ILLINOIS DEFENSE INDUSTRY
ADJUSTMENT PROGRAM

Rockford Region

Economic Composition
& Change Analysis

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UNIVERSITY OF ILLINOIS
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QUAD CITIES CHAMBER

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Nathalie P. Voorhees Center
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OEA

Introduction

The Office of Economic Adjustment (OEA), an arm of the U.S. Department of Defense, initiated the Defense Industry Adjustment (DIA) Program to assist communities in planning for adjustments and resiliency in the face of defense industry changes. As of the beginning of 2016, a project team made up of the University of Illinois Office of Vice President for Research (OVPR), the University of Illinois at Chicago (UIC) Voorhees Center, and the Quad Cities Chamber of Commerce, has begun work on the Illinois Defense Industry Adjustment Project to assess the impact of changes in defense industry spending in Illinois, and to assist impacted sectors in their efforts to develop plans and options to mitigate detrimental impacts.

The State of Illinois was ranked number 48 of the 50 states for defense spending as a percentage of total state GDP in 2014 with only 0.8% of the state GDP attributable to it. Based on a recently released report, spending increased from $5.6 billion in 2014 to $7.0 billion in 2015, ranking the state number 43 of the 50 states. In terms of actual defense spending, the state's position jumped from 23rd to 19th. Measured both as a proportion of state GDP and total spending, there is a significant increase in Illinois in 2015 ($7 billion) compared to 2014 ($5.6 billion).[1] Illinois' increased share is notable given that during the same period, total national defense spending declined from $418 billion in 2014 to $408 billion in 2015.

In Fiscal Year 2015, while $4.8 billion of total defense spending was in the form of defense contracts, $2.2 billion consisted of spending on defense personnel. Defense contracts were largely for manufacturing of Supplies & Equipment (a category with 64% of annual defense contracts). The top direct defense spending locations in the state include: Lake, Cook, St. Clair, DuPage, Rock Island, Winnebago, Peoria, and Madison Counties. These eight counties currently account for nearly $6 billion of annual defense spending in the state.

As part of the project team, the UIC Voorhees Center for Neighborhood and Community Improvement analyzes data, conducts studies, and engages with stakeholders to inform and assist impacted sectors in their efforts to develop plans and strategies. The first of these efforts involved compiling community and economic profiles which were shared with community stakeholders in five regions of the state (Quad Cities, Rockford, Chicago Metro, Metro East, and Peoria) in order to inform the direction of the state DIA Project.

The purpose of this economic composition and change analysis is to provide a deep understanding of the region's economy in terms of its current composition and to identify

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[1]Defense Spending by State reports (for FY 2014 and FY 2015) are available at http://oea.gov/defense-spending-state-fiscal-year-2015?utm_medium=email&utm_source=govdelivery. Note that Fiscal Year 2014 defense spending figures from this same source were used for the Regional Economic Profiles that have been completed for the five regions.

drivers of changes in employment. The national economy is designated as the reference region for all of the analyses conducted. A comparative understanding of a region's economy in terms of compositional change and performance informs policy makers and analysts to better position the region in the national economy.

Drawing on national data sources, the analysis focuses on three different, but interrelated regional economic issues.

Regional Economic Diversity: Analysis of the current distribution of employment among industries demonstrates the degree to which the regional employment base depends on a few large industries and indicates the potential of the local economy to diversify industrially over time. We develop an economic diversity index by comparing the share of each industry in the local economy with the share of that industry in the national economy. The diversity index is constructed at different levels of aggregation (2-Digit NAICS and 3-Digit NAICS) to check the robustness of the findings. In addition, the index is calculated for two points in time (2005 and 2015) to examine whether the local economy is becoming more or less diversified over time relative to the nation.

Regional Industrial Specialization: This analysis identifies industry sectors in which the regional economy is specialized relative to the national economy. For this purpose, we calculate employment-based location quotients (LQs). In addition to indicating how specialized a local economy is relative to the larger economy, location quotients are essential in determining the economic base of a local economy. In the analysis of LQs, particular attention is given to specific manufacturing and professional/technical services industries in which businesses may be performing defense contract work or are part of the defense industry supply chain.

