

EMPLOYMENT CHANGE IN THE U.S. CENSUS DIVISIONS FROM 2000 THROUGH THE GREAT RECESSION AND CURRENT RECOVERY

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Abstract. This paper takes a geographic look at how industry employment differed across the nine census divisions from 2000 to 2014. We use dynamic shift-share analysis with a focus on NAICS supersectors to compare and contrast differing industry performance across regions of the U.S. before and after the Great Recession. The dynamic method is extended to a graphical version that facilitates comparisons across regions. The graphs highlight the capability of dynamic shift-share to provide annual information on differences in performance and present decomposition into the separate causes of these differences in terms of the shift-share components. Further graphical analysis allows a closer look at the industry contributions to employment growth in each year.

JEL classification: O18, O47, O51, R11

Key Words: Regional Growth, Industry Employment, Dynamic Shift-Share, Comparative Economic Performance

1. Introduction

Following a decade of strong growth during the longest economic expansion in U.S. history, the employment situation in the United States has since been rather disappointing in most years. Nonfarm employment was relatively slow to recover following the short 2001 recession, with regular monthly gains in employment not beginning again until late 2003. Unfortunately those gains only continued for a few years before the onset of the financial crisis and the deep recession that came with it. Although this “Great Recession” ostensibly ended in June of 2009, according to data from the Bureau of Labor Statistics’ Current Employment Statistics (CES) program nonfarm employment didn’t recover to the level it was at prior to the crisis until April of 2014, despite the fact that nonfarm employment has increased every month since October 2010.²

Figure 1 below indicates the behavior of employment relative to its level at the previous business cycle peak, as dated by the Business Cycle Dating Committee of the NBER, through the last four U.S. recessions and into the following recovery periods. As is clear in the graph, the recovery time for employment has been increasing through each of the subsequent periods shown, with it taking 28 months, 30 months, and 46 months for the 1981, 1991, and 2001 recessions, respectively. In the current recovery it has taken 76

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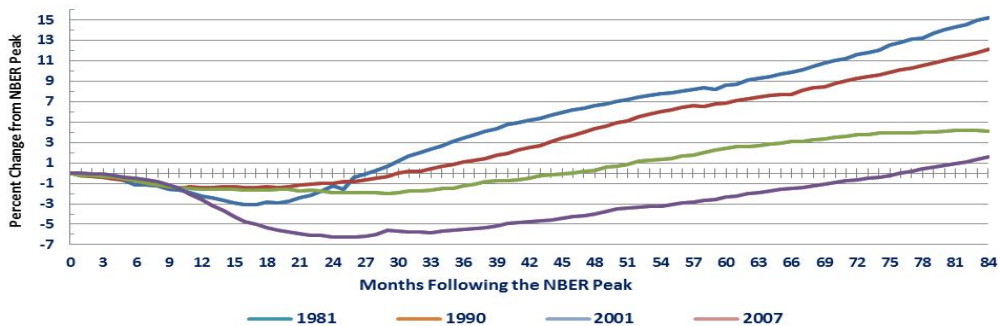
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² As we will be focusing primarily on annual average employment levels in this study, it is worth pointing out that the 2013 annual average employment was still more than 1.5 million below the 2007 annual average. The strong employment growth throughout 2014 has resulted in an annual average that is more than 1.10 million above.

months – nearly six and a half years – since the December 2007 beginning of the Great Recession to regain and surpass the level of nonfarm employment at that time. In fact this is the longest any employment recovery has taken since the Great Depression. Of course part of the reason for this is that declines in monthly employment continued for longer and was a significantly greater percentage drop than in the previous recessions. To emphasize the depth of the most recent employment recession: there was a dramatic 8.7 million worker drop in employment from the high of 138.37 million in January 2008 to the recession low of 129.66 million in February of 2010.

Despite the poor overall growth in employment at the national level – not just following the latest recession, but since 2000 in general – some areas of the country have performed much better overall than others, with disparate regional performance of certain industries being a key driver for this. In this paper we take a geographic look at how industry employment has differed across the nine census regions over the period from 2000 to 2014. This is done through the use of dynamic shift-share analysis with a focus on North American Industry Classification System (NAICS) supersectors to compare and contrast the differing industry performance across the regions of the United States.

Figure 1 – Percent Change in Nonfarm Employment from Prior NBER Peak for the Last Four Recessions:



Data Source: U.S. Department of Labor, Bureau of Labor Statistics

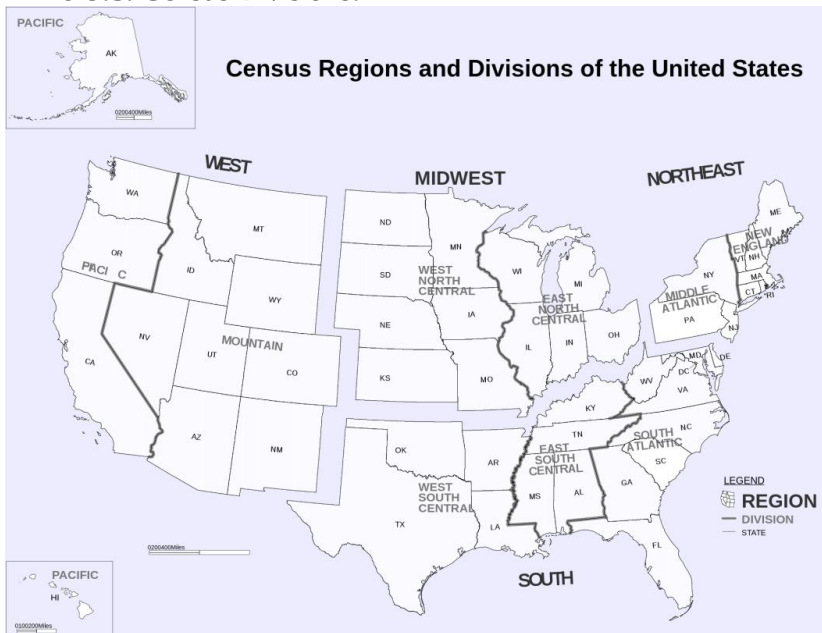
Dynamic shift-share **ANALYSIS** was first used by Barff and Knight (1988) to study employment changes in New England. Since then the technique has been applied in a wide range of studies. Harris et alia (1994) investigate the effects of the 1981-82 and 1990-91 recessions on employment in Nevada. Herath et alia (2011) look at employment growth patterns in West Virginia from 1970 to 2007. Herath et alia (2013) look more closely at the West Virginia economy analyzing employment changes at the local district level by using a combination of dynamic and spatial shift-share. Others have applied dynamic shift-share analysis to international trade. Wilson et alia (2005) compares Singapore's export competitiveness in electronics and chemicals with other Asian nations. Piezas-Jerbi and Coleman (2009) use a mix of static and dynamic shift-share in analyzing growth of exports for a wide number of economies.

