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Change of Knowledge Intensive Service Sectors' Employment in Two Highway Corridors on the U.S. East Coast

Yena Song* · William P. Anderson** · T. R. Lakshmanan***

Abstract : Aiming to reveal the employment evolution around interstate highway corridors, an extended shift-share analysis is conducted for metropolitan areas in two interstate highway corridors on the U.S. east coast: I-95 and I-85. Our focus is on knowledge service sectors, specifically finance, insurance, business services and health services for two time periods, 1977-1990 and 1990-2005. In the first period, the two corridors' metropolitan areas have outperformed their regions in terms of both output and labor productivity. But this picture turned negative in later period with some variation by industries. Also variation in performance over time was found even in metropolitan areas in the same corridor or in geographically adjacent areas.

Keywords : highway corridor, shift-share analysis, knowledge sector, metropolitan statistical area

1. Introduction

Large investment in transportation infrastructure has usually been justified by its positive impact on economic development in regional or national level as well as for its original function, connecting regions. The primary purpose of building transportation networks would be the provision of better connectivity and accessibility to potential users. However, well-developed transportation system contributes to economic growth in various ways. Improved transport networks lower travel times and travel costs, which are the direct benefits from transport investment to transport users. Lowered transport cost again leads to land development in the areas which have been considered unreachable and stimulates regional economies. In addition, a better transport system

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* Research Fellow, Transportation Research Group, University of Southampton, Y.Song@soton.ac.uk

** Ontario Research Chair, Cross Border Transportation Policy, University of Windsor, bander@uwindsor.ca

*** Professor Emeritus, Department of Geography and the Environment, Boston University, laksh@bu.edu

opens new opportunities for companies to optimize their logistics systems to just-in-time levels and to broaden their markets for input and output. Faster and more punctual transport even enables more face-to-face interactions which enhance distribution and accumulation of sticky knowledge and improves the chance of innovation (Lakshmanan and Anderson, 2002 and 2005). To provide evidence of such benefits that sometimes seem only vague, many studies have empirically approached this topic (Aschauer, 1989; Tatom, 1991; Thompson et.al., 1992; Holtz-Eakin, 1994; Nadiri and Marmeneus, 1996; Boarnet, 1998; Sturm, 1998; Peterson and Jessup, 2008). Some of them provided supporting evidences whilst the others reported no definitive or negative effects from transportation networks. Still the general consensus is well-connected transportation networks are a necessary condition for thriving regional economics (Huddleston and Pangotra, 1990) though regional variation is inevitable.

Construction of the interstate highway is one of the biggest transportation investments in the U.S. history. The interstate highway was initially proposed to provide transport routes for military supplies after the First World War but it was also intended to provide necessary surface connections. After the World War II, the need for military transport had been dramatically diminished while its role as an economic artery had been more empathized. Then, has the interstate highway provided better economic opportunities to those located near or on the system? If the major surface networks have offered better economic opportunities to nearby regions, their indicators should have shown higher performance compared to others. Indicators that could show economic impacts of transport network include, just to name few, changes in production, productivity, or employment levels. Employment and production are crucial outcomes of economic performance and considered desirable in their own light. This paper, thus, explores employment changes along two interstate highway corridors in the U.S. and to capture the issues on productivity and output by employing an extended shift-share method.

The next section will provide the information of the analytical technique used for empirical work. Section 3 will define study areas, period and other related information for the analysis and section 5 will report the analysis results in two perspectives: aggregated by corridor and geography. Then conclusion will follow.

2. Shift-share analysis

Industrial employment growth in a region is generally considered a good sign of regional economic vitality, but there could be many factors contributed to such growth other than regional economic strength. If national economic performance has been good and thus employment level has gone up, then many regions would show growth in employment level regardless of relative regional economic strength. Or if a certain industrial sector has prospered and the demand has been high for a while, then regions in which that sector accounts for a large share of employment would more likely show employment growth due to their privileged industrial mixtures, rather than to regional advantages.

Shift-share analysis controls for such effects by

the decomposition of employment change into three parts: national share (*NS*), proportional share (PS) and differential share (*DS*). We chose this analysis technique for this study based on such effective separation of three different sources in employment changes since the regional economic advantages, partly from well-connected transportation networks, need to be distinguished. This technique was developed by Creamer (1942) and has been in modest use until Perloff *et al*. (1960) revived it by employing it as a major analysis tool. Despite of widespread criticisms on the issues like aggregation problems and predictive capabilities (Knudsen and Barff, 1991), it has been popular among regional economists, regional scientists, and geographers because of its simple and straightforward formulation and modest needs of data. This study does not intend to forecast future trends but to analyze past employment evolution therefore limited predictive capacity is not an issue here. Aggregation problem always occurs when geographical data are used and cannot be eliminated unless individual point data are available and usable. So the best that can be done to avoid criticisms should be to select the study region carefully and this will be discussed in the next section.

In this model, NS reflects the employment change that would have occurred due to a national or reference region's employment change in general. *PS* is the component attributed to the industrial mix and sometimes called the structural shift. It is a measure of the degree of favourability of regional industrial mix and the sum of *NS* and PS could be referred to the expected employment change of a region in this model (Forhergill and Gudgin, 1979). Finally *DS* is the component related to regional competitiveness since it shows employment growth or decline after controlling the impacts from the general economic climate and the industrial mix. Therefore *DS* will be the focus of the study as it is directly related to regional economic advantages including infrastructural factors.

