six-times larger on a percentage point basis in North Carolina.

The remainder of Table 2 gives the labor market changes for North Carolina regions (in alphabetical order for each regional category). Looking first at the percentage change in each of the three pay categories (columns 4, 5, and 6), although a large majority (34 of 46 regions) had, like the state, a decline in middle-pay jobs, there are some differences. Fifteen of the 34 regions had a pattern like that of the state with a decline in middle-pay jobs coupled with an increase in both high-pay and low-pay jobs. Twelve regions, however, matched the decline in middle-pay jobs with a decline in high-pay jobs, three regions paired the decline in middle-pay jobs with a decline in low-pay jobs, and four regions experienced a decline in all three pay categories. Of the 12 regions that had an increase in middle-pay jobs, ten of them were regions with gains in all three pay categories. Among these ten regions, the percentage gain in middle-pay jobs was the smallest in all but one region (Currituck-Gates). One region (Kinston) demonstrated reverse hollowing-out with gains in middle-pay jobs (primarily in manufacturing) and declines in both high-pay and low-pay jobs. The remaining region (Morehead City) had gains in middle-pay and low-pay jobs but a decline in high-pay jobs.

Columns 7, 8, and 9 of Table 2 remove the effects of the quantity of job changes by depicting the results as shifts in the percentage point shares of each of the three job categories of total jobs between 2001 and 2015.<sup>2</sup> All but two regions (44 of 46) had declines in the percentage point share of middle-pay jobs, with the exceptions being Kinston and Roanoke Rapids. Roanoke Rapids is a declining region with job losses in all pay categories. Only Kinston - the region with the reverse hollowing-out of a gain in middle-pay jobs combined with declines in high-pay and low-pay jobs - could be said to be a region that went against

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<sup>2</sup>Note that in all cases the direction of change in the share percentage point change (columns 7, 8, and 9) may not be the same as the direction of shift in the percentage change of the job totals (columns 4, 5, and 6). A category can gain jobs and thus register a percentage increase in jobs. However, if one or both of the other categories experience larger job gains, the category can decline in its share of total jobs. Likewise, a category can lose jobs and have a percentage decline in jobs, but if the job loss in one or both of the other categories is sufficiently greater, the category can gain in its share of total jobs.

**Table 2: Labor Market Hollowing-Out Measures in North Carolina Regions, 2001-2015 (HP= high-pay jobs, MP=middle-pay jobs, LP=low-pay jobs)**

Region	Type	2010 Population	Percentage Change in Job Total			Share Percentage Point Change		
			HP	MP	LP	HP	MP	LP
U.S.	nation	308,745,539	7.50	5.60	12.50	-0.1	-1.2	1.3
N.C.	state	9,535,483	25.20	-4.80	29.40	1.9	-7.3	5.4
Asheville	metro	424,858	31.90	3.50	24.50	1.3	-4.9	3.6
Boone	metro	51,079	10.50	-5.30	7.90	0.8	-3.2	2.4
Brunswick <sup>a</sup>	metro	107,431	16.00	12.30	61.50	-1.2	-7.3	8.5
Burlington	metro	151,131	-47.90	-12.80	15.30	-5.2	-2.8	8.0
Charlotte <sup>a</sup>	metro	1,881,147	39.00	3.00	43.60	2.5	-7.9	5.4
Currituck-Gates <sup>a</sup>	metro	35,744	33.30	36.40	60.90	-1.1	-3.1	4.2
Durham	metro	506,764	21.60	14.00	18.40	0.8	-1.2	0.4
Fayetteville	metro	366,383	2.00	1.10	17.50	-0.6	-3.0	3.6
Greensboro	metro	723,801	-3.10	-10.30	14.10	-0.1	-4.8	4.9
Greenville	metro	168,148	16.70	-8.10	8.00	1.5	-4.4	2.9
Hickory	metro	365,497	4.40	-29.80	2.00	1.7	-8.5	6.8
Jacksonville	metro	177,772	30.00	2.70	32.70	0.7	-5.6	4.9
Raleigh	metro	1,130,490	40.50	26.30	95.30	-1.8	-7.9	9.7
Rocky Mount	metro	152,398	-6.30	-20.00	-4.10	0.9	-4.3	3.4
Wilmington	metro	254,884	45.50	7.20	31.70	2.3	-5.7	3.4
Winston-Salem	metro	640,595	15.60	-10.90	17.70	2.4	-6.8	4.4
Albemarle	micro	60,585	22.20	-20.80	23.50	1.5	-10.3	8.8
Brevard	micro	33,090	16.70	-25.90	3.20	2.3	-8.7	6.4
Cullowhee	micro	40,271	-12.50	-7.80	8.70	-0.9	-3.4	4.3
Dunn	micro	114,678	-5.30	-7.70	44.60	-0.9	-8.5	9.4
Elizabeth City	micro	64,094	27.30	-0.90	9.50	1.3	-3.0	1.7
Forest City	micro	67,810	54.50	-43.40	3.60	5.5	-15.8	10.3
Goldsboro	micro	122,623	11.10	-6.10	-5.00	1.1	-0.9	-0.2
Henderson	micro	45,422	62.50	-19.00	-26.20	4.5	-0.9	-3.6
Kill Devil Hills	micro	38,327	25.00	3.30	14.80	1.8	-2.8	1.0
Kinston	micro	59,495	-20.0	3.70	-8.90	-1.4	3.5	-2.1
Laurinburg	micro	36,157	-37.50	-42.40	-26.90	0.1	-5.1	5.0
Lumberton	micro	134,168	-4.80	-4.10	14.90	-0.3	-3.4	3.7
Marion	micro	44,996	0.10	-15.30	48.40	0.1	-10.2	10.1
Morehead City	micro	66,469	-5.00	1.10	11.50	-0.9	-1.8	2.7
Mt. Airy	micro	73,673	25.00	-34.70	11.40	2.6	-12.7	10.1
New Bern	micro	126,802	-6.10	-7.30	15.80	-0.4	-4.3	4.7
N. Wilkesboro	micro	69,340	-26.20	-22.70	-12.10	-1.2	-1.5	2.7
Oxford	micro	57,529	-20.00	-2.60	41.40	-0.8	-5.8	6.6
Pinehurst	micro	88,247	33.30	-1.20	10.10	1.8	-3.5	1.7
Roanoke Rapids	micro	76,790	-16.70	-7.90	-7.40	-0.5	0.2	0.3