Our application of dynamic shift-share is a continuation of Doorn and Jacobson (2008), in which the dynamic shift-share method of Barff and Knight (1988) and Arcelus (1984) was extended to a graphical analysis to facilitate comparisons of the employment experience across industries and areas from 1982 to 2005. That period covered two complete expansionary phases of the U.S. business cycle as well as the 1990–91 recession, the 2001 recession and a portion of the recovery that followed the latter. Such a

graphical analysis highlights the capability of dynamic shift-share to easily provide information on differences in performance through decomposition into separate contributions to these differences from the shift-share components. Further graphical analysis allows us to look more closely at the industry contributions to employment growth in each division in each year.

While the period of analysis in this paper overlaps by a number of years the end period studied in Doorn and Jacobson (2008), we felt that beginning with the 2001 recession provides a number of important elements toward the understanding of relative regional performance prior to the Great Recession, as well as allowing for a nice comparison of employment growth in the current recovery to the last. We look not only at changes in overall nonfarm employment for these periods, but also consider industry contributions at the NAICS supersector level within the census divisions.³ Figure 2 shows the grouping of states that make up the four census regions and the further breakdown into the nine census divisions.

Figure 2 – The U.S. Census Divisions:



Source: U.S. Department of Commerce Economics and Statistics Administration U.S. Census Bureau

The paper proceeds as follows: first the employment growth performance of the nation as a whole is discussed and used as background against which to build the regional analysis; we then look at industry performance nationally; next, the dynamic shift-share methodology is presented; following that, the components of the dynamic shift-share decomposition for each area are used to construct the graphs used in the subsequent analysis; finally we consider each census division in turn and, making reference to the

³ Throughout the remainder of the paper we use annual average employment data from the Current Employment Statistics (CES) program of the Bureau of Labor Statistics.

graphs, discuss growth performance over the period studied, highlighting any significant industry contributions along the way.

2. Employment Change Nationally and at the Census Division Level

Prior to considering the employment experience in the census divisions, we take as a starting point the behavior of nonfarm employment for the U.S. as a whole. Making use of data from the National CES survey, Figure 3 shows total nonfarm employment and its actual annual growth rate for the United States from the trough of the 1990-1991 recession through 2014.⁴ It is clear that annual employment growth in the brief expansion after the 2001 recession never approached the growth rates seen in the 1990s expansion. Of course there were technically only four years of positive annual employment growth in this period, versus ten years in the earlier employment expansion. We see similarly slow annual growth rates following the latest recession, with just four years of positive growth so far.

Figure 3 – Aggregate Total Nonfarm Employment and Annual Growth Rate 1990 – 2014

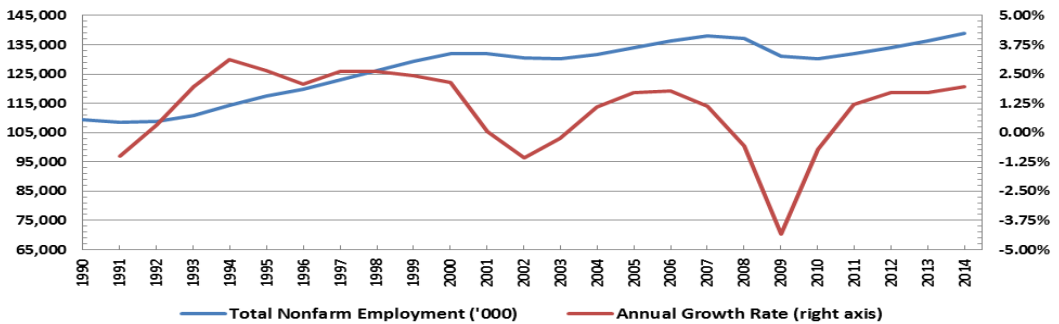
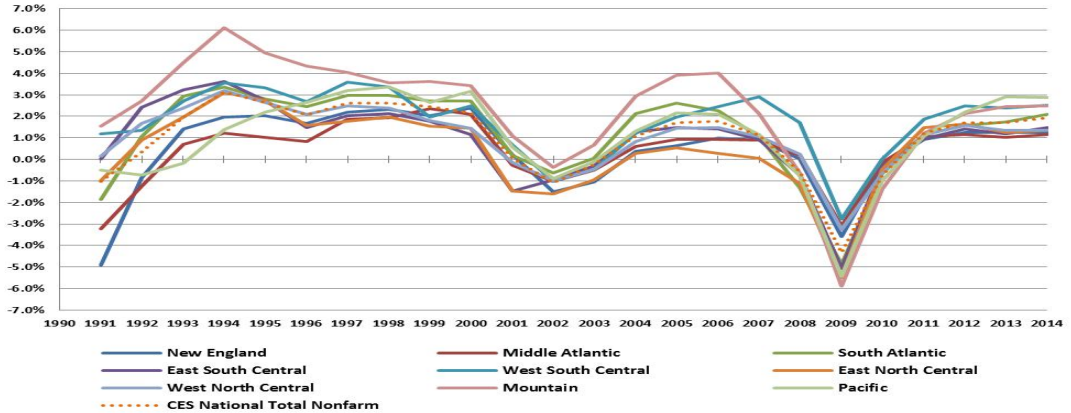


Figure 4 –Annual Growth Rates of Nonfarm Employment in the Census Divisions:



Focusing on the expansionary periods, Table 1 shows us that total nonfarm employment in the U.S. grew 21.81 percent from 1991 to 2000, which is a 2.22 percent annualized

⁴ Although Doorn and Jacobson (2008) also covered the expansion of the 1990s, we find it useful to start with it in this section of the paper to provide additional context and stress the fact that the employment performance in the U.S. had been relatively poor even preceding the Great Recession. This was apparent in Figure 1 as well.

average growth rate throughout the period.⁵ From 2001 to 2007, overall employment growth was only 4.44 percent, which gives a 0.73 percent annual average. Of course that is (roughly) from trough to peak over the expansionary phase defined by the NBER Business Cycle Dating Committee. If we go from the actual employment trough in 2003 we get growth of 5.85 percent to the 2007 peak. This gives a much improved 1.43 percent annualized average following the prolonged declines seen in Figure 1. Doing the same thing from 2010 to 2014 gives a 1.64 percent annualized average growth rate in nonfarm employment. While this is still substantially smaller than the 2.22 percent in the 1990s, this is an improvement over the previous employment expansion from 2003 to 2007.