The traditional shift-share model is as following[1]:

$$NS=\sum_i E_{irt}g_n$$

$$PS=\sum_i E_{irt}(g_{in}-g_n)$$

$$DS=\sum_i E_{irt}(g_{ir}-g_{in})$$

$$TS=NS+PS+DS \quad (1)$$

Where E_{irt} is employment in industry i in region r during time t, g is employment growth rate from t to t+1, and n indicates the nation (or reference region). Thus g_{ir} is regional employment growth rate of industry i and gin is a national growth rate of the same industry i.

In this study we use extended shift-share model developed by Rigby and Anderson (1993). Hynes and Dinc (1997) modified Rigby-Anderson model adopting total factor productivity approach. However, due to high demand of data for Hynes-Dinc model and reliability issue of capital data, Rigby-Andersons extension will be used for the analysis. Still Rigby-Anderson extension effectively tackles the weakness of the basic shift-share model which concentrates exclusively on the number of employment and is blind to the labor productivity.

In fact, it is crucial to recognize the force leading employment change over time to evaluate the quality of employment. It is quite possible that

employment growth of a certain region was simply driven by poor productivity of employees and significant increase in labor productivity may lead decrease in employment level. Similarly, a very promising and fast developing firm's employment level could stay at the status quo as the effect of its output growth is cancelled by the negative employment effect from the improved labor productivity. If these effects are not disentangled, regional economic effect on the industrial employment cannot be clearly evaluated. Rigby-Anderson extension addresses this problem directly in the model and separates output and productivity effects on employment level. The extended model is as follows:

$$q_{irt}=\frac{Q_{irt}}{E_{irt}}$$

$$A_{ir}=\frac{(Q_{ir(t+1)}-Q_{irt})}{q_{irt}}$$

$$B_{ir}=\frac{Q_{ir(t+1)}}{q_{ir(t+1)}}-\frac{Q_{ir(t+1)}}{q_{irt}}$$

$$a_{ir}=\frac{A_{ir}}{E_{irt}}$$

$$b_{ir}=\frac{A_{ir}}{E_{irt}} \qquad (2)$$

Where Q is output (or value added) and q is the average product of labor. The above definitions lead to each component of shift-share looks as below:

$$NS=NS(a)+NS(b)=\sum_i E_{irt}[a_n+b_n]$$

$$PS=PS(a)+PS(b)=\sum_i E_{irt}[(a_{in}-a_n)+(b_{in}-b_n)]$$

$$PS=PS(a)+PS(b)=\sum_i E_{irt}[(a_{ir}-a_{in})+(b_{ir}-b_{in})]$$

$$TS=TS(a)+TS(b)=\sum_i E_{irt}[(a_{ir}+b_{ir})]=NS+PS+DS \qquad (3)$$

As the equations (2) and (3) indicate, this expanded model separates productivity effect (b) and output effect (a) and the sum of these two effects, in turn, is the same as the traditional employment shift. For example, TS(a) indicates total employment change that would occur given constant labor productivity and TS(b) is total employment change due to labor productivity change, holding output constant. So positive TS(a) means employment increase due to increased output whilst negative TS(b) indicates employment decline resulted from bettered labor productivity. Similarly, positive $DS(a)$ value would be caused by relatively rapid output growth for the study region and positive $DS(b)$ would suggest relatively slow growth in labor productivity, i.e. less productive labor in the region requires more workforce to produce the same amount of output.

3. Case study and data

We conduct the study on two major interstate highway corridors on the east coast, namely I-95 and I-85. They are chosen from a highway project report (Lakshmanan *et al.*, 2006) that identifies 8 interstate highway corridors, and these two corridors represent an older industrial area (I-95) and a comparably young urban area (I-85). Although interstate highway 95 goes all the way down to Florida, the I-95 corridor in this study extends from Southern Maine only to Washington D.C. excluding comparably young Southern metropolitan areas and covering one-day travel distance. Along this corridor four major metropolitan areas in the US are located, Boston,

New York, Philadelphia and Washington D.C with several small MSAs. This section of the east coast region coincides with "megalopolis" acknowledged by the pioneering Gottmann's work (1961). I-85 covers regions from Raleigh-Durham, North Carolina to Birmingham, Alabama and this corridor was identified as a younger, more dynamic corridor region in the same report.

The old and young characteristics of two corridors can be depicted by population growth trends presented in the figure 1. The population growth rate of I-95 MSAs has stayed below the national average whilst I-85's has always been above the average. One interesting point in the figure 1 is that there have been times when old MSAs' population has declined from mid to late 1970s. Such trend was closely related to severe deconcentration in traditional metropolises (I-95 area) but it has not lasted for long and old metropolitan areas started gaining population in 1980s although its speed was not impressive.