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Region	Type	2010 Population	Percentage Change in Job Total			Share Percentage Point Change		
			HP	MP	LP	HP	MP	LP
Rockingham	micro	46,639	-40.00	-25.00	2.60	-1.6	-4.9	6.5
Sanford	micro	57,866	-20.00	-17.10	14.70	-0.7	-6.1	6.8
Shelby	micro	98,078	-15.80	-10.30	10.50	-0.6	-3.6	4.2
Washington	micro	47,759	-8.30	-18.30	14.30	-0.1	-7.0	7.1
Wilson	micro	81,234	5.10	-9.90	2.00	1.1	-3.1	2
Downeast	rural	215,224	16.20	-5.70	-2.80	1.1	-1.4	0.3
Mountain	rural	89,630	0.10	-30.00	11.50	0.9	-10.9	10
Northeast	rural	125,649	-16.70	-17.80	1.00	-0.2	-4.0	4.2
Piedmont	rural	99,437	0.10	-24.30	1.80	0.9	-6.2	5.3
West	rural	115,305	26.50	-13.00	15.80	2.1	-7.2	5.1

<sup>a</sup> only North Carolina portion of region included  
the hollowing-out trend.

It is also informative to examine the performance of particular North Carolina regions with national notoriety. Charlotte and Raleigh have been the state's fastest growing regions accompanying a national recognition in technology (Raleigh with the Research Triangle Park) and financial services (Charlotte with a concentration in banking). Although both regions experienced job growth in all of the three pay categories, hollowing-out still occurred as shown by the much faster growth in the high-pay and low-pay categories compared to the middle-pay category. This is clearly seen in the shifts in the share changes where middle-pay jobs lost almost eight percentage points in both metropolitan regions. The very rapid growth in low-pay jobs in Raleigh even caused a drop in the high-pay category's share of total jobs, despite a gain of 40 percent in high-pay employment during the 2001-2015 period.

To investigate if there are noticeable differences in hollowing-out between the three geographic classifications, Table 3 gives the results for the two hollowing-out measures averaged for the regions in each of the three geographic classifications.<sup>3</sup> Looking first at the results for the percentage changes in job totals, it is clear that each of the regions shows a pattern of hollowing-out. Hollowing-out occurs either on a relative basis in the metro region where job growth is substantially higher for the high-pay and low-pay categories compared to the middle-pay category, or on an absolute basis in the micro and rural regions where job growth is negative for the middle-pay category and positive for the high-pay and low-pay categories. The higher growth percentages for the metro region compared to the micro and rural regions also demonstrates the growth gap in North Carolina between the metropolitan areas and small town (micro) and rural areas.