Table 1 – Overall Percent Growth and Annualized Average Growth over Expansionary Periods:

	1991 - 2000		2001 - 2007		2003 - 2007		2009 - 2014		2010 - 2014	
	Overall	Annualized Average	Overall	Annualized Average	Overall	Annualized Average	Overall	Annualized Average	Overall	Annualized Average
New England	16.41%	1.70%	0.29%	0.05%	2.94%	0.73%	4.51%	0.89%	4.75%	1.17%
Middle Atlantic	10.96%	1.16%	1.84%	0.30%	3.40%	0.84%	4.30%	0.85%	4.46%	1.10%
South Atlantic	26.87%	2.68%	7.69%	1.24%	8.30%	2.01%	6.15%	1.20%	6.73%	1.64%
East South Central	20.74%	2.12%	3.86%	0.63%	5.20%	1.27%	4.80%	0.94%	5.15%	1.26%
West South Central	28.77%	2.85%	7.16%	1.16%	8.78%	2.13%	9.60%	1.85%	9.57%	2.31%
East North Central	16.57%	1.72%	-1.41%	-0.24%	1.15%	0.29%	5.34%	1.05%	5.85%	1.43%
West North Central	21.80%	2.22%	3.37%	0.55%	4.88%	1.20%	4.85%	0.95%	5.55%	1.36%
Mountain	45.55%	4.26%	13.98%	2.21%	13.65%	3.25%	7.02%	1.37%	8.51%	2.06%
Pacific	19.72%	2.02%	5.81%	0.95%	6.88%	1.68%	8.28%	1.60%	9.37%	2.26%
CES Total Nonfarm (National)	21.81%	2.22%	4.44%	0.73%	5.85%	1.43%	5.95%	1.16%	6.73%	1.64%

As also indicated in Table 1, and even more so in Figure 4, the employment experience in different areas of the country has varied quite a bit.⁶ Some noteworthy aspects of this disparate employment behavior include:

- Over the 1990s expansion in employment growth in the Mountain division far exceeded that in any of the others, resulting in an increase of over 45 percent from 1991 to 2000. The next highest employment performance took place in the West South Central division, with the South Atlantic not far behind. Although the Pacific division had a late employment recovery, it did have strong growth in the latter half of the decade. The remaining divisions had growth rates below the national average for much of the decade, with the Middle Atlantic division having the lowest with only 11 percent total growth over the period. New England and the East North Central division fared better, but their growth rates also were relatively low.
- While we saw above that the employment recovery following the 2001 recession was quite slow nationally, as it turns out only four of the nine divisions actually even experienced employment contractions in 2001. These were the Middle Atlantic at – 0.27 percent for the year; the East South Central and East North Central divisions, at

⁵ Annualized average growth rates in Table 1 are calculated as the constant annual growth rate that would yield the overall percentage change in employment for the given period.

⁶ Census division employment at the nonfarm level shown here, as well as for the industry employment analysis to come, is an aggregation of CES state level data over the states within each division.

–1.5 percent each; and the West North Central division, in which employment only declined by 0.15 percent in 2001. Despite the recession ostensibly being over, all divisions experienced employment declines in 2002, with the Mountain division experiencing the mildest drop of –0.37 percent. The contraction in employment continued into 2003 for all but the South Atlantic and Mountain divisions.

- During the employment expansion from 2003 to 2007, the Mountain division again had the strongest growth at 13.65 percent. This was followed by the West South Central, South Atlantic, and Pacific divisions whose growth rates were 8.78, 8.30, and 6.88 percent, respectively. Employment growth in the remaining divisions was below the 5.85 percent average over the same time period, with by far the weakest growth occurring in the East North Central division with an overall employment gain of only 1.15 percent for the whole period.
- Positive growth continued into 2008 for the New England, Middle Atlantic, West South Central, and West North Central divisions. Of these the West South Central division's 1.71 percent expansion in employment was significantly higher than the rest, which all minimal growth of less than a quarter of a percent for the year. The South Atlantic and East North Central had significant declines of 1.32 and 1.1 percent, respectively, while the remaining divisions had milder declines of less than 1.0 percent in 2008.
- All of the divisions experienced substantial contraction in employment in 2009, when the national average fell by 4.33 percent. While the four divisions that had continuing growth in 2008 experienced the smallest declines in 2009, they were still pretty substantial at –3.59, –3.09, –2.77, and –3.26 percent, respectively. Interestingly, the Mountain division, which had dramatic growth above the rest of the divisions through all of the years graphed prior to 2007, experienced the largest percentage declines in 2009 and 2010, dropping 5.91 percent in 2009 alone. The drops in the East North Central, East South Central, and Pacific divisions exceeded 5.0 percent as well, with the South Atlantic not far behind with a 4.9 percent fall in employment that year.
- While the West South Central division had the smallest employment decline of all the divisions in 2009, that was its only annual decline. It experienced a slight increase of 0.02 percent in 2010 while employment continued to fall in the others. All of the divisions have experienced positive annual average employment growth from 2011 forward.
- Employment growth in the West South Central division continued to be the strongest in 2011 and 2012, but was surpassed by the Mountain and the Pacific divisions in 2013 and only the Pacific division in 2014. These three along with the South Atlantic division exceeded the national average employment growth rates of 1.71 and 1.94 percent in 2013 and 2014. The remaining five divisions have experienced employment growth at rates below the national average, with New England and the Middle Atlantic division having the slowest employment recoveries so far.

In what follows we will make use of dynamic shift-share analysis to take a more in-depth look at the drivers of these growth disparities from 2000 forward.

3. Dynamic Shift-Share⁷

Shift-share analysis breaks down the change in a variable over a particular time period into contributing factors – those changes that are due to national growth trends for total employment and those that can be attributed to the particular industry make-up within each region and the relative performance of those industries, both nationally and within the region of analysis. This decomposition is given in equation (1).

$$(1) AC_i = NG_i + IS_i + RS_i,$$

where AC_i is the actual change in census division i employment over the period of interest; NG_i is termed the *national growth effect*; IS_i is called the *industry shift effect*; and RS_i the *regional share effect*.

The formula for NG_i is given in equation (2), where the growth rate for nonfarm employment in the nation is applied to initial period employment in each industry in the census division and then the result is summed over all industries.⁸ In effect this is the same as applying the national growth rate to the initial level of total employment for the division.

$$(2) NG_i = \sum_j G_* \cdot E_{ij}^t = G_* \cdot E_i^t,$$

where G_* is the growth rate of nonfarm employment nationally for the period; E_{ij}^t denotes beginning of period industry j employment in census division i ; and E_i^t denotes beginning of period level of total nonfarm employment in census division i .

In essence, NG_i tells us what the change in employment would have been had division growth matched that of the nation as a whole. Any difference between that and the actual change in division employment over the period, AC_i , is then explained by breaking that difference into the two remaining components of equation (1). Equation (3) gives the formula for the industry shift effect, which explains the portion of the growth difference that is due to industry performance at the national level relative to the overall growth in nonfarm employment. The regional share effect, generated through equation (4), then explains that portion of employment change in the division that is due to its particular industry mix and performance relative to the national experience. The breakdown of employment changes in this fashion allows a determination of each area's relative strengths and weaknesses.

$$(3) IS_i = \sum_j (G_j - G_*) \cdot E_{ij}^t$$

⁷ While static shift-share analysis has been in use for a long time (see Richardson (1978) and Esteban-Marquillas (1972) for explanation and examples), the dynamic approach was developed later (see Barff and Knight (1988) and Arcelus (1984)).

⁸ BLS procedures do not ensure that state level data will aggregate to national estimates, so total nonfarm employment is recalculated as state level aggregates over all states for the decompositions into shift-share components.

$$(4) RS_i = \sum_j (G_{ij} - G_j) \cdot E_{ij}^t$$

where G_j is the percentage growth in industry j employment nationally and G_{ij} is the growth in industry j employment in census division i .