Drivers of Regional Employment Change: We analyze all industry sectors at the 3-Digit NAICS level for employment change from 2005 to 2015. A shift-share analysis is conducted to better understand how the local area economy is changing, and in which industries it is competitive. By disaggregating the portions of change that result from local factors versus broader changes in the national economy or in the particular industry, the shift-share analysis sheds light on the sources of growth and decline in regional industrial employment.

This analysis covers the two-county Rockford region that consists of Boone and Winnebago Counties. Unless otherwise indicated, regional data are defined using these geographies. Additional notes on definitions and data sources may be found at the end of this document. If there are any questions, please contact Yittayih Zelalem, Co-director of the Nathalie P. Voorhees Center for Neighborhood & Community Improvement at the University of Illinois at Chicago at 312-996-6674 or e-mail at: yittazel@uic.edu.

Economic Diversity

- Relative to the national economy, the regional economy is less diverse. This is to be expected, as the United States economy often is considered a standard for industrial diversity.

- Regional industrial diversity declined from 2005 to 2015. While there are numerous possibilities for why this decline in diversity may have occurred, the trend towards less diversity throughout the regional economy may indicate movement away from the objective of resiliency.

- A lower diversity index at the 3-Digit NAICS industry level suggests employment at this level of aggregation is less evenly distributed across industries than employment at the 2-Digit NAICS industry level. This is normal—greater aggregation tends to smooth out differences across industries.

Index of Economic Diversity		
	2005	**2015**
2 Digit NAICS	0.7771	0.7111
3 Digit NAICS	0.7120	0.7042

Regional Industrial Concentration

- Four out of ten regionally concentrated industry sectors are manufacturing sectors (a reflection of the fact that manufacturing accounts for over 20% of local employment).[2]

  The following three industries and businesses operating in these industries are either performing defense related contract work or are part of the defense industry supply chain: Machinery manufacturing (NAICS 333); fabricated metal products manufacturing (NAICS 332); transportation equipment manufacturing (NAICS 336). Besides being regionally concentrated, these three industries are major sources of employment in the region. Together, they accounted for two thirds of total manufacturing employment and nearly 17% of total regional employment in 2015.

- Three of the industries (indicated with symbol † below) are regionally concentrated based on both employment and establishment counts. For these three industries, regional employment per establishment is greater than the equivalent national ratio. The employment-to-establishment ratio for regional transportation equipment manufacturing (NAICS 336) is more than twice the size of the national ratio. This industry at the regional scale is probably dominated by relatively large firms (e.g., Chrysler, GE Aviation Systems LLC, UTC Aerospace Systems, etc.). The average size of establishments may have implications for the strength of the region's relationship with defense industry and prospects of growth. Industries that are heavily concentrated within large firms may wield greater political or supply chain power. Yet this may also mean the local strength and health of the industry is dependent on the fortunes of just a few firms, often businesses that are not owned or led locally.

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[2] Regional Economic Profile, 2016 prepared by the University Illinois-Nathalie P. Voorhees Center-Quad Cities Chamber DIA Team.

Concentrated Regional Industry Sectors: Employment-Based LQs[3]

NAICS Code	Industry	Region	U.S.	LQ
333	Machinery manufacturing†	7,817	1,115,478	6.76
336	Transportation equipment manufacturing†	8,563	1,643,368	5.03
332	Fabricated metal product manufacturing†	7,517	1,456,264	4.98
492	Couriers and messengers	1,537	603,287	2.46
493	Warehousing and storage*	1,838	831,905	2.13
442	Furniture and home furnishings stores*	828	467,050	1.71
335	Electrical equipment and appliance mfg.†*	647	381,635	1.64
711	Performing arts and spectator sports*	668	466,984	1.38
561	Administrative and support services*	11,528	8,445,060	1.32
452	General merchandise stores	4,334	3,213,467	1.30
Total Employment with Data Suppression		**131,968**	**139,473,615**	**N.A.**
Total Employment without Data Suppression		**144,605**	**139,491,699**	**N.A.**

* Industries for which employment data at the regional level are suppressed. LQs are likely underestimated for these industries.

[3] Note that regionally concentrated industries are identified in this analysis by LQs exceeding 1.25.