Examining the changes in each pay category's share of total jobs reveals large similarity between the regions. The middle-pay category lost share in all regions, with the loss ranging from 4.9 percentage points to 5.9 percentage points. Each region experienced a gain in the low-pay share of total jobs, with the spread being between 4.4 and 5 percentage points.

Likewise, each region also gained in the high-pay category's share of total jobs. Interest-

<sup>3</sup>The averages are simple averages not weighted by the population share of each region.

**Table 3: Average Hollowing-Out Measures in North Carolina Regions, 2001-2015 (HP= high-pay jobs, MP=middle-pay jobs, LP=low-pay jobs)**

Type	Number	Percentage Change in Job Total			Share Percentage Point Change		
		HP	MP	LP	HP	MP	LP
Metro	16	15.60	0.60	28.10	0.3	-5.1	4.8
Micro	25	1.80	-13.70	8.80	0.5	-4.9	4.4
Rural	5	5.20	-18.20	5.50	0.9	-5.9	5

ingly, the increase in the high-pay share of total jobs was greatest for the rural region, next highest for the micro region, and lowest for the metro region.

## 5. FACTORS RELATED TO HOLLOWING-OUT

The previous section established the existence and extent of hollowing-out in North Carolina regions. Although all but one region (Kinston) displayed hollowing-out during the 2001-2015 period, the degree of labor market change varied. This section reports on an investigation of factors associated with hollowing-out in the regions.

Two types of regional characteristics are studied for their effect on the variation in regional hollowing-out. One set includes variables measuring economic sectors in the regions whose changes could have major impacts on the degree of hollowing-out. For example, regions more tied to economic sectors paying middle-range salaries and experiencing downsizing during the period might be expected to have experienced more hollowing-out of the labor force. The second set includes variables describing key socioeconomic characteristics that could generate differences in the rate of labor market hollowing-out.

Three economic sectors are used to capture the first set of regional characteristics, with each measured as regional employment in the sector as a percent of total regional employment in 2001. They are the share of 2001 total employment in manufacturing, in construction, and in the information sector.<sup>4</sup> Each of these sectors has experienced major changes in the 21<sup>st</sup> century. Domestic manufacturing has downsized as a result of increased international trade and the shift of consumer spending to the service sector (Autor et al., 2013, 2016). The construction sector was devastated by the Great Recession, and the economic expansion following the recession has not brought a full recovery to building activity (Scott, 2017). In contrast, as a result of growth in information technology, information sector output has almost tripled in size during the last two decades, far exceeding the overall economic growth rate (US Census, 2017c).

Four measures describe the socioeconomic characteristics of the regions: population density, the percent of the population aged 25 and older with a college degree, the median age,

<sup>4</sup>It can be argued that a preferred measure is the share of total regional GDP in each of the sectors. However, consistent GDP estimates are not available for all the regions in the state.

and population growth from 2001 to 2015. The 21<sup>st</sup> century has been characterized by a distinct dichotomy in the economic performance of regions. On one side are young, highly educated, fast growing, urban regions, and on the other side are older, less educated, small town and rural regions with slow or declining rates of growth (Kotkin, 2000; Ehrenhalt, 2012; Moretti, 2012). Each of the four variables test the relationship between a particular characteristic of this dichotomy to the phenomenon of hollowing-out.

Three dependent variables are individually related to the economic sector and socioeconomic characteristics of the regions. The dependent variables are the percentage point changes between 2001 and 2015 in the share of total regional employment in high-pay jobs, in middle-pay jobs, and in low-pay jobs (columns 7, 8, and 9 of Table 2). The three estimated equations are:

$$HP\%PTCHG = f(MF\%, CON\%, INFO\%, DEN, COLDEG, AGE, POPCHG) \quad (1)$$

$$MP\%PTCHG = f(MF\%, CON\%, INFO\%, DEN, COLDEG, AGE, POPCHG) \quad (2)$$

$$LP\%PTCHG = f(MF\%, CON\%, INFO\%, DEN, COLDEG, AGE, POPCHG) \quad (3)$$

where  $HP\%PTCHG$  is the percentage point change in the share of high-pay sectors,  $MP\%PTCHG$  is the percentage point change in the share of middle-pay sectors,  $LP\%PTCHG$  is the percentage point change in the share of low-pay sectors,  $MF\%$  is the manufacturing sector's share of total employment in 2001,  $CON\%$  is the construction sector's share of total employment in 2001,  $INFO\%$  is the information sector's share of total employment in 2001,  $DEN$  is density of the region in 2001 measured by persons per square mile,  $COLDEG$  is the percentage of adults with a college degree in 2001,  $AGE$  is median age in the region in 2001, and  $POPCHG$  is growth in the regional population between 2001 and 2015 in percentage points.