In contrast to a comparative static shift-share analysis, which calculates the above components just once for each extended period of interest (such as a decade) using only the beginning and final employment levels, the dynamic approach to be employed here involves calculating the component breakdown for each year of the study. Thus the growth rates used in each formula are the actual annual percent changes in employment for each industry and area. This allows for any changes in the distribution of employment across industries each year to explicitly be taken into account, as E_{ij}^t is updated annually.

To determine the overall effect over a lengthier period the annual changes can just be summed.⁹

As can be seen in equations (3) and (4), both IS and RS are affected by an area's initial distribution of employment across industries. For IS , the direction of impact on every area is the same for each industry. However, the overall impact of IS on an area's employment will depend on its industry distribution. The IS contribution will be positive for those census divisions which have a larger share of employment in high growth industries, i.e. those which grew faster than the national average for all industries. A negative industry shift indicates that an area's initial employment mix was heavy in what turned out to be low growth or declining industries. Although interesting, the IS contribution to employment growth in each region is relatively small, and therefore we focus on the RS contribution in the discussion that follows. The direction of impact from industry performance on the RS contribution to growth within each area will differ according to its performance relative to the same industry in the nation as a whole. An area with many of its industries outperforming the industry average for the nation is considered to have had a competitive advantage over those areas which do not have such high performing industries, and thus will have a positive regional share. This makes RS the primary determinant of differences in growth rates across areas.

4. National Industry Employment

Before looking at the census division shift-share analyses, it is useful to first consider the aggregate industry employment history over the period studied. This serves to better clarify and provide context to the degree of the positive and negative contributions of each industry sector to overall division growth. Figure 5 shows the annual average growth rates for each of the industry sectors used in the shift-share analysis, while Figure 6 shows the aggregate employment for each industry.

While Mining & Logging experienced some of the biggest swings in its growth rate, the number of jobs this actually represents is relatively tiny compared to the changes experienced in the other industries in most years. That being said, the strong growth in

⁹ Additional discussions and examples of the differences in these approaches can be found in Doorn and Jacobson (2008), Dinc et al (1998), and Knudsen (2000).

that sector¹⁰ beginning in 2003 was interrupted only by a dramatic 10.5 percent decline in employment in 2009, with growth picking back up in 2010 and accelerating to 11.5 percent in 2011. As mentioned, the actual number of jobs affected was relatively small. After the 2009 loss of slightly less than 80 thousand jobs in the sector, the ensuing growth in 2010 and 2011 more than replaced those jobs, adding more than 93 thousand employees back to the sector over those two years. The sector has continued to expand since.

Figure 5 – Annual Growth Rates of Employment by Industry Sector:

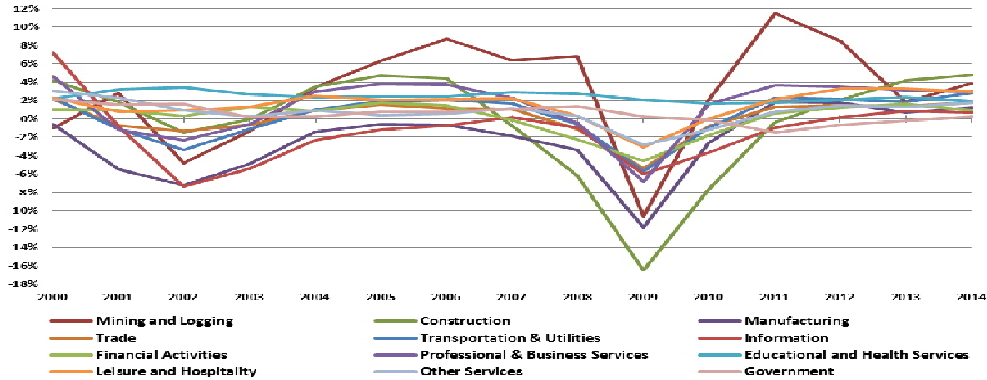
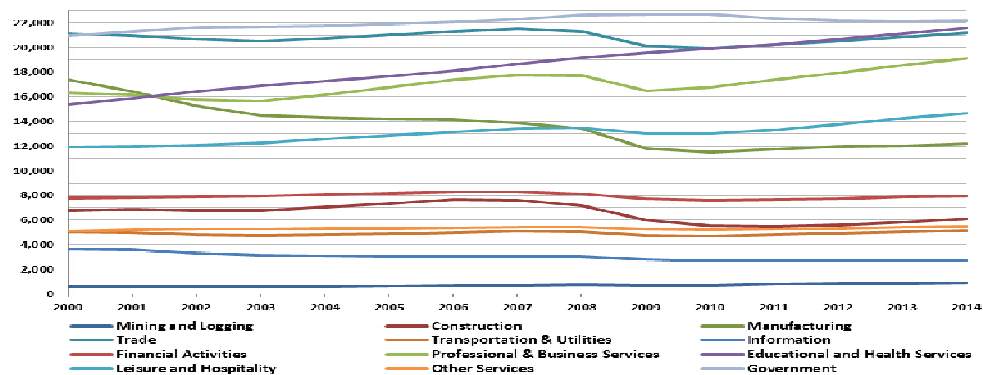


Figure 6 – Aggregate Industry Employment (in thousands):



After a few years of small increases in the mid-1990s, employment in Manufacturing continued its long-run slide, with declines picking up rather dramatically in the 2001 to 2003 employment recession. After employment fell by more than 2.88 million workers over this period, declines continued at a slower pace until picking up again in 2007 with a 1.85 percent decline. This was followed by annual declines of 3.34, 11.79, and 2.61 percent in 2008, 2009, and 2010, respectively. In 2011 employment in manufacturing began to increase and has every year since. However, it is still about 2.0 million workers below its pre-recession level. As with most sectors, Trade, Transportation, and Utilities experienced declines throughout the employment recession of the early 2000s. Both the Trade subsector and the Transportation & Utilities subsector experienced similar behavior

¹⁰ Of course this supersector contains Oil and Gas Extraction as a subsector, which has grown dramatically in the U.S. over the past decade or so.