Tables 1 and 2 report the major MSAs' population in two study corridors over last 35 years. In absolute terms, Consolidated Metropolitan Statistical Areas (CMSAs) in I-95 have been and are bigger regions in the context of population than any of MSAs in the I-85 corridor. This can be explained by the term itself, CMSA and MSA. CMSA is designated to an area that has a census population of 1,000,000 or more and it is another fact that there has been and is no CMSA in I-85 corridor area. If an area that meets a metropolitan area has a population more than a million, two or more primary metropolitan statistical areas (PMSAs) are established within a MA and that MA is redefined as a CMSA (Glossary, 2000, U.S. Census

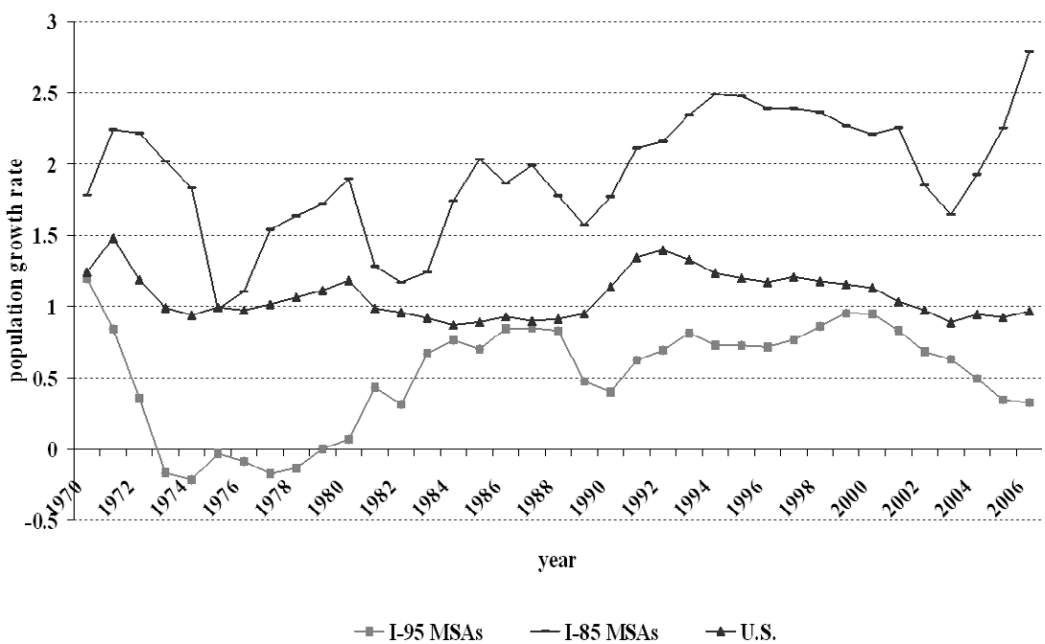

Figure 1. Population growth rate of two study corridor

Bureau).

However, population growth patterns of these two regions are quite different. In general, average population of five I-85 MSAs has been more than doubled during last 35 years whilst 4 CMSAs' population has grown only 18%, which is lower than the national average of 44.6%. Interestingly New York and Philadelphia's populations dropped during the period between 1970 and 1980 although they gained population again and grew back slowly as shown in the figure 1. This can be explained in the same vein with the population decline of old metropolises in 1970s.

The regional unit used in this study is MSA and the PMSA in case of CMSA. It is determined by consideration of three factors: data availability, geographical consistency and location relative to the interstate highway system. Some of the data used in the analysis are not available for non-urban areas. Also, the interstate highway system was first constructed to provide all necessary connections through and around cities (Weingroff, 2006). Thus it would be proper to restrict the study to *urban* areas along the corridors as rural or non-urban areas were not original targets of the system and are less likely to be affected by it. It is also revealed that the impact from highway network varies between MSA and non-MSA regions (Chandra and Thomson, 2000) and earlier works on highways (Chernoff, 1978; Lichter and Fuguitt, 1980; Rephann, 1993) argued that highways have more stimulating effect to urban areas or non-urban areas near metropolises[2]. So such exclusion of rural or less urbanized areas gives us a chance to look at only regions that have been endowed carefully planned highway for their own interest and thus may have garnered naturally positive effects from transportation infrastructure along with other types of infrastructures. Metropolitan areas cover only urban areas and data has been available in such level since 1950.

MSAs have been defined and designated by the

Table 1. Population in 4 CMSAs: I-95

	1970	1980	1990	2000	2005
Boston	6,303,676	6,436,853	6,868,008	7,317,865	7,448,861
New York	19,667,848	19,077,652	19,759,157	21,402,067	21,890,199
Philadelphia	5,750,214	5,690,122	5,921,364	6,214,112	6,339,084
Washington D.C.	5,367,845	5,769,877	6,718,550	7,603,868	8,127,683

Table 2. Population in major MSAs: I-85

	1970	1980	1990	2000	2005
Raleigh-Cary-Durham	565,652	697,136	895,781	1,230,669	1,415,339
Greensboro	438,730	493,196	542,612	645,490	674,925
Charlotte	743,122	859,640	1,030,945	1,340,227	1,522,192
Birmingham	834,280	930,680	958.709	1,053,405	1,088,218
Atlanta	1,852,135	2,340,517	3,091,278	4,282,441	4,957,459

Census Bureau and the number and the borders of MSAs have changed over time, due to additions of new MSAs and suburbanization. When discrepancies exist in the study regions between the start and the end of a study period, new MSAs are excluded in the shift-share analysis. When there is geographical discrepancy over time, the bigger area becomes a standard and smaller areas are merged to one as the opposite is not feasible. As a result, the number of MSAs in our study would not necessarily match the number of MSAs existing at any given time.