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Components of Regional Employment Growth

- The region is not performing as well as the national average. The national growth component (regional shift in the box below) shows that, if the local economy's growth rate were identical to that of the national economy, then the number of jobs in the region should have grown by 8,933 between 2005 and 2015. However, the region lost 3,801 jobs from 2005 to 2015.

- The industry mix component of -1,256 means that the region has nearly 1,256 less jobs than it would have if its structure were identical to the nation. The local industrial composition is weighted toward industries that are growing more slowly than the national average.

- According to the local share component, a shift of -11,478 jobs in the Rockford Region are attributable to its relative competitive position. That is, a loss of more than eleven thousand jobs is attributable to characteristics specific to the local economy.

> **Regional Shift (RS) = 8,933**
> **Industry Mix (IM) = -1,256**
> **Local (Competitive) Shift (LS) = -11,478**

- Figure 1 below graphically summarizes the results for individual industries. In this graph the location quotient (the employment concentration relative to the nation) appears on the vertical axis and the regional component of the change in employment from 2005 to 2015 appears on the horizontal axis.[4] The size of the circles represents current employment levels. Industries that appear in the upper right quadrant (high LQ-high competitive shift) represent solid strengths. For example, transportation equipment manufacturing (NAICS 336) and warehousing and storage (NAICS 493) are both regionally concentrated and growing locally faster than the national industrial average. Positive competitive shifts suggest that local factors, specific to the Rockford Region, contributed to the growth of the industry.

- Industries that appear in the upper left quadrant (high LQ-low competitive shift) represent current industrial strengths that are struggling. Two regionally concentrated manufacturing sectors (machinery manufacturing, NAICS 333 and fabricated metal products manufacturing, NAICS 332) and the largest local sector by employment (administrative and support services, NAICS 561) are located in this quadrant. Negative competitive shifts mean that these industries are not growing at the same rate as the

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[4] The minimum possible LQ value is 0. The vertical axis is extended for illustrative purposes.

national industrial average. In fact, because employment in NAICS 332 is declining at the national level, a negative competitive shift for this industry indicates that it is declining faster regionally than nationally.

- Industries that appear in the lower right quadrant (low LQ-high competitive shift) represent potential emerging local industrial strengths. By employment size, these industries are relatively small but are growing faster than national industry trends suggest. Only one of the industries in this quadrant is in the manufacturing sector (beverage and tobacco product manufacturing, NAICS 312).

- The lower left quadrant (low LQ-low competitive shift) is the least interesting of the four quadrants. Industries that appear in this quadrant are not regionally concentrated and the local economy does not exhibit a competitive advantage to support employment growth in these sectors.

- In order to see the quadrant locations for all industries clearly, Figure 2 replicates the information from Figure 1 without taking industry size into account and excluding outliers (industries with LQ > 2 or competitive shift > 150%). According to Figure 2, the greatest number of industries are located in the lower left quadrant. However, a considerable number of industries are located in the upper right and lower right quadrants of the graph. Industries such as food manufacturing (NAICS 311), wood product manufacturing (NAICS 321), chemical manufacturing (NAICS 325), nonmetallic mineral manufacturing (NAICS 327) represent solid strengths while paper manufacturing (NAICS 322), merchant wholesalers, non-durable goods (NAICS 424), telecommunications (NAICS 517), and amusement, gambling, and recreation show emerging local industrial strengths.