as far as the relatively mild rates of decline through 2003 and subsequent annual growth rates, with both re-attaining pre-recession levels of employment by 2005. For the next few years Transportation & Utilities employment grew at higher rates than employment in the much larger Trade subsector. It also experienced smaller declines through the Great Recession and was back near its 2006 high point of nearly 5 million workers by 2012, with that being surpassed in 2013 and 2014 due to relatively strong growth in the sector. While the Trade subsector experienced slightly slower rates of employment decline in 2009 and 2010, its subsequent growth rates have been significantly slower and the 2007 high in employment over the period still has yet to be regained, with 2014 employment of about 21 million still more than half a million workers below the 2007 level. Following the bursting of the 1990s tech bubble, the Information sector experienced the greatest rates of employment decline of any sector during the employment recession after 2001. Growth turned positive for only a single year in 2007, increasing 0.17 percent before turning negative again through 2012. The 2014 employment in the sector is still nearly 300,000 employees below its 2007 level, a nearly 10 percent decline from the 3 million employees overall in that year. Growth in the Financial Activities sector was relatively low and stable for the beginning part of the 2000s, averaging about 1.1 percent growth per year from 2000 to 2006. Growth turned slightly negative in 2007 at -0.13 percent before falling further in 2008, 2009, and 2010 at -2.20, -4.61, and -1.78 percent, respectively. Growth rates turned positive in 2011 at rates comparable to those pre-recession and remained positive through 2014. From the beginning of the sample in 2000, overall employment in the Financial Activities sector is up by only 176,400 workers in 2014. The Professional & Business Services sector saw declines in employment growth during the 2001-2003 employment recession. Growth became positive from 2004 to 2007 before turning negative again in 2008 and 2009. The growth rate decline of -6.86 percent in 2009 was the fourth largest percent decline across industry sectors during the Great Recession. However, the level decline of 1.2 million jobs lost was second largest drop of any sector. Job growth rebounded in 2010 and remained positive through 2014. The sector recovered all its jobs lost during the Great Recession and ended 2014 with 1.3 million more jobs than it contained in 2007. Education and Health Services sector was the only sector whose growth remained positive over the entire 2000-2014 period. The lowest growth rates occurred in 2010 and 2011 at 1.70 and 1.73 percent, respectively. Surprisingly, the two best years for growth occurred during 2001 and 2002 when growth was 3.20 and 3.40 percent, respectively. Overall, the sector saw a gain of 2.9 million jobs since 2007 and a gain of 6.2 million jobs since the beginning of sample period in 2000. Employment growth rates in the Leisure & Hospitality sector and the Other Services sector followed similar paths over the 2000 to 2014 sample period. Growth rates in both remained positive during the 2001-2003 employment growth recession and remained positive through 2008. In 2009, both sectors' growth rates declined, -3.04 percent for Leisure & Hospitality and -2.86 percent for Other Services. Growth in Other Services remained negative in 2010 at -1.15 percent while growth in Leisure & Hospitality turned slightly positive at 0.03 percent. Growth remained positive from 2011 to 2014 for each sector. Employment levels for Leisure & Hospitality increased by 1.2 million jobs from 2007 to 2014 while employment levels in Other Services increased by 84,900 jobs over the same time period. The remaining sector, Government, saw a small moderate growth in employment following the 2001-2003 employment recession through 2009. The largest year of employment growth during this period was 2008 which saw an increase of 1.37

percent. Following the Great Recession employment growth turned negative from 2010 to 2013, with growth rates of -0.10 , -1.48 , -0.68 , and -0.19 percent respectively, before turning positive again in 2014 with an increase of 0.26 percent. Total employment in the Government sector was 124,400 jobs lower in 2014 than its level prior to the Great Recession in 2007.

5. Shift-Share Analysis of the Employment Experience of Each Census Division, 2000-14

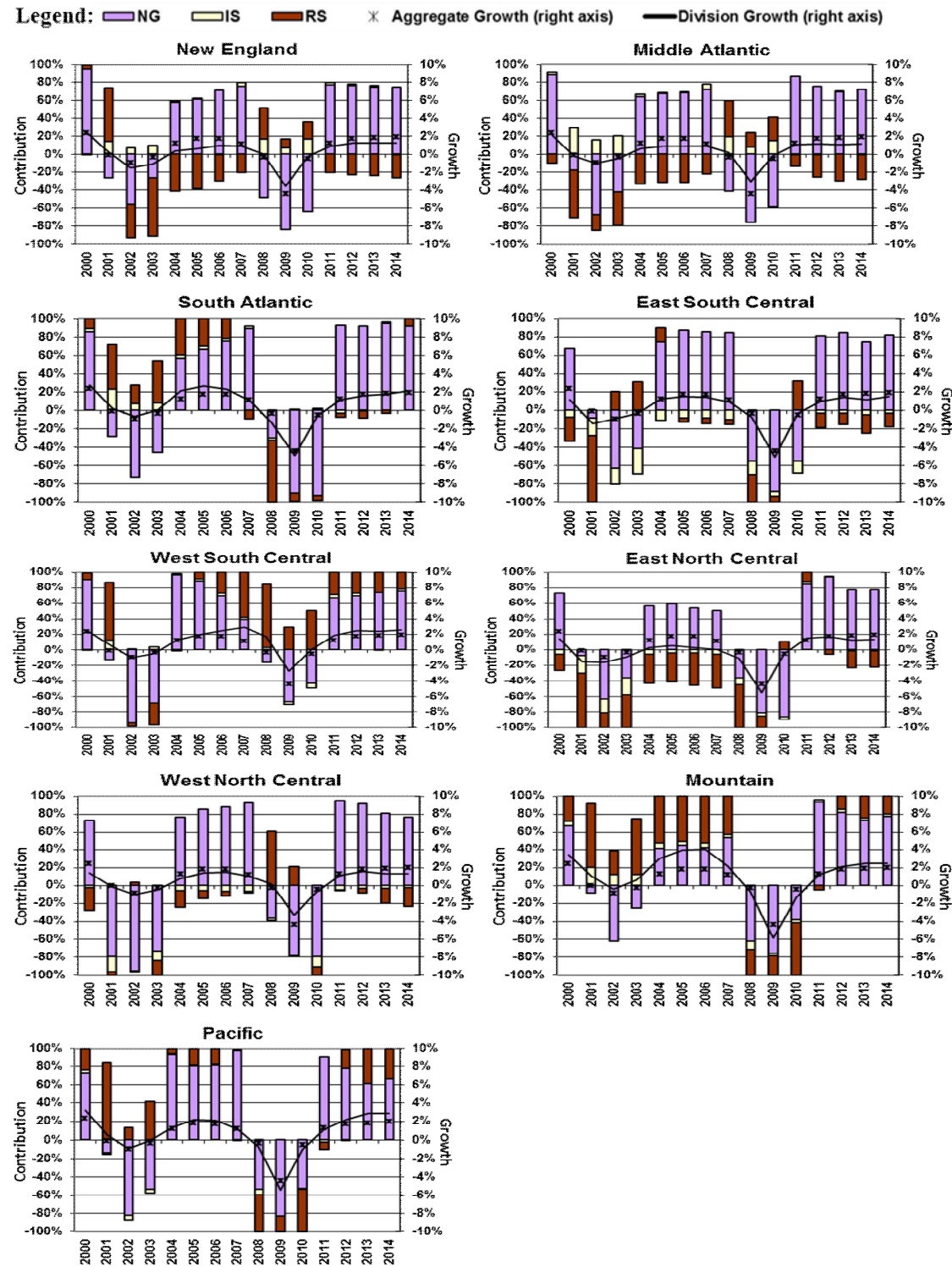
In this section we apply the above shift-share decomposition procedures to illuminate what the main drivers are behind the discrepant employment experience across the census divisions and to further investigate the industry performance behind the important regional share effect for each division. The results are shown graphically in order to concisely present the results and to facilitate the discussion.

