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A Benchmarking Study of the Lehigh Valley

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by

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Executive Summary

This study benchmarks the Lehigh Valley to nine other metropolitan areas within the United States. These areas represent a wide array of economic growth levels. Charlotte, Portland, Seattle, and Nashville represented high growth cities. Minneapolis and Lancaster represented moderate growth cities. Hartford, Flint, Rochester and the Lehigh Valley represented low growth cities.

Three analyses attempted to identify reasons for economic growth. The study period included the years 1970 through 1995. All three analyses looked at regional growth relative to the nation. A study of each region's industry mix compared the diversity of this mix to the overall employment growth of the region. This study also included an analysis of high technology industry, which entailed studies of its presence, its growth and its relation to income growth for each city. The final analysis studied employment growth relative to the nation for specific industry components within each city.

Industry diversity analysis identified a strong correlation between diverse economies and high employment growth. The Lehigh Valley showed lower than predicted employment growth, based on the diversity of its industry mix. High technology analysis identified a strong presence of high technology industries within low growth regions. This analysis also identified a strong relationship between positive high-tech industry growth and high growth regions. The Lehigh Valley showed lower than predicted income growth, based on its growth in high-tech industry. Analysis of the industry components showed positive growth in almost all high growth region industry components; a mix of growth and decline in moderate growth region industry components; and declines in almost all low growth region industry components. The Lehigh Valley's industry components showed growth similar to that of the other low growth regions.

The relationship between industry diversity and employment growth may be due to changes in national industry trends. Regions that are more diverse may be able to absorb shocks and react to major shifts in national trends better than regions that specialize in one or more industries. The hypothesis suggests that cities will lie along a curve that correlates higher growth to a more balanced array of industries. Conversely, lower growth will correlate to a more variable mix of industries, or a mix that exhibits specialization in one or more industries.

The study notes that presence of high technology industry alone does not foster economic growth. Growth may instead correlate to a constant stable growth of regional high-tech industries relative to the nation.

The Lehigh Valley does not follow the patterns of either relationship identified. One of two hypotheses may explain this phenomenon. The first of these suggests that the Lehigh Valley is currently in a transitional state, heading toward higher growth rates powered by an increase in the chemical manufacturing industry and a shift towards a more diverse industry mix. The converse to this hypothesis suggests that the Lehigh Valley belongs as an outlier to the identified trends due to the lackluster growth of its industry components and/or non-economic factors that are not a part of this study.

Further analysis of the trends identified here should include a study of a much larger sample size. Research should also look into the true causality of these trends. Two specific avenues of future research include studies of the true affects of industry diversity and of the regional demand for

high-tech industry. Additional research may also look into other factors, both economic and non-economic, which may affect growth and do not appear in this study.

Introduction

The Lehigh Valley, like other northeastern metropolitan areas, has undergone stagnant growth compared to the rest of the nation in recent decades. Both income and employment growth have lagged behind national averages since 1970. Conversely, cities of the south and western regions have experienced significant growth levels in the same span of time. This growth may be a function of the industry mix of the local area. Divergence from national industry mix trends may indicate reasons for low growth rates. The level of high-technology industry may be a contributing factor to economic growth. Finally, a breakdown of industry growth by sector may indicate reasons for either high or low economic growth.

A benchmarking study of the Lehigh Valley and a selection of cities representing a spectrum of growth levels to the United States may indicate how the above factors may affect these regions. A range of high growth regions will indicate trends that the Lehigh Valley may hope to imitate in their development decisions. Comparisons of the Lehigh Valley to other low growth regions will indicate differences the Valley may wish to focus on and similarities it may wish to avoid. This study indicates where the Lehigh Valley stands nationally, notes its industrial strengths and weaknesses and provides aid in development decisions for the Lehigh Valley Planning Commission.

Background Research

This study focused on nine metropolitan areas chosen based on their expected economic growth rates. Charlotte (NC), Seattle (WA), Portland (OR), Nashville (TN), Minneapolis (MN), and Lancaster (PA) were chosen based on expectations of growth rates higher than the national average. Rochester (NY), Flint (MI) and Hartford (CT) were chosen based on expected growth rates below the national average. The Lehigh Valley was the tenth study area; its growth was expected to be lower than the national average. Figure 1 depicts the location of each study area.

The primary source of data was the Bureau of Economic Analysis' Regional Economic

Information System, produced by the U.S. Department of Commerce. This data includes information provided by both the BEA and Census Bureau. It consists of income and employment data arranged regionally. These bureaus disaggregated data for both Total Full and Part-Time Employment and Personal Income. Figure 2 depicts the breakdown of Personal Income by earnings. A similar disaggregation existed for Total Full and Part-Time Employment. Personal Income data included a further breakdown of its Private Earnings components (i.e., Manufacturing, Retail, etc.) This breakdown made possible the high-tech analysis portion of this study.

A study of the industry mix of each region used data for Total Employment. This study includes calculations of each industry's regional share. Location quotient analysis, discussed later, allows a comparison of these shares to the national norm.

The findings of Markusen et al. (1986) form the basis for the high technology analysis. These findings classify 29 manufacturing sectors as high technology, based on the percentage of advanced occupations they included. Examples of these occupations include engineers, physicists, chemists, mathematicians, and natural scientists. Identification of five non-manufacturing industries as high-tech related came from a correlation of these industries' presence to a large agglomeration of high technology manufacturing. This study's analysis used the BEA's Personal Income data for both the manufacturing sectors and the non-manufacturing industries.

The final part of this study uses a simplified version of a shift-share analysis. The complete form of this analysis appears in McDonald (1992). This analysis factors out regional growth due to national trends allowing a more accurate representation of an industry's regional growth.

General Analysis

This study compiled data for Personal Income and Full & Part Time Employment. The study years included the following: 1970, 1975, 1980, 1985, 1990, and 1995. Analysis involved a regional breakdown by county. Cities whose metropolitan area extended significantly into bordering counties included multiple counties. This study aggregated income and employment data for those regions with multiple counties. Table 1 depicts a list of the study counties used.

Analyses of industry diversity, high technology agglomeration and regional industry growth use the growth in either personal income or total employment as a comparison. Figures 3

Table 1. County composition of selected metropolitan areas.

City	Counties
Charlotte, NC	Mecklenberg*, Gaston, York (SC)
Flint, MI	Genesee
Hartford, CT	Hartford
Lancaster, PA	Lancaster
Lehigh Valley, PA	Lehigh, Northampton
Minneapolis, MN	Hennepin
Nashville, TN	Davidson*, Rutherford, Sumner, Williamson
Portland, OR	Multnomah*, Washington, Clackamas, Clark (WA)
Rochester, NY	Monroe
Seattle, WA	King*, Snohomish

* Indicates central county, where applicable

and 4 show the percent growth in employment and income, respectively for the period 1970-1995.