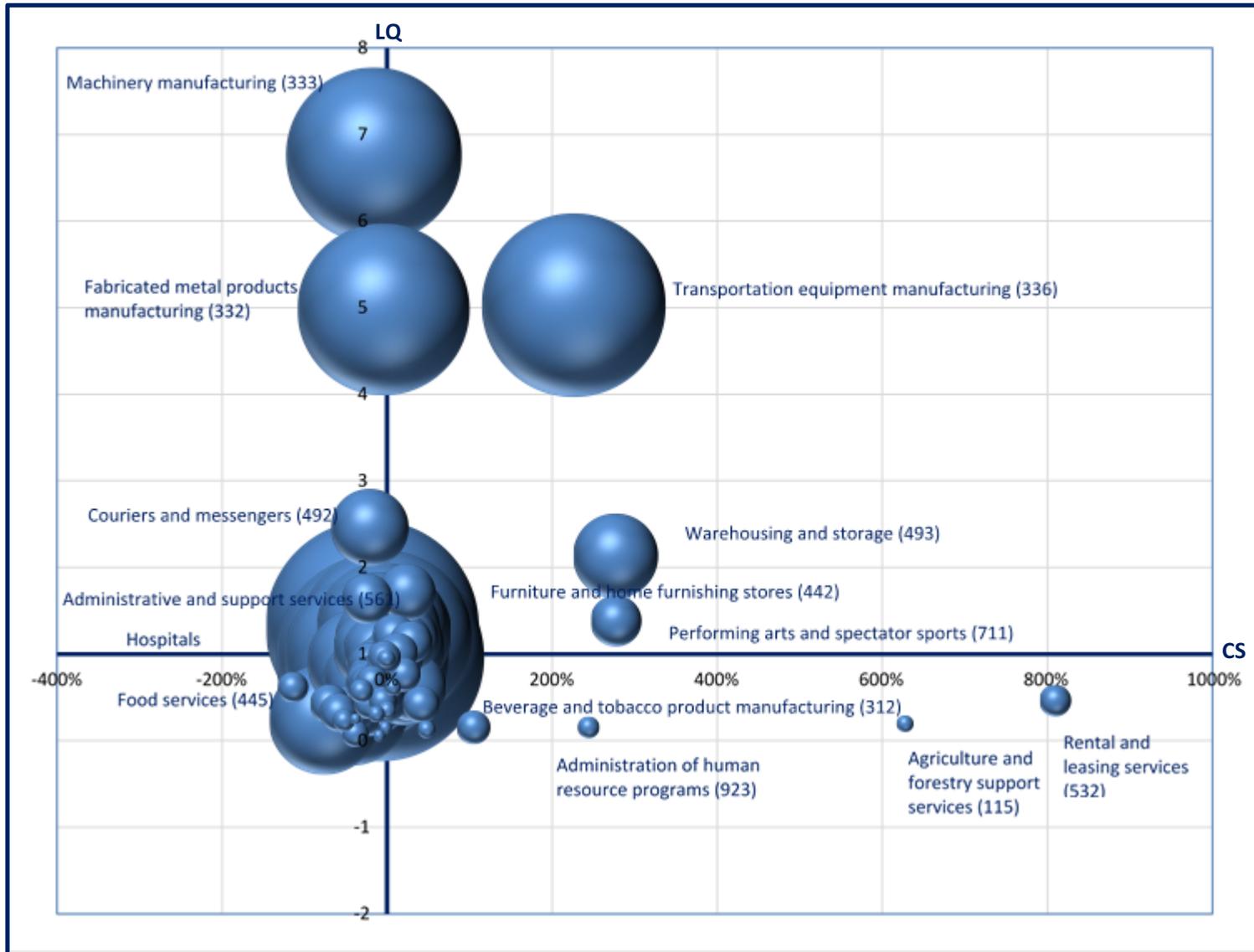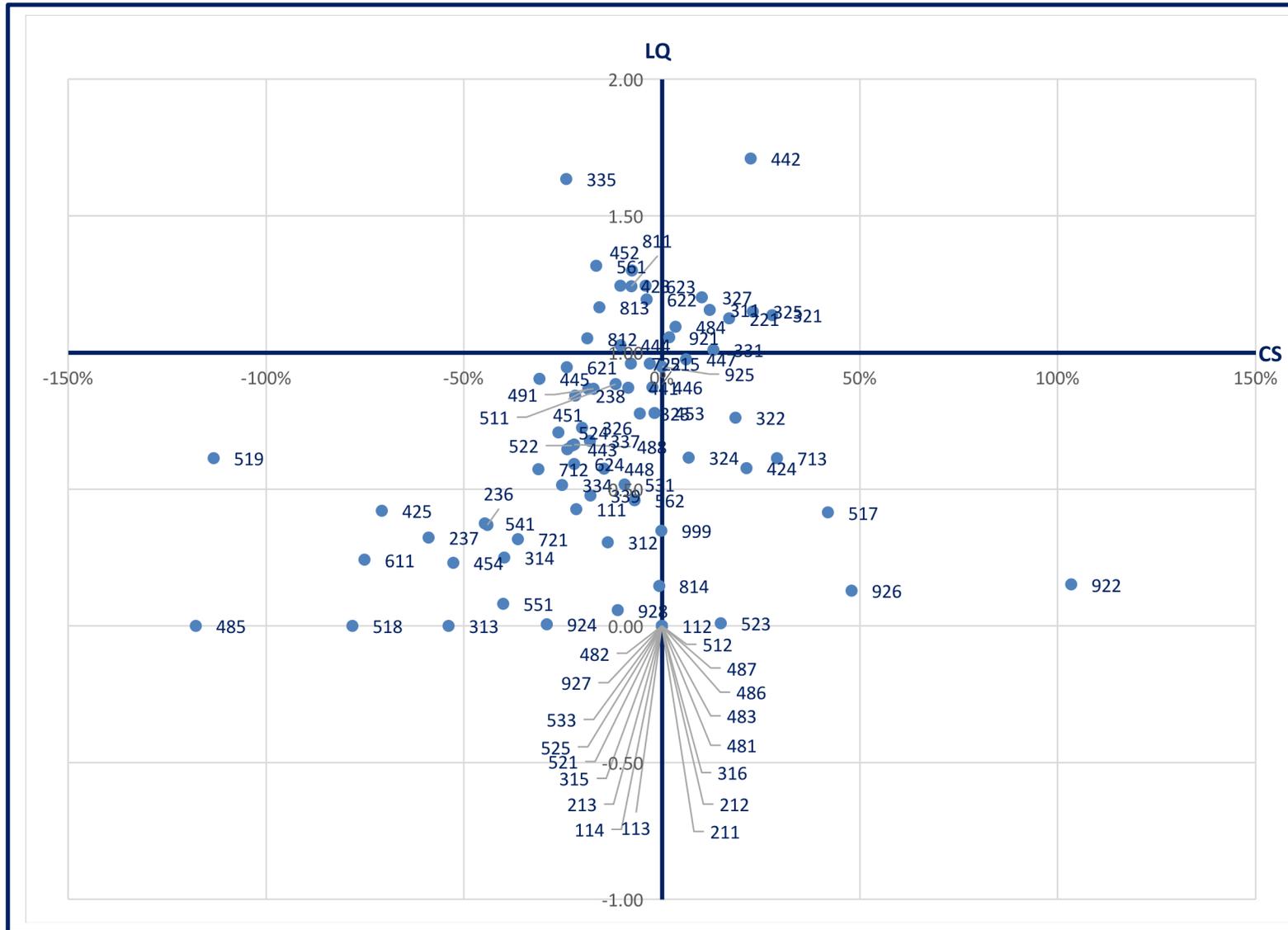**Figure 1: Regional Concentration and Regional Effects**