Figure 7 presents a graph of the annual growth rate of nonfarm employment along with a breakdown of the shift-share contribution to this growth for each division from 2000 to 2014. Note that the annual division growth rates are the same as those shown in Figure 4, only now we have information on what has driven some of the disparities in these rates between divisions. The annual growth rate of aggregate nonfarm employment nationally is also included in each graph. This allows us to see visually the difference in regional employment performance that the shift-share analysis seeks to explain, i.e. $AC_i - NG_i$.

Figure 8, in the Annex, contains two graphics for each census division. The top graphs plot the annual growth rate of nonfarm employment along with a breakdown of the shift-share contributions to this growth for each division from 2000 to 2014. The bottom graph for each census division breaks the *RS* effect on their annual employment growth into each industry's contribution to that effect. Together these graphics give a more complete picture of the industry performance underlying the overall employment growth within each division. For years in which industries with positive impacts outweigh those with negative, the overall *RS* will be positive. In addition, it is fairly easy to determine which industries provided the greatest boost. Unfortunately this can be somewhat misleading, as declining industries can show up as positive contributors to a division's growth if employment in the industry in that division is declining more slowly than others.

New England: In the 2001 recession this census division actually had a slight increase in overall employment by 0.20 percent while overall national employment declined by 0.12 percent; hence the negative *NG* contribution. Both *IS* and *RS* provided enough positive impact from the division's industry mix to overcome the national decline that year. Recall that a positive *IS* contribution indicates that the share of employment in the division that was in industries with growth stronger than the national average for all industries outweighed the share in slow growth or declining industries. The industries with growth in annual average employment that year included Mining & Logging, Construction, Financial Activities, Education and Health Services, Leisure & Hospitality, and Other Services. We see in the bottom panel that the positive contribution of *RS* in 2001 was driven by relative outperformance by seven of the twelve industrial sectors in the division. Recall that a positive contribution to *RS* indicates that the industry in the region is growing faster or experiencing less of a decline than the industry is nationally. The biggest positive contributions to New England's *RS* came from Manufacturing, Construction, and Trade in order of descending impact.

Figure 7 – Employment Growth Rates and Shift-Share Decomposition across the Census Divisions:



Other positives included Financial Activities, Leisure & Hospitality, Information, and Other Services. In the continuing employment contraction from 2002 to 2003, New England fared worse than just about every other division. We can see that this was due to relative underperformance of most industries in the division resulting in large negative *RS* in both years. In fact, in both 2003 and 2004 all industry sectors in New England underperformed. This underperformance continued for the majority of industries through 2007, but actually turned around in many for 2008, leading to continued growth in overall employment in that recession year. Four of the division's industry sectors had positive growth in 2008, while an additional four experienced less of a decline than their counterparts nationally. Other than Education and Health Services, which grew in every year of the study across all census divisions, no industry sector had growth in 2009, but a good number had relatively smaller declines than other area's experienced. In fact only two industries saw relatively worse outcomes that year – Educational & Health Services and Government. In 2010 another two industries in the division experienced positive employment growth for the year – Professional & Business Services and Leisure & Hospitality – while three others continued relatively mild contractions. Once the national employment recovery got started in 2011, however, New England reverted back to underperformance in most of its industries and in fact continued to experience employment contractions in Manufacturing, Information, and Financial Activities through 2014. This again has led to annual growth rates lower than the national average.

Middle Atlantic: This census division has had a similar overall employment experience to that of New England during the period studied, although slightly better in the early 2000s. In this case it was the *IS* component that boosted performance to be roughly in line with the national average through 2003, as the *RS* break down indicates most industries in the division were relative laggards to their peers. This underperformance of most industries in the division continued to be the case through 2007, with Information actually declining throughout the post-2001 expansionary period.¹¹ As we saw with the New England division, the Middle Atlantic had growth in its overall nonfarm employment in 2008, with the *RS* effect similarly being the largest contributor. Seven of the twelve industries experienced rising employment that year, led by strong growth in the Mining & Logging industry. In 2009 all industries but Government and Educational & Health Services declined in the Middle Atlantic, but again this division suffered less dramatic employment declines, at -3.09 percent overall, than all but one other division. Hence the positive *RS* effect, with Financial Activities and Educational & Health Services being the only negative contributors that year. 2010 saw three other of the division's industries return to employment growth, led by Mining & Logging at +14.04 percent, but also including the Professional & Business Services and Leisure & Hospitality sectors. Most of the division's industries continued to outperform their peers nationally that year, but once the employment expansion began nationally in 2011 most of the Middle Atlantic's industries began underperforming again, with negative *RS* for the remaining years

¹¹ Manufacturing also declined throughout this period, but that is the case for this industry for most years of the study in the majority of the divisions.

bringing division growth below the national average again. In fact we see that all but two of its industries had negative contributions to *RS* in 2012 and all of them in 2013 and 2014. That being said, only Manufacturing, Information, and Government actually experienced employment declines in this division over the last two years.

South Atlantic: We can see from the graphs that this division outperformed nearly all of the others from 2000 through 2006, with employment growth well above the national rate due to strong contributions from both *IS* and *RS*. The lower panel indicates the division's relative industry performance was quite good for most sectors, with only three or fewer sectors providing negative contributions to *RS* in all of these years except 2001. Manufacturing and Transportation & Utilities were the primary underperformers of this period, while Professional & Business Services was by far the biggest positive contributor. In 2007 overall growth slowed to just under the national rate, 1.06 percent versus 1.15 for the nation. Industry *RS* contributions that year split evenly between six positive and six negative contributors, but overall the result was a small negative *RS* contribution to division growth. This was primarily driven by a 3.32 percent contraction in Construction employment that year, although Manufacturing and Information also experienced declines. In 2008 only Government provided a positive contribution to *RS*, while a 10.79 percent decline in Construction employment was the biggest negative for the division. This was followed by Manufacturing, Trade, and Professional & Business Services having sizeable negative impacts, bringing the overall decline in division employment that year to -1.32 percent, significantly worse than the nation. The South Atlantic's rate of employment decline moved much closer to that of the nation in the following two years, as can be seen by the large decrease in the size of the negative *RS* contribution in 2009 and 2010. In 2010 positive growth in Professional & Business Services and Trade helped provide a positive contribution to *RS* for the division. However, all other industries save Government underperformed their peers.

In the first three years of employment recovery beginning in 2011 the South Atlantic's *RS* has had a small negative influence on relative division growth, with Construction, Manufacturing, and Professional & Business Services being the primary negative factors and the relative performance of Leisure & Hospitality, Financial Activities, and Government having the biggest positive contributions to *RS*. In 2014 Government became the largest negative contributor and was only joined by Logging & Mining, as all other industries contributed positively to *RS*. This led to the division's employment growth exceeding the national average in that year, at 2.10 versus 1.92 percent.