These figures identify Seattle, Nashville, Charlotte, and Portland as high growth regions. Moderate growth best describes both Minneapolis and Lancaster, while the Lehigh Valley, Hartford, Rochester and Flint are all low growth regions. This data correlates well with preliminary expectations, save for the success of Lancaster. As a northeastern city, it should

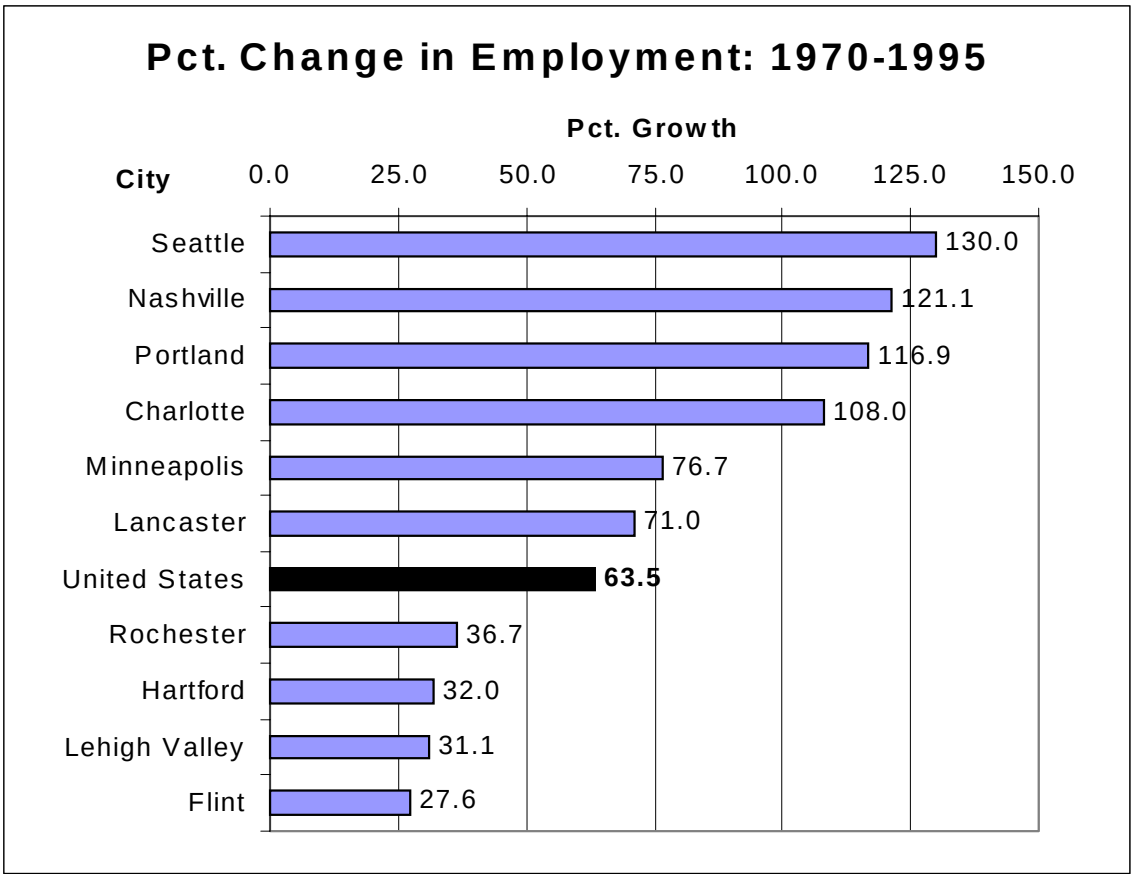


Figure 3. **Employment growth of selected cities, 1970-1995.**

follow that Lancaster would experience less than average growth due to the older, more evolved nature of these metropolitan areas. For this reason, this study considers Lancaster a moderate growth region, since its growth is significantly higher than would be expected. Also, this study has an emphasis on the Lehigh Valley, since the purpose of this study is to compare its growth to other regions.

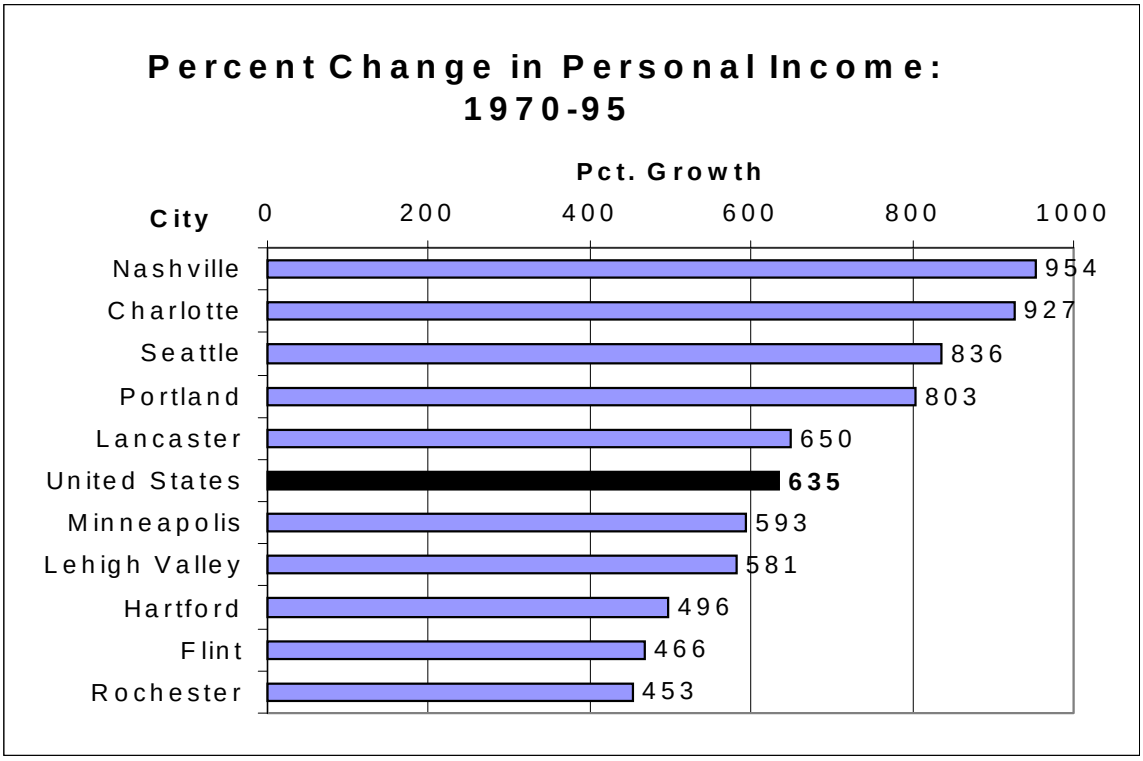


Figure 4. Personal income growth of selected regions, 1970-1995.

Industry Diversity

Methodology

Initial calculations identified each industry's percent share of total employment for all ten cities and the United States. Each five-year interval included these calculations as well as a location quotient for each industry. *Location quotients* are an excellent indicator of a specific industry's degree of regional specialization. A full explanation of the location quotient appears in McDonald (1992). For this study, the location quotient divides the percent share of total employment for a city's given industry by the percent share of total employment for that industry nationally. It can be written mathematically as

$$LQ = \% E_i / \% E_{US}$$

A location quotient of one would indicate that an industry's regional share of total employment matched the national share (i.e., the region has 100% of the national employment share for that industry). Location quotients greater than one indicate a relative regional specialization in that industry. For example, a location quotient of two would indicate that a region has 200%, or double, the national share of a given industry's employment. Similarly, a location quotient less than one indicates lower than average employment share for a region's given industry.

Analysis included location quotients for all private industries and government. Graphs depict the results for the largest industries (as defined by the national shares) in each region. These graphs catalogue each city for both 1970 and 1995 to display the industry mix of each region.