The study period is from 1977 to 2005. It is determined by data availability at the metropolis level. The study period is divided into two sets, 1977-1990/1990-2005 for shift share analysis. Considering that globalization process has set in its advanced pace in 1990s, it would be proper to separate two eras of national integration and global integration in the analysis. As a result, two sets of empirical shift share analyses will be performed.

This study focuses on knowledge intensive service sectors which have recently grown rapidly in terms of both quantity and quality. Four sectors were selected and related data were arranged according to 2-digit US Standard Industrial Classification (SIC): Finance (SIC 62), Insurance (SIC 63 and 64), Business Services (SIC 73), and Health Services (SIC 80). Table 3 shows employment and wage level changes of these four sectors during the two separate study periods. Their wage level growth, which reflects labor productivity, surpasses average growth rate during last 30 years and employment growth has been quite impressive too except for the insurance sector in the second period. The finance sector's rapid development in terms of both quality and quantity is not comparable to any other sectors': employment growth was four-folded with over 200% real wage level increase during the study period.

Shift-share analysis requires only a modest amount of data, employment and GDP or value added of each unit area. Since there is no industrial GDP or value added data in metropolitan level, gross wages by industry replaces industrial GDP in the model. In national account estimation, net value added equals gross wages, pre-tax profits net of depreciation and indirect taxes less subsidies, thus gross wages would be a good proxy for output component, so long as there is not much regional variation in the ration of capital to labor. Employment and wage data were obtained from Bureau of Economic Analysis.

Table 3. Employment and wage changes in the U.S.

Growth Rate (%)	period	Finance	Insurance	Business Services	Health Services	All Private Sector
Employment	1977-1990	118.23	41.41	121.84	103.06	37.70
	1990-2005	109.28	9.65	51.99	81.88	28.20
Total wage (2000 dollars)	1977-1990	214.90	52.56	110.76	121.51	32.04
	1990-2005	231.73	49.90	79.37	84.53	47.54
Real wage per employee	1977-1990	44.30	7.89	-5.00	9.09	-4.11
	1990-2005	58.51	36.71	18.01	1.46	15.09

4. Empirical results

1) Aggregate results

A reference region in the shift-share analysis generally refers to the national economy, however, different reference regions can be also used. In a country with the size of the U.S., big regions like the 9-census division would likely have their own regional economic trends that may be inconsistent with the nation's. A famous example is the industrial shift from snow-belt to sun-belt, which might have severely affected I-95 region during the study period. To get rid of such influence and to get a clear idea how the corridor regions performed against other places located in its same general region, it would be better to downsize the reference regions that the corridors are set into. Thus the analysis is done using Northeast census division as a reference for I-95 and Southeast census division as a reference for I-85 as well as additional analyses using the entire U.S. as a common reference. The Northeast region is compromises 11 states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and District of Columbia), and Southeast region comprises 12 states (Alabama, Delaware, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia and District of Columbia).

As noted earlier, *DS* values, *DS*(*a*) and *DS*(*b*), are the center of our interest and interpretation will concentrate on those values. Positive value of *DS*(*a*) and negative *DS*(*b*) is the ideal combination: employment increase due to relatively fast growth of output and employment decrease due to relatively rapid productivity growth. Conversely, negative *DS*(*a*) and positive *DS*(*b*) would suggest unfavorable regional economic condition although it does not necessarily mean decline of the employment level.

Tables 4 and 5 summarize aggregate analysis results for two time periods with reference to the nation. During the first period, the I-85 region shows excellent performance in all four sectors, positive *DS*(*a*) and negative *DS*(*b*) indicating this region has enjoyed increased industrial demand and labor productivity growth. I-95 region also had ideal combination in finance and insurance whilst business and health services did not follow such pattern. Output of business services has not grown as expected but its labor productivity has showed relatively fast growth resulting negative regional share of employment in I-95 corridor. Health service showed exactly contrast picture of business services: higher output with lower productivity change thus increase in employment.

In the second period, regional performance of business services in I-95 corridor turned worse: they were behind average national output and labor productivity growth trends. Health services' *DS* signs have turned the opposite, both negative, suggesting less than average output growth but more efficient workforces. However, finance and insurance still perform relatively well although their employment dropped due to fast productivity growth, which may reflect this area's dominant position in world financial business sector represented by the presence of *Wall Street*. These two sectors perform well in the I-85 region too with the best combination of signs while business

Table 4. Aggregate analysis results, 1977-1990 (ref: nation)