East South Central: This division has underperformed the nation in all but four years of the study – those with the positive *RS* effects. Despite the outperformance of some industry divisions in those years, the negative effect of *IS* largely offsets *RS* and the result is only negligible differences from the national experience. In fact, *IS* is negative in every year, indicating an employment mix in this division that has been more concentrated in relatively slower growth industries. This division had the worst employment performance of all of the census divisions in 2000 and 2001. Apparently only the Transportation & Utilities industry in this division outperformed its peers in 2000, joined by Other Services and, to a small extent, Information in 2001. All other industries significantly underperformed in the East South Central division. During the continuing employment contractions of 2002 and 2003, it seems declines were smaller for many of this division's industries than the national averages, with employment growth in a few, but the positive

contributions from this were offset by the negative *IS* effect, as mentioned. The same was true in 2004. During the rest of the employment recovery from 2005 to 2007, the majority of the division's industries underperformed. While some industries were significant outperformers – Construction in particular, the overall negative *RS* combined with the negative *IS* caused overall employment growth in the division to again fall below the national average. This relative underperformance continued through 2009, with a number of industries declining faster in the East South Central division than elsewhere. Slower declines in Construction and in Financial Activities, as well as some other industries in these years, did help to offset some of this and a boost from positive growth in Professional & Business Services turned the *RS* effect positive in 2010. Once the employment recovery began in 2011, underperformance by the majority of the East South Central division's industries returned it to lackluster employment growth that has lagged the national average. In 2014 only Professional & Business Services, Manufacturing, and Financial Activities outperformed their national averages in this sector.

West South Central: In 2001 only two industries experienced declining employment in this division, Manufacturing and Professional & Business Services. Besides Construction, Government, and Other Services having negative contributions to *RS*, the rest all outperformed their industry averages, leading to positive overall Nonfarm employment growth of 0.66 percent in that recession year. This changed in 2002 and 2003, with underperformance in the majority of the division's industries leading to negative *RS* contributions. The positive *IS* in these two years kept the overall Nonfarm growth rates very close to the national averages and this continued in 2004. From 2005 forward, this division has been among the strongest performers and its employment growth rates exceeded all other divisions from 2007 to 2012. The only overall decline in employment occurred in 2009, and at -2.77 percent this was the mildest of all of the census divisions. From 2006 forward we see that nearly all of the division's industries have been relative outperformers in every year, with strong positive contributions to *RS*. In 2007 only the Information sector experienced a decline in employment and this was joined by Manufacturing in 2008, when Manufacturing employment in the division fell by a relatively small 1.59 percent. While only Educational & Health Services and Government saw growth in 2009, all but two industries in the West South Central division had smaller relative employment declines than the industries experienced nationally. 2010 added growth in Mining & Logging, Professional & Business Services, Educational & Health Services, Leisure & Hospitality, and Government employment to the mix, pushing overall employment growth in the division back into positive territory. In 2011 only three of the division's industry sectors experienced declines, which were Construction, Information, and Government. Other than the continued decline in Government in 2012, all industries have had positive employment growth in the division in each of the remaining years and we see that only one or two have had negative contributions to the division's *RS*.

East North Central: Almost the opposite of the West South Central division's experience, this division has underperformed the nation every year but 2010 and 2011, with *RS* only positive in these years as well and *IS* only a positive contributor in 2011. Other than in 2012, the remaining years have pretty large negative *RS* impacts. As seen in the graph, prior to 2010 only three or fewer industries in the division exhibited relative outperformance in most years, with none in many. The result has been overall employment growth that has significantly lagged the national average in all of those

years. In 2010 four of the divisions outperformed, with this being strong enough to make the *RS* effect positive for that year. In addition to the typical growth in Educational & Health Services, the division's Professional & Business Services industry saw relatively strong growth for the year at +2.64 percent. At the same time the decline in the division's Manufacturing industry slowed to -0.55 percent, which is significantly smaller than the declines in that industry elsewhere. This combination was enough to at least bring the division's overall employment experience that year more in line with the national average. This continued in 2011, with positive growth in all sectors but Information and Government. As seen in the *RS* breakdown, that year's relatively strong growth in Manufacturing, Professional & Business Services, and Construction helped generate the positive *RS* effect for the division. Unfortunately all of the other industries underperformed their peers, so the boost in overall employment for the division was only slightly above the national average. Over the last two years industry sector performance in this division has returned to its lackluster past, with only Manufacturing outperforming in 2013. This was joined minimally by Mining & Logging in 2014. The continued underperformance of the sector's industries has resulted in the East North Central division's nonfarm employment growth rate remaining below the national average.

West North Central: This division has underperformed the nation in all years but 2008 and 2009, with the only positive *RS* effects occurring in those two years and in 2002. Note that the *IS* effect is negative in all years, indicating a concentration of employment in slow growth industries. The majority of industries in this division have also been underperformers relative to national industry averages in every year through 2006, with Manufacturing being the only consistent outperformer. In 2007 we see a movement of more industries to being outperformers, but it is not enough to boost overall employment growth even to the national average. In 2008 all but three of the divisions outperformed, with the laggards being Leisure & Hospitality, Information, and Government. In fact half of the industries in the division experienced positive employment growth that year and some of those that declined did not fare as bad as in other divisions; hence the large positive contribution of the *RS* effect that year and the movement of the overall employment growth rate above the national average at a positive 0.24 percent. In 2009 we see that all of the industry sectors in the division except Information outperformed their peers, or at least experienced smaller declines in employment. This helped the West North Central division to suffer only the second smallest decline in nonfarm employment that year. Moving forward, however, the division returned to having the majority of its industry sectors underperform their peers again, resulting in their overall employment experience again lagging the national average over the recovery years. In 2014 only Logging & Mining, Construction, Leisure & Hospitality, and Government outperformed in this division.

Mountain: As we saw in Figure 4, the Mountain division had the strongest employment growth of all of the census divisions up until 2007, when it only lagged the West South Central division. Both *RS* and *IS* effects were strongly positive in this division up to that point as well. We can see from the *RS* breakdown that almost all of the industries in this division outperformed in every year through 2007, with only Construction, Information, and Leisure & Hospitality having negative contributions. In 2008 there was still growth in four of its industries, led by Mining & Logging, but the relatively large declines in others caused the division's overall employment performance to be slightly worse than the

nation's. In 2009 we see that nearly all of the industries underperformed, causing the Mountain division to experience the largest employment declines of any of the census divisions that year. Construction, Professional & Business Services, Trade, and Leisure & Hospitality were the biggest causes of this decline in relative performance, although nearly all of the sectors had negative impacts on *RS*. This continued into 2010, as well. Once the nation entered its employment recovery in 2011, industry performance in the Mountain division picked up, although *RS* remained a negative for the year. From 2012 forward relatively strong employment growth in all of the Mountain division's industries has moved it back into being one of the top three divisions in the country in this respect. In 2014 only Professional & Business Services and Mining & Logging had negative contributions to the division's *RS*, despite growing 2.73 and 3.06 percent, respectively.