Further analysis examined the diversity of each city's industry mix. A weighted average calculated the mean location quotient for each region. The next step calculated the location quotient variance for each city. This variable identified the average deviation from the mean for each city's industry mix. A weighted version of the variance represented each industry's share of total employment, providing a more realistic comparison. Cities with diverse industry

employment have a low variance while cities that highly specialize in an at least one have a high variance.

Finally, a comparison of employment growth from 1970 to 1995 and the variance of each city's 1995 industry mix shows any correlation between the two variables. Regression analysis identifies the best linear relationship for the data of each city. A statistical tool known as the R^2 coefficient measures the strength of the relationship between the variance of the location quotient and the growth in employment.

Results

Figures 5a and 5b identify the national breakdown of industry shares for 1970 and 1995 respectively. Nationally, there is a significant decrease in the share of manufacturing. This occurs simultaneously with a large increase in the share of services. The share of government employment also decreases from 1970 to 1995.

Figures 6 and 7 show the industry shares for the largest industries in 1970 and 1995, respectively. Location quotients act as the indicator of each industry share. Clusters of industry mixes identify each metropolitan area.

In 1970, nearly all study cites had manufacturing and finance, insurance & real estate (FIRE) shares higher than the national average. All areas classified as high growth also had shares of the construction industry either equal to or greater than the national average share. In 1995, regions classified as low growth still showed greater than normal shares of manufacturing and/or FIRE, and significantly lower than normal shares of the construction industry. Areas with high employment growth show a distinct balance of nearly all industries in 1995. All study cities showed lower than average shares for government in both years.

Regression analysis of employment growth versus a weighted variance of 1995 location quotients identified a strong correlation between them (Figure 8). The weighted variance was the

independent variable, while the percent growth in employment was the dependent variable. Most cities lie along a logarithmic trendline. The R^2 for this line was 0.5845, meaning that 58.45 % of

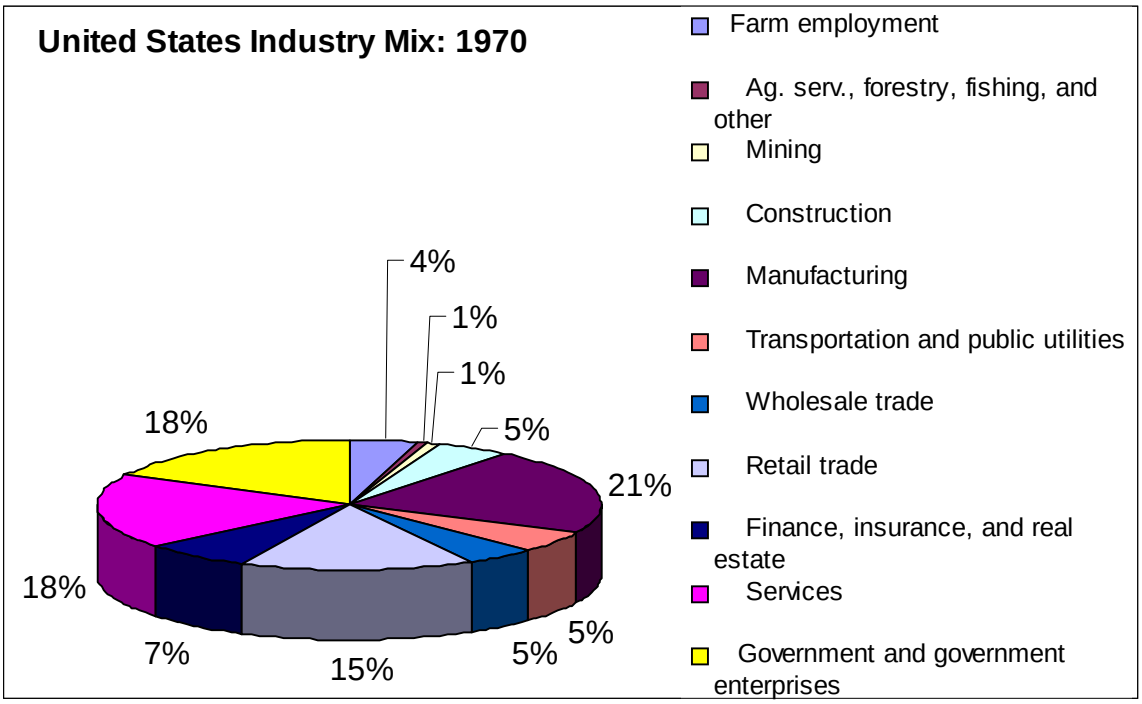


Figure 5a. **United States Industry Mix, 1970; based on percent share of total employment.**