77-90 reference : Nation	Industry	*NS*(*a*)	*NS*(*b*)	*PS*(*a*)	*PS*(*b*)	*DS*(*a*)	*DS*(*b*)
I-95	Finance	29,899	5,288	170,651	-95,500	42,786	-40,905
	Insurance	125,756	22,240	80,567	-66,033	380,386	-397,669
	Business Services	20,842	36,828	511,640	35,228	-67,693	-142,477
	Health Services	293,283	51,867	819,062	-220,820	44,240	18,002
I-85	Finance	1,245	220	7,105	-3,976	1,204	-1,758
	Insurance	19,257	3,406	12,337	-10,112	49,756	-39,439
	Business Services	24,674	4,363	60,622	4,174	102,423	-27,649
	Health Services	30,667	5,423	85,646	-23,090	92,906	-16,146

Table 5. Aggregate analysis results, 1990-2005 (ref: nation)

90-05 reference : Nation	Industry	*NS*(*a*)	*NS*(*b*)	*PS*(*a*)	*PS*(*b*)	*DS*(*a*)	*DS*(*b*)
I-95	Finance	97,732	-39,764	378,685	-211,979	119,474	-164,561
	Insurance	255,939	-104,134	12,737	-112,577	1,984,947	-2,076,881
	Business Services	585,976	-238,417	392,417	-99,084	-1,519,468	1,241,606
	Health Services	915,304	-372,411	712,247	321,368	-323,161	-52,214
I-85	Finance	3,924	-1,596	15,204	-8,511	15,231	-9,135
	Insurance	46,197	-18,796	2,299	-20,320	400,773	-396,654
	Business Services	119,612	-48,667	80,102	-20,225	-327,586	408,578
	Health Services	136,315	-55,463	106,074	47,861	39,789	23,630

services' competitiveness turned gloomy and health services' productivity has not caught up with the national average.

Tables 6 and 7 report aggregate analysis results for the I-95 and I-85 corridors against Northeast and Southeast census division respectively. Overall I-95 metropolitan areas outperformed both in terms of output and productivity with one exception: business services in the second period. Also their *DS* values turned out to be better than in the results against nation, which suggests that industrial shift to Sunbelt has negatively affected I-95 corridor's regional competitiveness during the study period. I-85's results in the first period are consistent with those against nation implying corridor metropolitan areas in I-85 have performed very well compared to their own region as well as to the whole nation. However in the second period, the picture turned not so bright in the I-85 region: *DS* values for finance, business services and health services had the worst combination of signs, negative *DS*(*a*) and positive *DS*(*b*). When the nation was in use as a reference region, finance and insurance' sectors performance appeared to be

good with ideal signs in *DS* values and even health services had better indication. This suggests that metropolitan areas in I-85 have been more competitive than national average but less than their own region reflecting fast economic development of the southeastern region in recent years especially in service sectors.

Acs and Ndikumwami (1998) pointed out that most high-technology employment changes occurring in U.S. metropolitan areas can be explained by the regional competitiveness, i.e. *DS*(*a*)+*DS*(*b*) in our model. Our results do not support their claim. In fact, regional competitiveness has the smallest of employment effect in most cases when output and productivity parts were put together. This can be simply due to the differences in study area, time period, industry selection, and data source. Different industries would result in different structural shifts, different time periods mean changes in both of national and proportional shifts, and different study areas lead to different regional competitiveness. As noticed in the above tables, there is variation of regional competitiveness across industry, time periods, and

Table 6. Aggregate analysis results, 1977-1990 (ref: region)

77-90 reference : Nation	Industry	*NS*(*a*)	*NS*(*b*)	*PS*(*a*)	*PS*(*b*)	*DS*(*a*)	*DS*(*b*)
I-95	Finance	27,556	-3,985	207,084	-120,985	8,696	-6,147
: Northeast	Insurance	115,905	-16,762	36,915	4,315	433,890	-429,016
region	Business Services	191,929	-27,757	347,480	21,934	112,780	-64,599
	Health Services	270,308	-39,092	768,169	-111,768	118,108	-91
I-85	Finance	1,245	-21	6,554	-2,473	1,755	-3,021
: Southeast	Insurance	19,257	-322	5,203	7,825	56,891	-53,648
regio	Business Services	24,674	-412	96,576	14,648	66,469	-33,348
	Health Services	30,667	-512	132,143	-26,799	46,408	-6,502

Table 7. Aggregate analysis results, 1990-2005 (ref: region)

90-05 reference : Nation	Industry	*NS*(*a*)	*NS*(*b*)	*PS*(*a*)	*PS*(*b*)	*DS*(*a*)	*DS*(*b*)
I-95	Finance	55,394	-28,236	509,485	-355,925	31,012	-32,143
: Northeast	Insurance	145,064	-73,945	481,249	-578,912	1,627,310	-1,640,737
region	Business Services	332,125	-169,297	227,404	-103,749	-1,150,604	1,177,151
	Health Services	518,784	-26,445	784,652	194,683	953	-33,495
I-85	Finance	3,938	-1,309	33,817	-22,129	-3,398	4,195
: Southeast	Insurance	46,369	-15,408	112,290	-123,857	290,610	-296,506
region	Business Services	120,057	-39,893	188,522	-87,621	-436,451	467,200
	Health Services	136,822	-45,464	154,242	43,117	-8,886	18,375

reference regions even in this study. However, if we take output and productivity changes separately, it can be argued regional competitiveness has significantly contributed to employment evolution in some industries implying regional advantage has influenced employment quality. Insurance and business services are very good examples among our four sectors. Most of their absolute values are bigger than other components' in both periods, both corridors, and both reference regions. Finance sectors' employment changes from both factors came mostly from proportional shift, which is very understandable from its more rapid growth than other industries.