Pacific: This census division also performed well through most of the study period, with overall nonfarm employment growth above the national average in all but four years, from 2008 to 2011. We see that the *RS* effect is positive in all but those years as well. The *IS* effect, on the other hand, seems to move between positive and negative quite a few times, indicating that the employment distribution has probably been pretty well balanced between high-growth and low-growth industries in most years. Regardless, the *IS* effect is quite small in most years anyway, having little impact on the division's employment experience. Similar to the Mountain division, we see that most of the Pacific division's industries outperformed their peers across the nation in every year prior to 2008. Trade, Construction, Information, and Financial Activities tended to be important drivers of this in many of those years. On the other hand, Professional & Business Services was a fairly consistent underperformer. In 2007 the relatively strong underperformance of the Financial Activities, Professional & Business Services, and Construction sectors brought the division's employment growth rate down to match the national average for the year. These sectors continued to fare worse than their counterparts as other industries joined them in their underperformance, causing the *RS* effect to turn negative for the Pacific division for the following three years. This resulted in the division's annual declines during the years of national employment contraction to become greater than the national average.

While 2011 saw continued underperformance by a majority of the industries in the Pacific division, outperformance had returned in the Trade, Information, Leisure & Hospitality, and Other Services industries. In fact only Construction and Government had declining employment that year and only Government in later years. More industries followed this outperformance in 2012 and in 2013 Financial Activities was the only underperformer in the division. The end result of this was a return to stronger employment growth in the Pacific Division than the national average over the last three years and, indeed, a move to the highest employment growth all of the divisions in 2013 and 2014.

6. Conclusion

In this paper we have taken a detailed look at the employment experience in the United States over the past twenty-five years, with a focus on industry employment behavior over the last two recessions and ensuing recoveries. In doing so we have taken a regional approach and made use of dynamic shift-share analysis to determine some of the underlying causes of differences in employment experience across the census divisions, presenting the results graphically. Breaking the annual employment change in each

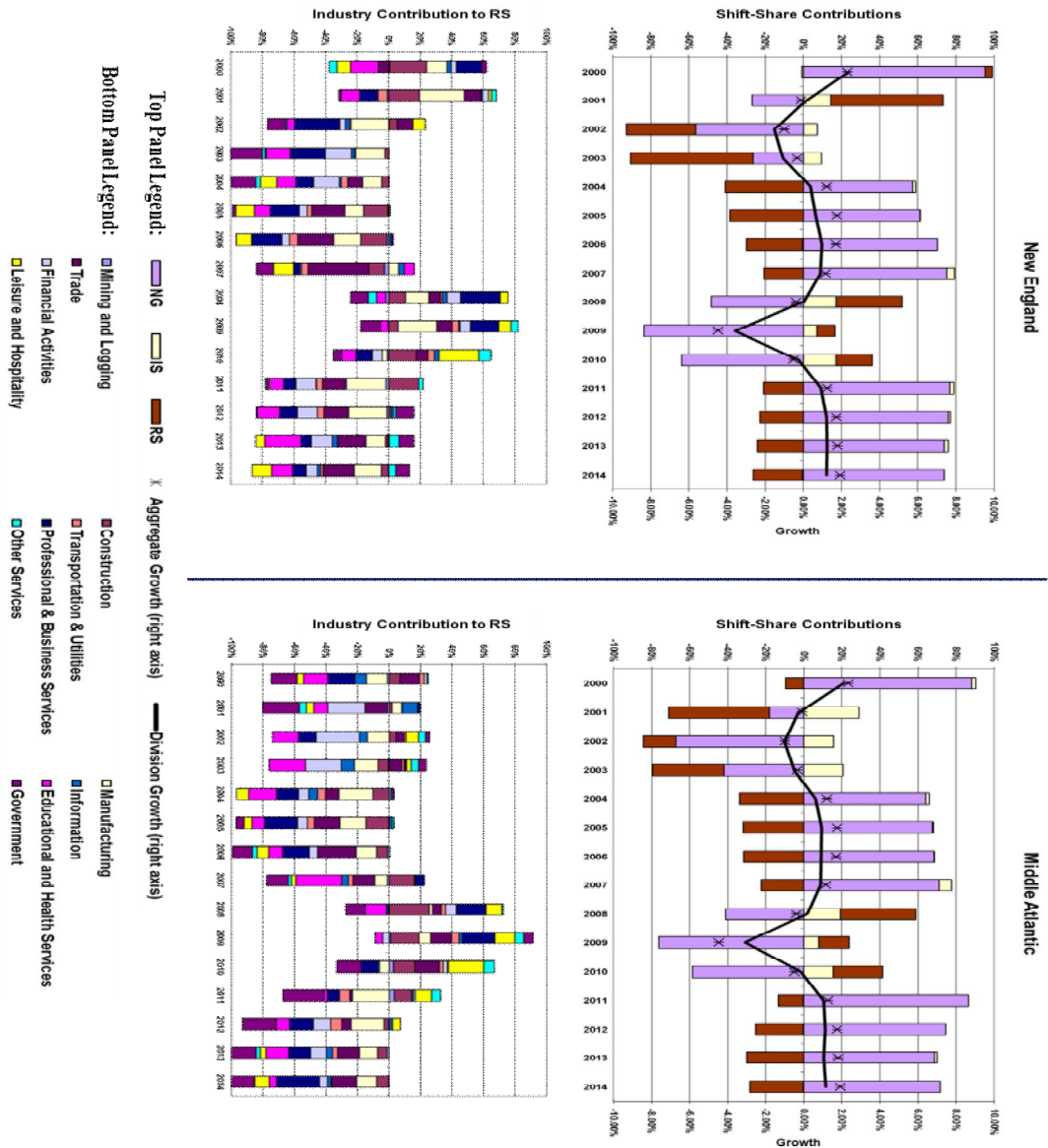
division into separate components allows us to see how the relative outperformance or underperformance of each industry in each division influenced its overall employment experience. In doing so, we see a wide array of industry outcomes. The graphs helped make clear how each division's overall employment growth in each year was affected by the relative performance of its industries, with the degree of this affect implicitly being dependent on the employment distribution and relative importance of each industry to the division. Furthermore this has given us a better grasp of how one division had stronger or weaker employment growth than another and why its overall employment growth was stronger or weaker than the national average. In addition to enhancing the understanding of recent differences in employment experience across the census divisions, another potential benefit of this paper is that it provides an example of the usefulness of this type of graphical presentation of numerical results from a dynamic shift-share analysis. This allows the reader to more easily see effects and outcomes without the need to delve into a lot of lengthy tables and lists of numbers. We would recommend use of this graphical approach, or at least its inclusion, any time a dynamic shift-share analysis is done.

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Annex

Figure 8 – Employment Growth Rates and Shift-Share Decomposition across the Census Divisions (top panel) and Industry Contribution to Regional Share Effect (bottom panel):¹²



¹² Note that this list of NAICS Supersectors is slightly different from that given by the BLS in their CES program documentation (see <http://www.bls.gov/sae/saestruct.htm>). We have separated Trade, Transportation, and Utilities into the two subcomponents listed. In addition, as noted in the BLS documentation the District of Columbia and some states do not report Mining & Logging separately but instead combine it with Construction employment. As this is done by only six states and D.C. we include the resulting sector employment – Mining, Logging and Construction – with the Construction sector from other states when aggregating to the census division level, as Construction is by far the largest component.