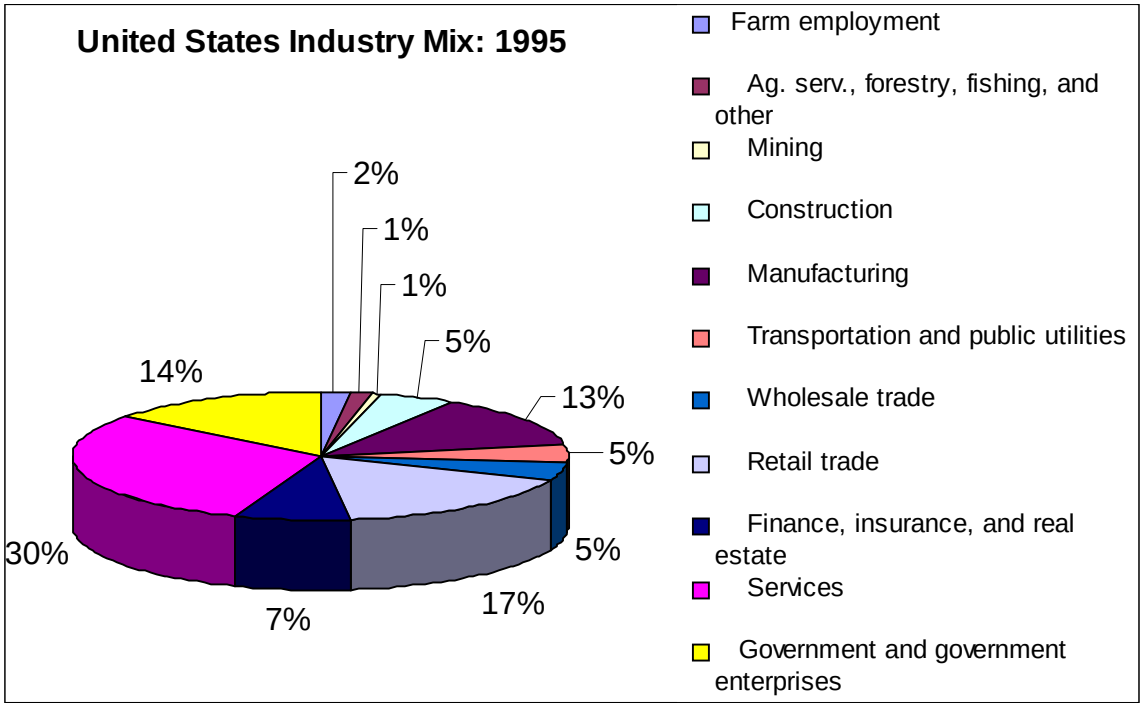
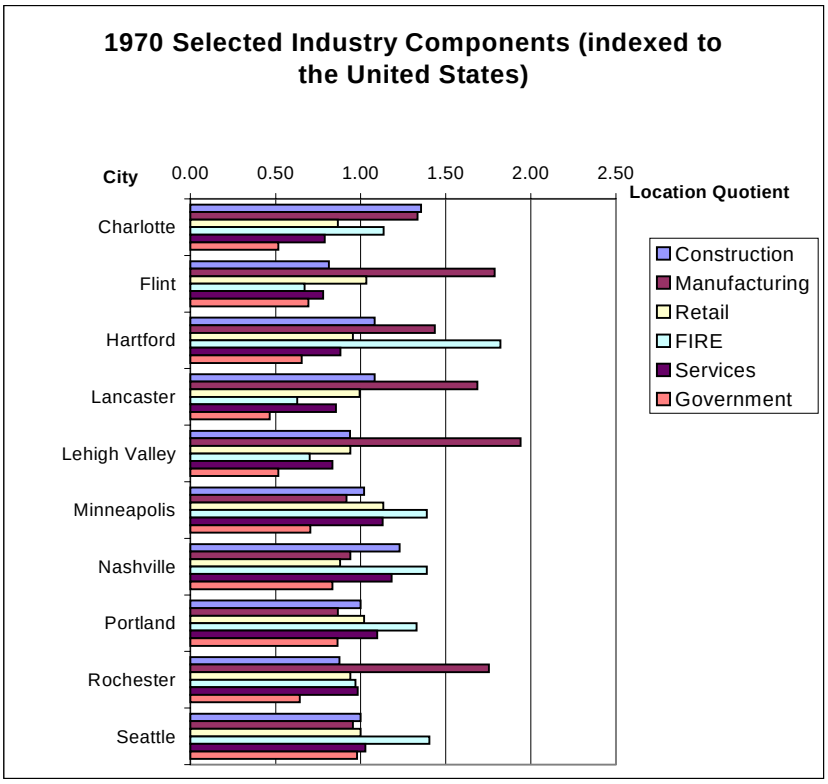
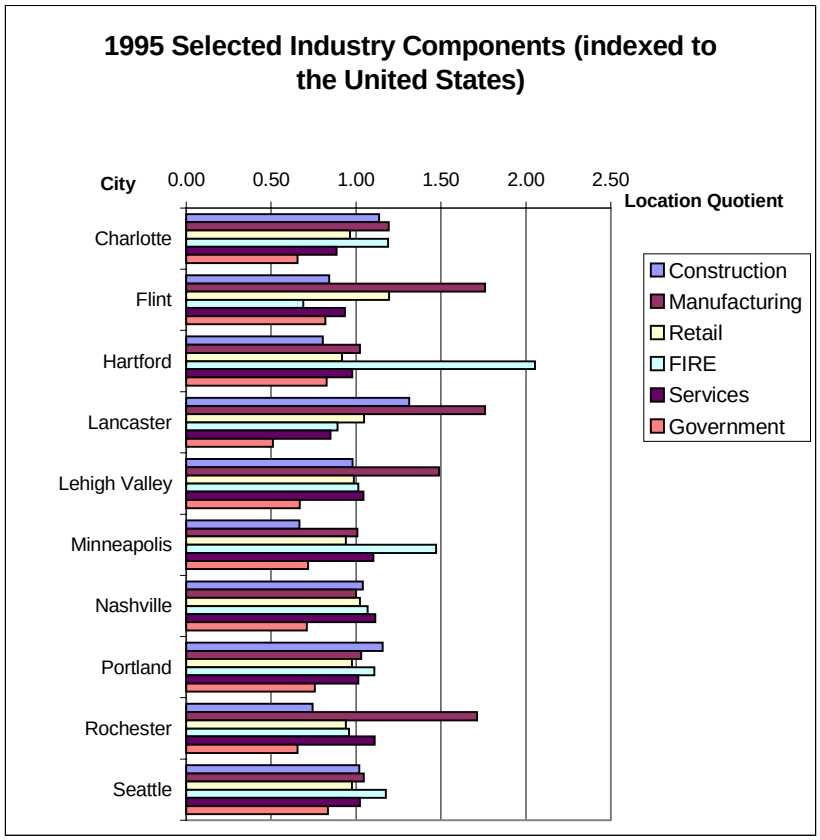


Figure 5b. **United States Industry Mix, 1995; based on percent share of total employment.**





Figures 6 (top) and 7 (bottom). Listing of each study city and a selected cluster of industry location quotients for each, for 1970 and 1995, respectively. Selections include industries with the highest shares of total employment nationally, plus Construction, which can be an indicator of growth in a region.

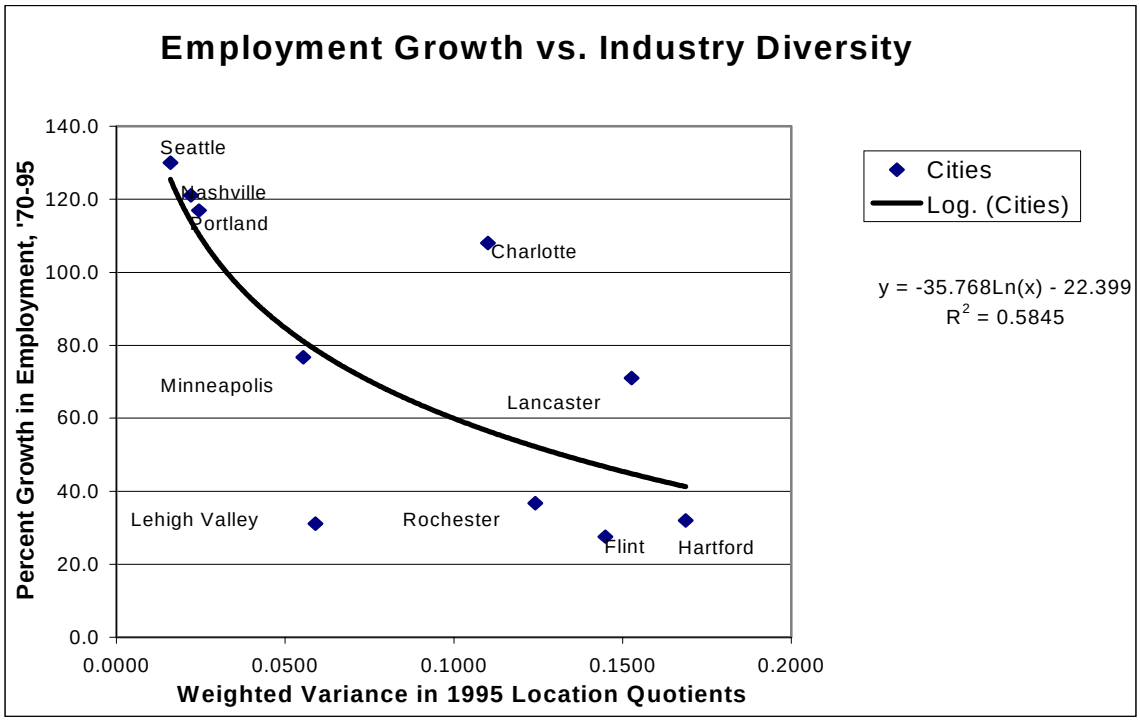


Figure 8. Comparison of percent growth in total employment from 1970 to 1995 to the weighted variance of each city's bundle of location quotients.

a variation in employment growth from 1970 to 1995 can be explained by the variation in weighted variance of its location quotients. One important note is that the sample size for this analysis was relatively small (n = 10). This small sample size cannot sufficiently identify a strong correlation. The true value of the coefficient (i.e., the true strength of the relationship) will surface only after analyzing a larger sample size. For this case, R^2 = 0.5845 represents a reasonably strong correlation. However, the existence of several outliers (i.e., the Lehigh Valley, Charlotte and Lancaster) suggests that this coefficient may change significantly, either higher or lower, if a future analysis included more cities.