Figure 2: Regional Concentration and Regional Effects

Appendix: Definitions, Methods & Data Sources

Index of Diversity

The diversity index is a summary measure that indicates how similar the local employment distribution is to the employment distribution in the national (reference region) economy. Diversity is not necessarily the absence of specialization, but rather reflects the presence of multiple specializations.[5] The use of the index as a summary measure of regional diversity is appealing in regional economic analysis because of its ability to collapse a large amount of information into a single representative figure.

$$\textbf{\textit{Gini}} \; = \sum_i x_i \; y_{i+1} - \sum_i x_{i+1} \; y_i$$

$$\textit{Index of Diversity} = 1 \text{ - Gini}$$

Where:

i = industry

x = cumulative employment for study area

y = cumulative employment for reference region

range: [0,1]

Gini = 0 (ID=1) → highly diversified

Gini = 1 (ID=0) → highly specialized

Location Quotient (LQ)

Location quotient is an economic analysis technique used to identify the concentration of an industry sector in a local economy relative to a larger reference economy. The LQ can be considered as an index of specialization indicating the expected share of an industry in the local area given the size of this industry in the reference economy. For example, if a regional economy has 15% of its employment in the manufacturing industry and the nation (reference economy) has 10% of its employment in manufacturing, the location quotient is the ratio of first percentage to the second percentage, or 1.5 (0.15 is divided by 0.10). In addition to indicating how specialized a local economy is relative to the larger economy, the location quotient is essential in determining the economic base of a local economy. Although LQ values greater than 1 mathematically indicate local concentration, industries with LQs greater than 1.25 are interpreted in this analysis as substantially regionally concentrated. These are industries that are likely to be part of the export base of the region, the further growth of which will stimulate the overall economy.