2) Geography of employment changes

Even within a corridor each MSA shows different economic performance and this cannot be captured by aggregated analysis result. Spatial distribution of aggregate *DS* values is studied in this section and figures 1-4 show the sum of four sectoral *DS* values of each MSA against the corridor regions. Since different reference regions were applied, the same values in I-95 corridor and I-85 corridor do not mean the same level of regional advantage in absolute terms but in relation to their own Northeast and Southeast regions.

We have used data only from urban areas and it is commonly known that knowledge sectors perform better in metropolis enjoying both of localization and diversification economies. However, as expected from aggregated results, there are many MSAs that have showed worse performance than the regional average whilst some still showed good performance. This indicates that metropolitan areas do not always excel in their economic performance even in knowledge sectors at least in terms of employment.

A common trend is found in all MSA: business service has not had good economic performance in the second study period. In this period, no MSA has the combination of positive $DS(a)$ and negative $DS(b)$, i.e. employment growth due to output increase and employment decline due to productivity improvement. All MSAs except one, Hagerstown-Martinsburg (MD, WV), had the opposite combination implying MSAs on these two corridors no more have regional advantages in the business service sector.

During the study periods, the fastest growing MSA in terms of population are Washington D.C. in the I-95corridor and Atlanta (GA) in I-85 corridor. But their employment growth trends due to regional competitiveness are not as impressive as population growth. In the first period's maps they have good combination of output and productivity but the trend have changed to the opposite in the second half of study period in those two areas. The business service sector contributed to this change the most amongst four knowledge sectors.

From figures it is noted that Hartford (CT) had the best economic performance among all MSAs for two study periods: its $DS(a)$ has been positive and big with negative $DS(b)$ values. Such excellence stems from its significant role in insurance industry and in fact, other industries have had modest or somehow disappointing values[3]. It has played a role as an international insurance center headquartered by big insurance companies such as Travelers, Aetna, and The Hartford Financial Services Group inside or close