The Lehigh Valley, Charlotte and Lancaster represent the three regions that lie farthest from the curve. Both Charlotte and Lancaster exhibit higher than predicted growth based on the weighted variance of their location quotients. The Lehigh Valley is the only area in the study

group that displays growth significantly lower than that predicted by its location quotient variance.

High Technology Industry

Methodology

Analysis done by Markusen et al (1986) defined a basket of 29 manufacturing sectors and five non-manufacturing industries as high technology or high technology related. The Markusen et al. study disaggregated each manufacturing industry into their 3-digit SIC codes, (defined as sectors.) The highest percentages of engineers, mathematicians, physical scientists and natural scientists within each sector defined industrial sectors as high technology. Markusen's study used the top 29 manufacturing sectors for its high technology analysis. That study also identified a correlation between the location of the 29 manufacturing sectors with a presence of five non-manufacturing industries.

The present study aggregated each manufacturing sector into its 2-digit SIC code. Two-digit SIC income and earnings data was the most detailed information available for this study. A multiplier for each aggregated industry identified the portion of high technology present within it. This multiplier reflected the percent of total high-tech employment in that industry at one of two years: 1981 (the conclusion of the Markusen study) or 1995 (the latest available data). These multipliers allowed higher accuracy at the aggregated level. Similar multipliers estimated the impact of the high technology related industries for the same years. These multipliers reflect an estimation of the percent of that industry used by the manufacturing industry. Estimations come from the percent shares each industry holds nationally. Table 3 lists the 2-digit industries used and the multipliers calculated for each.

High technology analysis included the use of the location quotient. This location quotient used personal income data rather than employment data. There were three categories used for the study of high-tech earnings: high-tech manufacturing, high-tech services, and total high

technology. All three categories had their location quotients calculated. Analysis focused on 1970 and 1995 to normalize it to the remainder of this study. The study charted location quotient trends from 1970 to 1995. These trends identified changes in each category for all ten cities.

2-Digit SIC Code	Multiplier Method	Industry Name	1981 Multiplier	1995 Multiplier
28	A	Chemicals and Allied Products	0.9973	0.9992
29	A	Petroleum Refining	0.6639	0.6438
35	A	Industrial Machinery and Equipment	0.6563	0.4311
36	A	Electronic and Other Electrical Equip.	0.7579	0.7168
37	A	Transportation Equipment	0.4475	0.3335
38	A	Instruments and Related Products	0.9163	0.9611
High-Tech Related Industries				
45	B	Transportation by Air	0.27	0.19
48	B	Communications	0.27	0.19
73	C	Business Services	0.35	0.32
82	D	Educational Services	0.70	0.60
87	-	Engineering and Management Services	Not Classified	1.00

Table 3. List of the 2-digit industries used in this study and the multipliers used to account for the conclusions found by Markusen et al. (1986).

Methods:

$A = \Sigma(Emp_{3\text{-digit industry sectors}}) / Emp_{2\text{-digit industry}}$

$B = Emp_{manuf} / \text{Total Emp} - (Emp_{agro} + Emp_{construc} + Emp_{mining})$

$C = Emp_{manuf} / \text{Total Emp} - (Emp_{agro} + Emp_{construc} + Emp_{mining} + Emp_{services})$

$D = \Sigma(Emp_{3\text{-digit collegiate educ. sectors}}) / Emp_{educ.\ services}$

A regression analysis plotted the absolute change in total high-tech industry's location quotient from 1970 to 1995 versus the percent growth in personal income over the same period. Each city represented a point on a scatter diagram.

Results

Cities classified as low-growth for this study exhibited the highest location quotients for both high-tech manufacturing and total high technology industries. High-tech manufacturing location quotients for all low growth cities averaged between 2.30 and 2.61. Total high-tech location quotients averaged between 1.58 and 2.14. Conversely, high growth cities exhibited significantly lower location quotients for high-tech manufacturing and total high-tech industry. High technology manufacturing remained stable relative to the nation throughout the study period

for the high growth cities. The average location quotient ranged from 0.77 to 0.90. Location quotients for total high technology also remained stable relative to the nation over this period, ranging from 0.83 to 0.91.

High technology services was the only category in which the high growth cities displayed a greater presence than the low growth cities. High growth cities exhibited average service location quotients between 0.87 and 1.01. Low growth service location quotients were slightly lower, ranging between 0.74 and 0.89. Table 4 summarizes a ranking of the ten cities by high technology presence relative to the nation.

Rank	City	1970 Total High-Tech LQ	1995 Total High-Tech LQ
1.	Rochester, NY	3.55	2.81
2.	Flint, MI	2.00	1.42
3.	Hartford, CT	1.54	0.88
4.	Minneapolis, MN	1.22	1.08
5.	Seattle, WA	0.92	0.85
6.	Lehigh Valley, PA	0.91	1.19
7.	Nashville, TN	0.90	0.94
8.	Lancaster, PA	1.12	0.64
9.	Charlotte, NC	0.62	0.90
10.	Portland, OR	0.65	0.95

Table 4. Cities Ranked by their average location quotients over the study period and their location quotients at the beginning and the end of the study.

Figure 9 compares the 1995 total high-tech location quotient to the percent growth in Personal Income over the study period. High growth cities have relatively low high-tech location quotients. Minneapolis has a high-tech location quotient just above one, while Lancaster has the lowest high-tech location quotient. All low growth cities, save for Hartford, have high-tech location quotients well above one. Regression analysis of this relationship yields an $R^2 = 0.3454$. The outlying nature of Rochester from the rest of the data may skew this moderate correlation, leaving the inverse relationship between high-tech specialization and income growth in need of further study.

A comparison of personal income growth to the change in the total high-tech study period identified a stronger correlation (Figure 10). The R^2 for this linear relationship equaled 0.533. Low growth cities, while still maintaining high high-tech location quotients overall, faced a significant decline in them over the study period. Conversely, the high growth cities exhibited positive high-tech location quotient growth during this time.

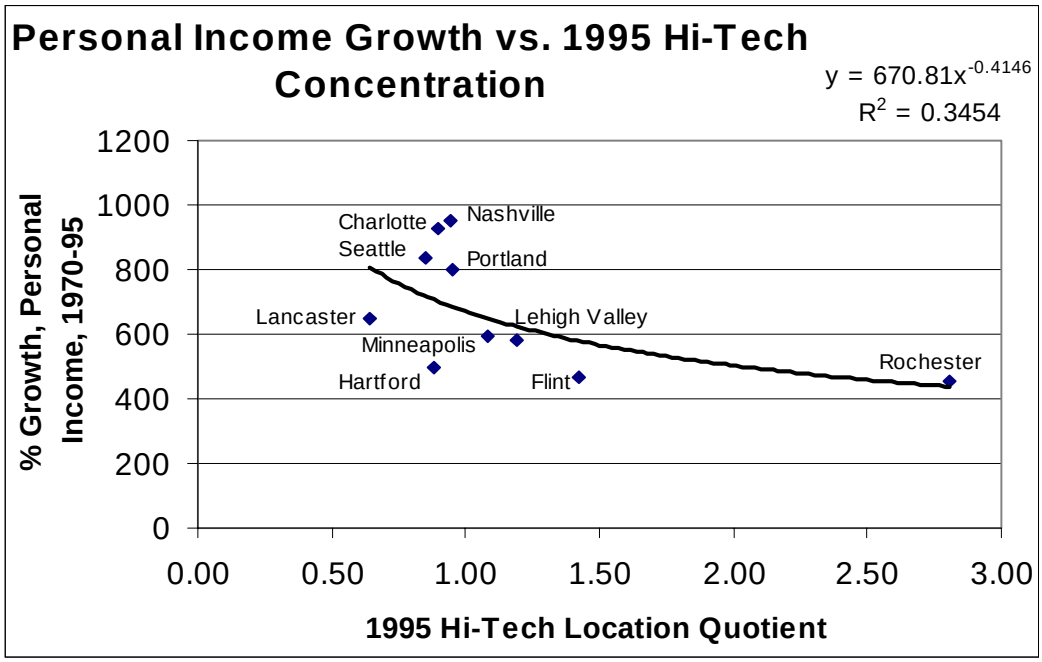


Figure 9. Comparison of personal income growth from 1970 to 1995 versus the 1995 high-tech location quotient for each city.