The formula for calculating the location quotient is as follows:

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[5] Wagner, J.E. (2000). Regional Economic Diversity: Action, Concept, or the State of Confusion. *The Journal of Regional Analysis and Policy*, 30(2): 1-22.

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$$LQ = \left(\frac{e_i}{e_t} \right) \div \left(\frac{E_i}{E_t} \right)$$

Where:

e_i = local employment in industry i

e_t = total local employment

E_i = reference (national) employment in industry i

E_t = total reference (national) employment

Besides employment, location quotients can be calculated using establishment counts. The location quotient is a static measure, depicting an industry at only one point in time. Therefore a single LQ measurement does not reflect whether an industry sector is growing or declining in importance relative to the local economy.[6]

Shift-Share Analysis

Shift-share analysis is a major tool for analyzing the changes in a local economy. Similar to the application of LQ, shift-share entails designation of a reference economy (state or nation). However, differently from the LQ, shift-share analyzes change over time, essentially disaggregating the growth of an industry into three contributing parts: (1) changes due to overall national growth, (2) changes due to growth or decline nationally in a particular industry, and (3) changes due to local factors particular to the study area.[7]

Reference Region Shift, also called the national growth effect, explains how much of the growth in a regional industry is attributable to overall growth of the national economy. It is based on the observation that national economic expansion or recession affects the entire economy.

Industry Mix Term represents the share of regional industry growth explained by the growth of the specific industry at the national level. Industries that are growing faster than the overall national economy are more likely to proportionally contribute to the growth of a regional economy. Thus, this component identifies industries whose local concentrations or deficits are contributing to the growth or decline of the overall regional economy.

Competitive Shift, also called the local or differential shift, is the difference in the rate of growth or decline in a local industry relative to the rate of growth or decline in that same industry nationally. This shift is the most interesting and useful of the three shifts. It explains how much of the change in a given industry is due to competitive advantages or disadvantages that the region possesses. A positive local shift means that employment in a regional industry is growing faster

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[6] Blakely, E.J. and Leigh, N.G. (2010). *Planning Local Economic Development: Theory and Practice*. 4th Edition. Sage, Thousand Oaks, CA.

[7] Shuffstall, W. Economic and Community Development. Penn State Extension. http://extension.psu.edu/community/ecd/understanding-economic-change-in-your-community/shift-share-analysis-helps-identify-local-growth-engines (Accessed July 20, 2016).

than the employment in that industry nationally or that the regional decline is less than the national decline. [8]

Because shift share analysis deals with job growth over time, a time frame (start year and end year) is required to perform shift share analysis.

$$\Delta L_i = RS_i + IM_{i+} + CS_i$$

$$RS_i = \frac{R_A^t - R_A^{t-1}}{R_A^{t-1}}$$

$$IM_i = \left(\frac{R_i^t - R_i^{t-1}}{R_i^{t-1}} - \frac{R_A^t - R_A^{t-1}}{R_A^{t-1}} \right)$$

$$CS_i = \left(\frac{L_i^t - L_i^{t-1}}{L_i^{t-1}} - \frac{R_i^t - R_i^{t-1}}{R_i^{t-1}} \right)$$

Where:
RS = reference region shift, IM = industry mix term, CS = competitive (local) shift, i = industry, A = all of economy, t = current time period, $t-1$ = previous time period

Employment Data
The QCEW employment count is a total derived from quarterly contribution reports filed by almost every employer in the U.S., Puerto Rico and the U.S. Virgin Islands. It counts only filled jobs, whether full or part-time, temporary or permanent, by place of work. The quarterly reports include the establishment's monthly employment levels for the pay periods that include the twelfth of the month. Because the QCEW data are based on an establishment census which counts only filled jobs, it is likely that a multi-job holder will be counted two or more times in QCEW data.

The U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW).
http://www.bls.gov/cew/datatoc.htm

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[8] Blakely, E.J. and Leigh, N.G. (2010). *Planning Local Economic Development: Theory and Practice*. 4th Edition. Sage, Thousand Oaks, CA.