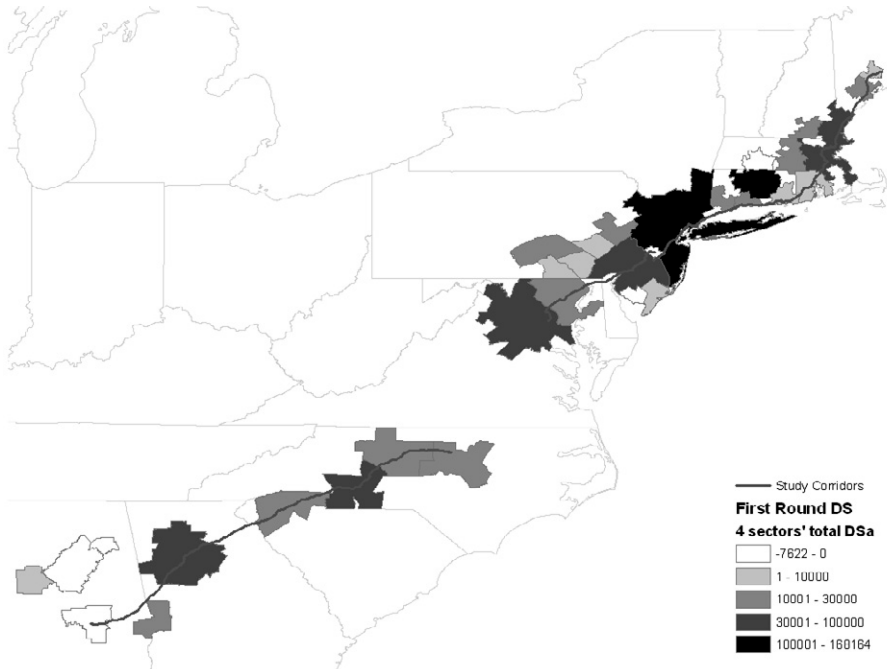

Figure 2. Differential shift (output): 1977-1990

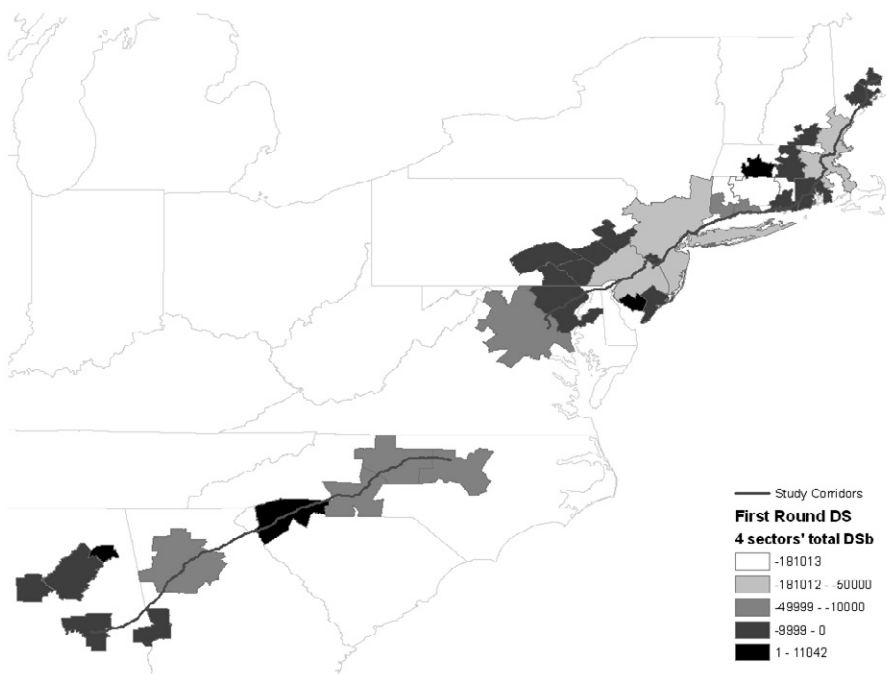

Figure 3. Differential shift (productivity): 1977-1990

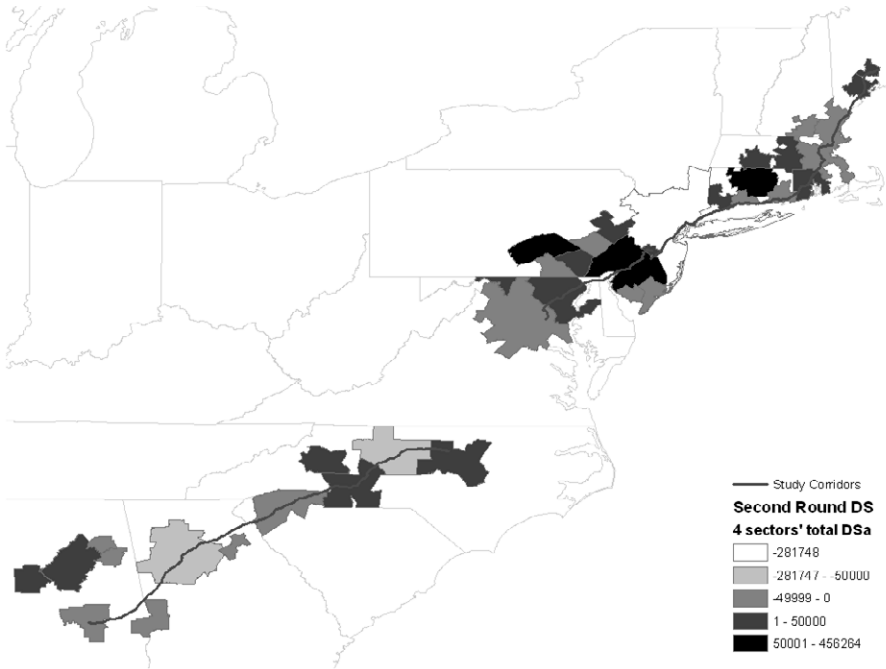

Figure 4. Differential shift (output): 1990-2005

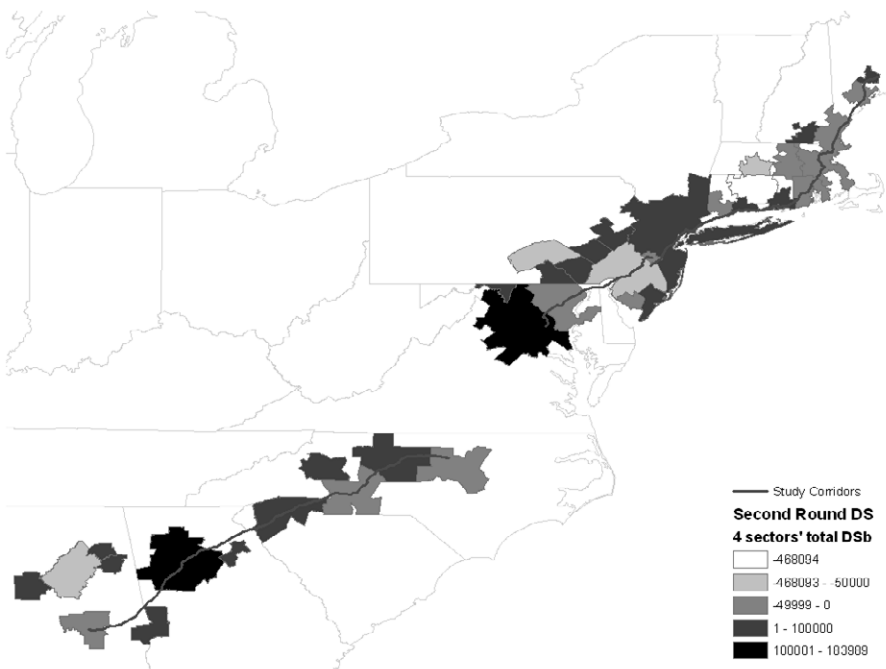

Figure 5. Differential shift (productivity): 1990-2005

to the central city. As a worldwide center of insurance industry, innovation would have begun in this region whilst improving labor productivity and creating demand. New York also showed very promising performance in insurance industry during both period, but business service sector in New York had performed badly while the other two sectors had modest or grim figures.