Descriptive statistics are given for the variables in Table 4. Recognizing the likelihood that the error terms of the equations are correlated, the analysis is performed with a seemingly unrelated regression procedure (Zellner, 1962). This procedure gives unbiased and more efficient estimators than ordinary least squares. Results are presented in Table 5.

The college degree percentage variable is positively related to the change in the percentage share of total employment attributed to high-pay employment. This is logical with an increasing number of high-paying employment requiring a college education (Bernardo, 2017). In the middle-pay equation, regions with a higher share of 2001 employment in manufacturing and in construction are associated with declines in the middle-pay share change. This is understandable since both manufacturing and construction have been key components of middle-pay jobs, and both sectors have been experienced downsizing over the time period. Regions with slower population growth are also associated with declines in middle-pay share change.

In contrast, regions with a higher manufacturing and construction share of 2001 employment are associated with increases in the low-pay share change. Combined with the results for middle-pay, this suggests a region's transition out of middle-pay jobs is related to a transition into low-pay jobs. Other research is consistent with this conclusion (McKay, 2013). As high as two-thirds of workers released from manufacturing positions who are re-employed earn less in their new job, with the majority taking jobs outside of manufacturing

**Table 4: Descriptive Statistics for High-Pay, Middle-Pay, and Low-Pay Equations**

Variable	Mean	Std. Deviation	Minimum	Maximum
HP%PTCHG	0.50	1.77	-5.19	5.48
MP%PTCHG	-5.11	3.55	-15.79	3.57
LP%PTCHG	4.61	3.31	-3.59	10.31
MF%	20.44	11.10	3.45	47.62
CON%	5.74	1.82	2.76	10.26
INFO%	1.25	0.76	0.00	4.11
DEN	152.64	97.81	41.5	461.40
COLDEG	18.81	8.52	8.96	43.53
AGE	36.52	3.90	25.00	42.20
POPCHG	115.8	14.49	95.28	161.66

in lower-paying industries such as administrative services, leisure and hospitality, and retail trade (Meckstroth, 2013). Interestingly, regions with a higher share of information sector jobs in 2001 are associated with a larger low-pay share change. One interpretation is that regions with a higher share of higher-paying information sector jobs create a demand for lower-paying jobs in the personal service and hospitality sectors. Faster-growing regions are also associated with larger increases in the low-pay share change. This relationship was observed in Table 1 for the fast-growing Charlotte and Raleigh regions.

The lack of statistically significant results for the density variable is consistent with the similarity of results for the averages of the share percentage point changes for each of the three regional categories reported in Table 3. This finding suggests that structural factors other than geography, such as the socioeconomic and economic sector characteristics investigated here, have greater associations to hollowing-out.

The robustness of the results were checked several ways. The employment shares in manufacturing, construction, and information were included for 2015 as well as 2001, but high correlations between each sector's shares in the two years reduced the statistical significance of the resulting estimators. A variety of combinations of other sectors' 2001 employment shares (in addition to those for manufacturing, construction, and information) were included as independent variables, but none added to the explanatory power of the equations. Rather than using the continuous variable density, categorical variables were created to designate metropolitan, micropolitan, and rural regional categories, but none were statistically significant in the equations.<sup>5</sup> The percentage change in the three pay category job totals was substituted for the percentage point change in each pay category's share of aggregate employment as the dependent variables, but the results were inferior. Last, the growth rate in total personal income was substituted for the growth rate in population with no improvement in the results.

<sup>5</sup>Two categorical variables were created, one indicating a rural region and the other indicating a micropolitan region, with the intercept capturing metropolitan regions.