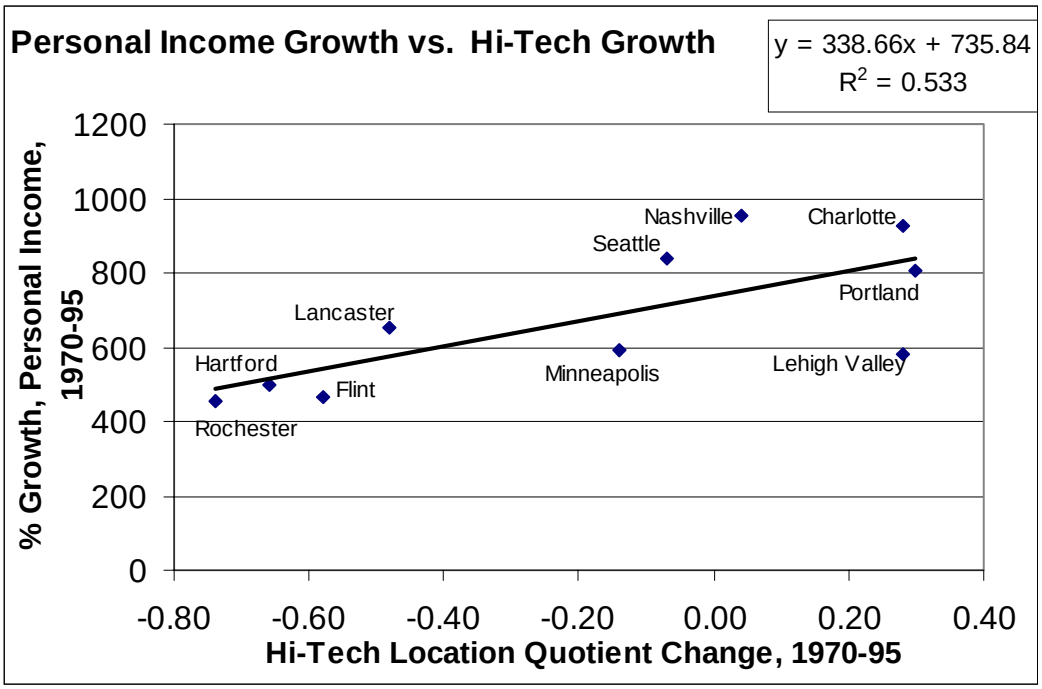


Figure 10. Comparison of the percent growth in personal income to the change in the high-tech location quotient from 1970 to 1995.

The Lehigh Valley is the only study city that does not follow this trend in any way. It has seen substantial growth in its high-tech location quotient, but has had income growth on par with the low growth areas. Note, however, that the majority of this growth came between 1990 and 1995 (+ 0.55). From 1970 to 1990, the Lehigh Valley experienced a decline in its high-tech location quotient comparable to that of the other low growth cities (- 0.27).

Breakdown of Growth by Industry Component

Methodology

This portion of the study involved a simplified *shift share analysis*. A complete description of this type of analysis appears in McDonald (1992). This study's simplified shift share subtracts the national employment growth from each industry's regional employment growth for the period 1970 to 1995This yields a measure of the regional industry's growth relative to national growth. These relative shares show how much growth, above or below the

national growth rate, the industry of a particular area is experiencing. This data is also useful in determining what sectors may be causing either growth or decline in a region. Ultimately, this analysis can benchmark the Lehigh Valley's true relative growth to the true relative growth of other regions.

Results

Figure 11 details the adjusted relative growth rates for the ten study cities. Based on this data, high, moderate or low growth again classifies each city. The linear nature of this analysis predicts that this classification will be to identical those outlined in the General Analysis. However, the values for each city now give a more explicit interpretation, relative to the national average, of the city's level of growth. Table 5 categorizes the cities by their general level of growth. High growth regions still exhibit a relatively high percentage of growth. However, moderate growth areas are now much closer to zero-growth, while low growth areas now correlate to negative growth.

High Growth Cities (Pct. Change in total employment = 44% to 66% higher than natl. growth)	*Seattle* *Nashville* *Portland* *Charlotte*
Moderate Growth Cities (Pct. Change in total employment = 7.5% to 13% higher than natl. growth)	*Minneapolis* *Lancaster*
Low Growth Cities (Pct. Change in total employment = 27% to 36% lower than natl. growth)	*Rochester* *Hartford* *Lehigh Valley* *Flint*

Table 5. Classification of study cities based on the simplified shift share analysis.

Figure 12 illustrates the adjusted percent growth in employment from 1970-95 for the Lehigh Valley, Minneapolis, and Charlotte. Charlotte clearly shows the highest relative rates of growth for its industries. This correlates with its classification as a high growth city. Charlotte also exhibits its highest growth in industry components with the highest shares of total

employment. Minneapolis's industry sector demonstrates mixture of both positive and negative relative growth, mimicking its moderate overall growth. The Lehigh Valley lags significantly behind the national rate of overall growth. Similarly, almost all of its industry components display negative adjusted growth. However, it has modest relative growth in three of its largest industry components (Government, Services, and FIRE).

Figure 13 compares the Lehigh Valley to Lancaster. This figure is useful in that it gives a direct comparison of two areas with similar geographical features. The Lehigh Valley has either higher growth or a smaller decline than Lancaster does in almost every industry component. It outperforms Lancaster in all the major industry components, with the greatest differences in services and FIRE. This data contradicts the information presented in Table 5, which infers that Lancaster should have higher growth than the Lehigh Valley for the majority of its industry components. Based on these growth classifications, Lancaster should have a mix of growth and decline similar to Minneapolis.