Boston (MA), Springfield (MA), Baltimore (MD), Philadelphia (PA), Raleigh-Durham (NC), Harrisburg (PA) and Charlotte (NC) showed good standing consistently in both terms of output and labor productivity during last 30 years. Their good standing in the later period mainly has come from finance and insurance sectors, not business or health sectors: grim performance in business services and mixed signals from health sector.

5 Conclusion

Trends in U.S. industrial structure reflect the emergence of a service economy and metropolitan areas are considered as the center of service industries, especially in knowledge intensive sectors. Using 4 selected knowledge sectors, our results revealed that MSAs have not always had better performance than national or regional averages. During the second study period (1990-2005), business services' performance was disappointing: proportional shift values suggested good industrial performance but differential shifts gave the opposite impression in both corridors against both reference units. This may simply indicate poor performance in the business service sector or the fact that this sector has been begun to shift out of study MSAs as manufacturing sector did at an earlier time. Also it might be indirectly related to diminishing economic returns of transportation networks (Nadiri and Marmeneus, 1996). Regional variation in *DS* values even after controlling the national and proportional shares could be explained by agglomeration effect. Industrial agglomeration, in which lower transport costs contribute crucially, could lead endogenous economic growth as well as higher labor productivity. With case sectors' agglomeration in a certain region, its *DS* values in those sectors should appear more promising than others. Hartford's case in previous section supports this argument. Unfortunately the shift-share analysis results do not tell much more and thus further study that covers longer period and considers agglomeration factors is required to confirm such explanations.

There are many ways to look at regional economic performance and the shift-share analysis is one of them. Using the extended model, we tried to separate productivity effect from output effect addressing employment quality issue. When regional (rather than national) reference was in use, the sums of 4 industrial *DS* values have been always positive indicating employment growth due to regional competitiveness although, the size of growth has declined significantly from the first period to the second. However this does not necessarily prove study corridors' excellence in knowledge sector performance: I-85 corridor's output and productivity values in the second period argue the opposite showing its output and productivity growth did not catch up to the regional levels. Our analysis result indicates that caution is in order when employment level is used as an economic performance indicator and the

quality of employment, as indicated by productivity, must also be taken into consideration.

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Notes

1) Although employment level is used in model description, other economic variables can be inserted in the traditional model such as income, number of establishments or value-added.
2) It is commonly believed that good transportation networks lead better connectivity and more economic opportunities, and thus better economic performances. Studies with real world data found that such positive pictures could not be applied to all regions: some of them showed negative or at least unclear economic impact in certain regions (Looney and Frederiksen, 1981; Rephann and Isserman, 1994). Two recent studies (Chandra and Thomson, 2000; Blumenthal *et al*., 2009) inform us that big cities or metropolitan areas are more likely to get benefits from better infrastructure but rural or non-metropolitan areas might get dis-benefits. The classic explanation for such deviance is that transportation networks in urbanized areas serve a greater population and thus resulted in greater comparative transport benefits than other regions (Wheat, 1969).
3) Each industry's *DS* maps are not included in the paper but they are available upon request to the authors.

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Correspondence: Yena Song, Transportation Research Group, University of Southampton, Southampton, SO17 1BJ, U.K., Tel: +44 (0)23 8059 2834, Fax: +44 (0)23 8059 3152, e-mail: Y.Song@soton.ac.uk

교신: 송예나, 사우스햄튼 대학교, 교통연구 그룹, 전화: +44 (0)23 8059 2834, 팩스: +44 (0)23 8059 3152, 이메일: Y.Song@soton.ac.uk

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미국 동부 연안 I-95, I-85회랑지대의 지식 기반 서비스업 고용 변화에 대한 연구

송예나* · 윌리엄 앤더슨** · 티알 락쉬만***

요약: 본 연구는 미국 동부 지역의 두 고속도로 회랑지대, I-95와 I-85 일대의 지식 기반 서비스업의 고용변화를 확장된 shift-share 분석을 통해 살펴보고 있다. 지식 기반 서비스업으로 선정된 산업은 금융, 보험, 비즈니스 서비스와 의료 산업이며 1977년부터 1990년, 1990년부터 2005년까지의 기간 동안의 대도시 지역이 연구 대상이다. 1977년부터 1990년 사이에는 생산량과 노동 생산성 측면에서 두 지역 모두 주변 지역 및 국가 전체 평균보다 월등한 성장세를 보였다. 그러나 1990년에서 2005년 사이에는 산업별 차이가 있었지만 평균에 미치지 못하는 성장 속도를 보이는 경우가 많이 나타났다. 또한 지리적으로 인접해 있거나 동일한 회랑지대에 위치한 대도시들도 유사한 고용 변화 패턴을 보이지는 않는다는 것이 밝혀졌다.

주요어: 고속도로 회랑지대, shift-share 분석, 지식 산업, 대도시

* 사우스햄튼 대학교, 교통연구그룹, 연구원
** 온타리오 리서치 체어, 윈저 대학교, 국경지역 교통정책
*** 보스톤 대학교, 지리-환경학과, 명예교수