**Table 5: Regression Results for High Pay, Middle Pay, and Low Pay Equations (HP= high-pay jobs, MP=middle-pay jobs, LP=low-pay jobs)**

Independent Variable	HP Share Change	MP Share Change	LP Share Change
Intercept	0.299	14.232**	-14.531**
MF%	0.04	-0.273*	0.233***
CON%	0.148	-0.760*	0.612**
INFO%	-0.166	-1.106	1.272*
DEN	-0.004	0.009	-0.005
COLDEG	0.095*	-0.046	-0.049
AGE	-0.012	0.033	-0.02
POPCHG	-0.017	-0.084**	0.101**
Adj. R2	-0.078	0.331***	0.326***

\*statistically significant at the 0.10 level; \*\*statistically significant at the 0.05 level; \*\*\*statistically significant at the 0.01 level; number of observations=46

## 6. CONCLUSIONS AND IMPLICATIONS

Hollowing-out, a term describing the relative decline of middle-paying jobs, has occurred in all but one of North Carolina's 46 economic regions during the 21st century. The labor market trend has been similar for each of the three categories of regions - metropolitan, micropolitan, and rural - investigated in the analysis.

Hollowing-out is strongly related to regions in North Carolina that began the century with high shares of jobs in manufacturing and construction. This is logical since both sectors are significant components of middle-pay jobs and both have shown either secular declines in employment (manufacturing) or a steep drop during the Great Recession followed by a modest recovery (construction).

Interestingly, hollowing-out is also positively related to fast-growing regions in the state, like Charlotte and Raleigh. At first glance, this finding may be counterintuitive, since many rapidly growing regions, like Raleigh, have economies based on high-paying technology and information based jobs, as well as other positions requiring a college education. One explanation is that fast-growing regions, particularly with strong gains in income, generate high demand for lower-paying personal service and accommodation jobs. Indeed, while Raleigh experienced a 40 percent gain in high-paying jobs and even a 26 percent rise in middle-paying jobs between 2001 and 2015, its low-paying jobs rose 95 percent during the period.

These findings support existing research of the topic indicating widespread hollowing-out among metropolitan regions of the nation (Kochhar et al., 2016). However, the current study expands our knowledge of hollowing-out to micropolitan and rural regions of one state and adds to our understanding of factors associated with hollowing-out. Further, while every state has unique features, the shifts in North Carolina's economy out of manufacturing and into services, the strong growth in the state's information sector, and the emerging economic divide between urban and rural regions of the state are characteristics seen in many areas of

the country. Hence, the findings on hollowing-out from North Carolina should be meaningful and useful to other states.

If some futurists are correct, the hollowing-out trends will persist for several reasons. Manufacturing jobs will continue to decline, even if output rises, as routine tasks increasingly are performed by technological machinery, such as robots (Frey and Osborne, 2017). Technology is even starting to substitute for human performance in some construction tasks (Murphy, 2017). Also, some see some middle-pay jobs in health care, like nurses and technicians, ultimately being performed by advanced instrument monitoring and care (Topol, 2015). This leaves job growth occurring in high-paying jobs where cognitive skills are still beyond the capabilities of technology, and in low-paying jobs where the savings from employing technology are either too low or the tasks are too non-routine. Yet some of these occupations may not be safe if advances and applications continue to be made in artificial intelligence (Frey and Osborne, 2017).

How fast hollowing-out progresses will mainly depend on three factors. One is the rate at which advances in technology substitute for better paying occupations. The second is the types of new jobs created in coming decades, particularly in new companies and developing industries. While impossible to predict - mainly because the creation of new economic sectors relies on unknown experimentation, innovation, and profitability - new firms requiring moderately skilled workers would be a path to augmenting middle-pay jobs. The third factor is the availability and readiness of educational institutions to train workers both at the start of their career as well as in mid-career for the middle-pay jobs of the future.

Policymakers will therefore likely continue to see hollowing-out as a major issue in the country, and there will be on-going calls to address it. But reversing, or even containing, hollowing-out will be difficult. Of course, although training individuals in lower-paying jobs for employment in middle-paying positions is an obvious objective, questions arise as to where middle-paying jobs will be in the future and whether individuals can be easily equipped for those positions. For example, the track record for retraining displaced workers is not strong (Selingo, 2018; Graham, 2017). Our models and methods for retraining and reskilling should be continually evaluated and updated.

Policymakers can also consider methods to ameliorate the conditions of hollowing-out. The loss of middle-paying jobs in micropolitan and rural regions is often complicated by the fact that aggregate job growth in those regions is slow relative to growth in metropolitan areas. Yet access to metropolitan employment by individuals living outside the regions is limited by the higher housing costs in urban areas and the significant transportation expenses of commuting to those areas. Both costs could be alleviated through the provision of housing and transportation vouchers to non-metropolitan residents.

As this research has shown, hollowing-out has been pervasive in all types of regions in North Carolina, and there is no reason to believe the same result would not be found in other states. Hence, both public and private decision-makers at all levels - national, state, and local - should be concerned about hollowing-out and its causes and prospects.

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