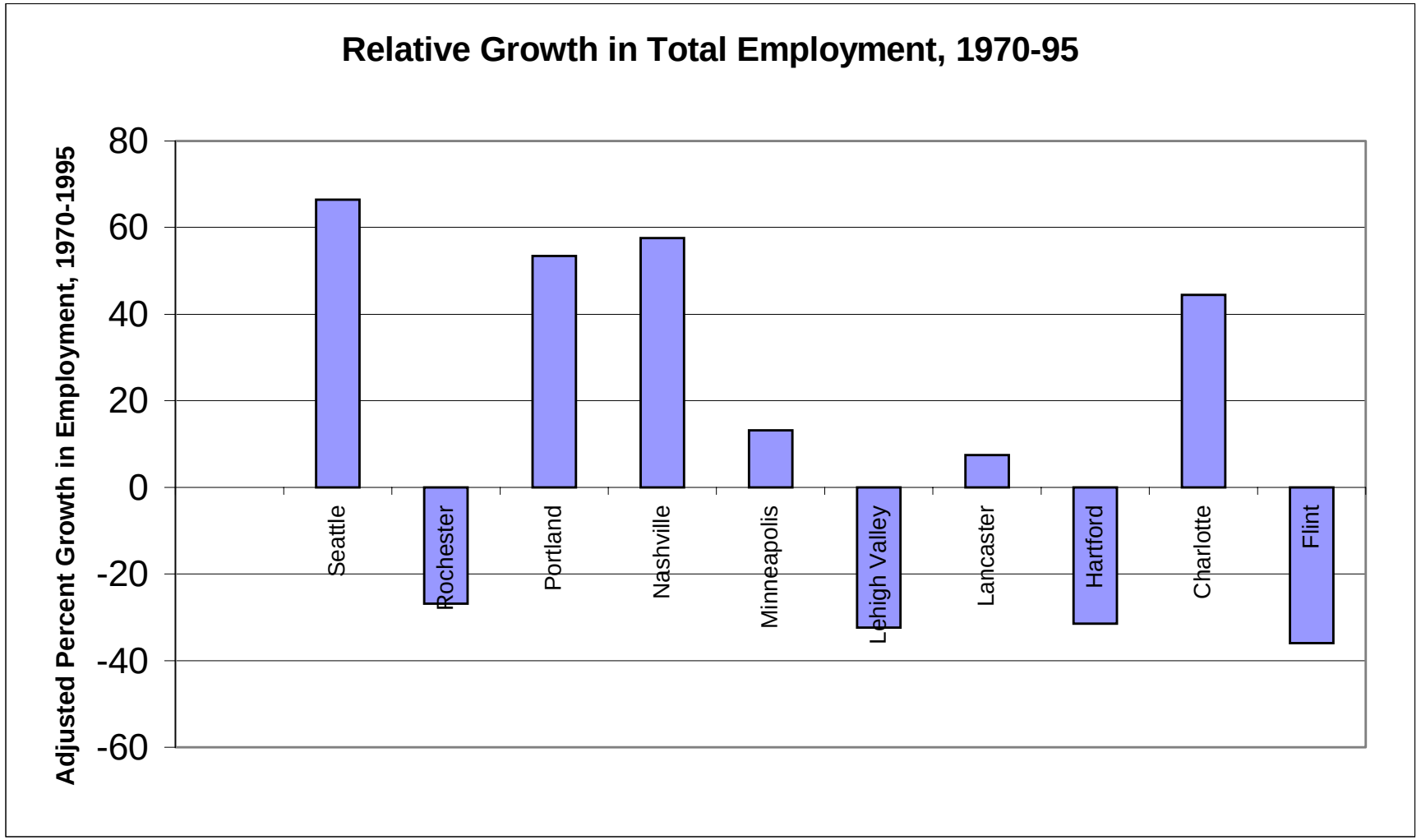


Figure 11. Total Full and Part-Time employment growth for 1970-1995.

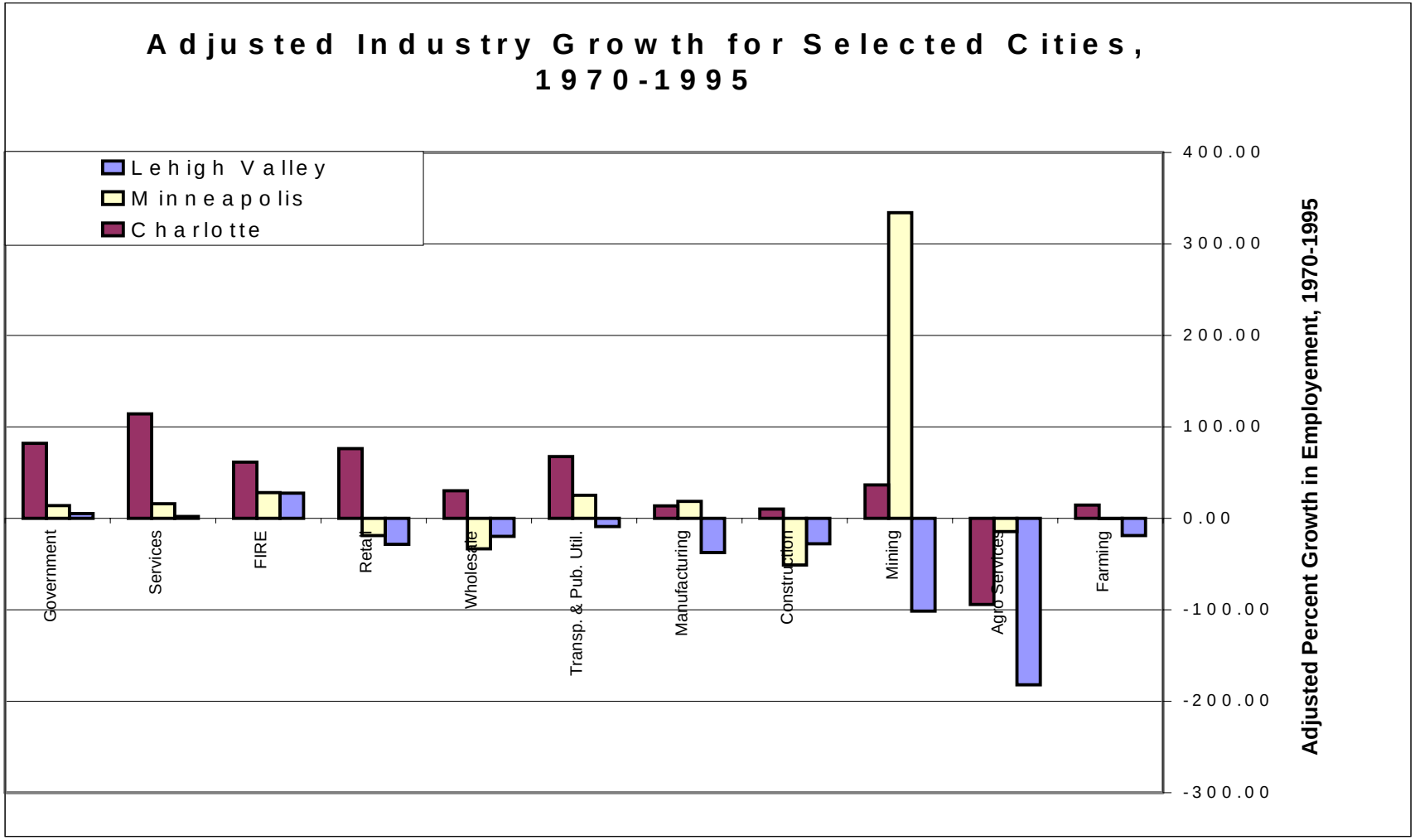


Figure 12. Adjusted percent growth in industry employment for selected cities, 1970-1995.

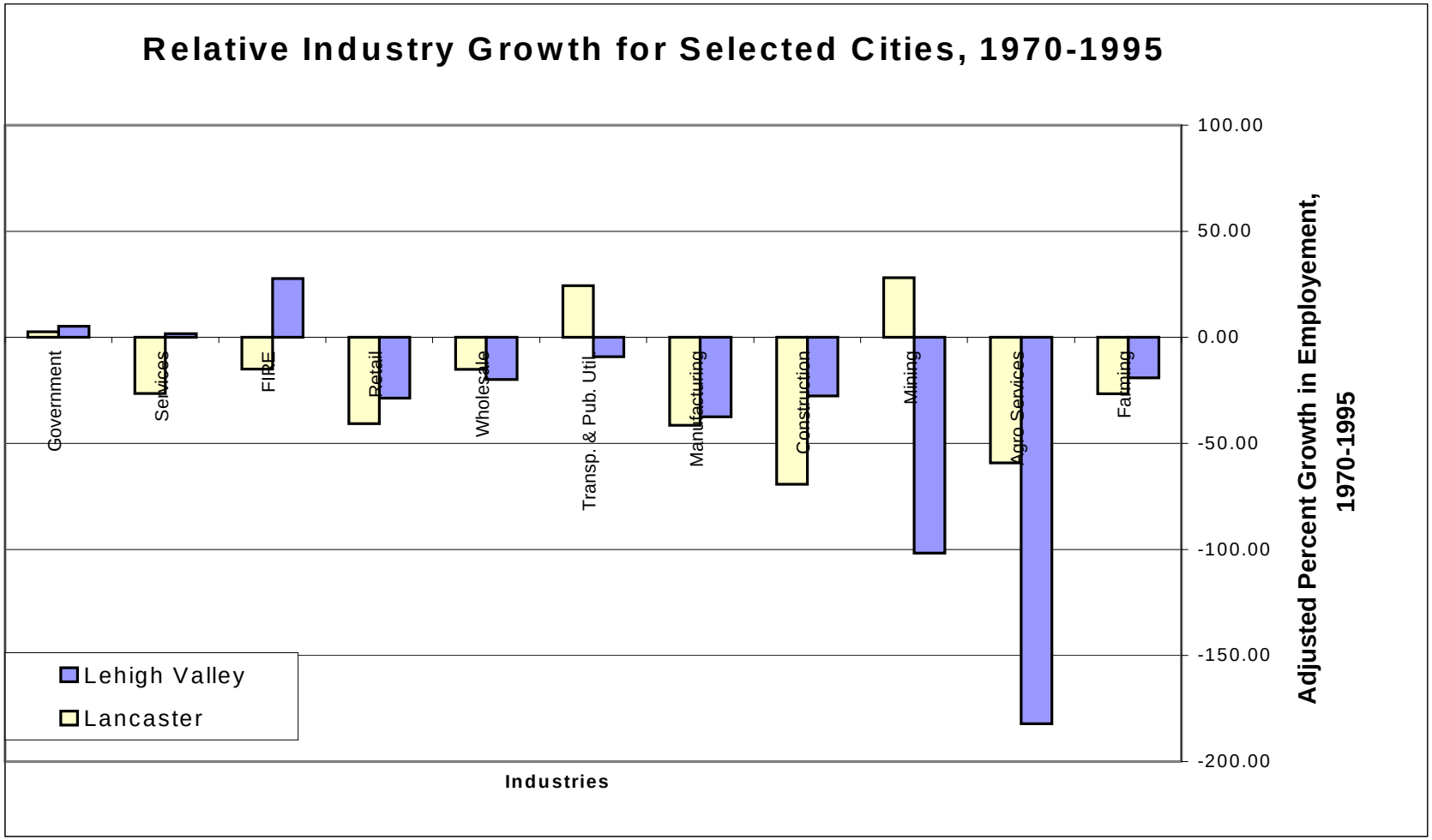


Figure 13. Adjusted percent growth in industry employment: Lancaster versus the Lehigh Valley, 1970-1995.

Discussion

Explanation of Findings

The most notable finding of this study is the correlation of industry diversity to employment growth. A strong relationship indicates that higher growth regions have a diverse mix of industry components that mimic national trends. Conversely, lower growth regions express trends of specialization in one or more of its industry components. The causality of this relationship is unclear (i.e., it cannot be determined if diversity causes growth or growth causes diversity.) It may be that both variables are dependent on a third and the true cause driving both of them is the shift in industry trends nationally.

The reasoning for this hypothesis is as follows. A combination of the industry diversity simplified shift share analyses indicate that high growth regions feature both diversity in their industry mix and high growth throughout the majority of their industry components. The highest growth is in industry components with the highest shares of total employment in 1995. These components include services, retail and FIRE. Conversely, low growth areas exhibit specialization in only one or two components. In addition, this specialization is usually in manufacturing, the industry component that has experienced the greatest decline nationally from 1970 to 1995. Figure 12 identifies the Lehigh Valley as having only modestly higher than average growth in services and decent relative growth in FIRE, but also having significant relative declines in all other industries, especially in manufacturing, its largest industry component. By specializing in only a few industry components, these low growth areas are more susceptible to decline if national trends ever change. Figures 5a and 5b clearly indicate that this was the case for the 1970-95 period. A major shift occurred from the manufacturing to services and retail. Following the hypothesis, areas either already specializing in services (Figure 6 shows this to be a rare case) or undeveloped enough to easily shift towards service and retail industries would be able to capitalize on this shift. Consequently, areas specializing in manufacturing that

are too developed to easily shift their industry mix (a common case for the northeastern "rustbelt" regions) could not react to this national shift and would suffer from poor growth as a result. As the nation continued to change structurally, diverse regions would be more prone to growth than specialized regions. By having a wide range of industries whose presence mimics national trends, these diverse areas increase their probability of realizing significant growth.

An excellent analogy to this hypothesis is the logic behind an individual holding a diverse financial portfolio, such as a mutual fund. An individual who holds equity in a may realize excellent short-term gains. However, this stock may be volatile in the long run, causing his gains to be negligible, or even negative, in the long run. Conversely, an individual with a diverse portfolio such as a mutual fund may never realize high short-term gains, nor may he realize large short-term losses. In the long run, the portfolio's diversity reduces the investors risk and gives him a much better chance for a return on his investment than if he had invested in only one form of equity.

The presence of high-technology industries is the other major variable that showed a strong correlation to growth, in this case income growth. The data displayed a significant trend for the location quotients of high-tech industries and their relation to the growth of a city. Low growth cities typically displayed a high location quotient for high-tech industry, while high growth cities show the opposite. This may be explained by a dual analysis with results of the industry composition. Low growth areas have very high location quotients for manufacturing, the largest component of the high-tech industry location quotient. It is quite possible that the high location quotient in total manufacturing spills over into the results of the high-technology analysis.

Figure 10 indicates that low growth areas also showed the greatest decline in their high-tech location quotients from 1970 to 1995. A dual analysis with the simplified shift share results may explain this decline. Again, the trends of total manufacturing many have spilled over into

the high technology analysis. Low growth areas exhibit a decline in most industry components, especially manufacturing. This decline may be the cause of the negative location quotient growth seen in Figure 10.

Regardless of a possible spillover effect from the manufacturing industries, the high technology analysis features a very strong correlation. It identifies a positive relationship between personal income growth and the change in the high-tech location quotient over time. A strong linear trend identifies declines in the high-tech location quotient with low growth cities and increases in the high-tech location quotient with high growth cities. This may indicate that it is not the presence, but rather the growth of high technology industries that contributes to the economic growth of a region. The Lehigh Valley is the only significant outlier for this relationship. The discussion of the next section suggests possible reasons for this.

Implications for the Lehigh Valley

This study identifies several distinct trends that may explain reasons for growth, or a lack thereof, for metropolitan areas. However, the Lehigh Valley seems to act contrarily to each of these trends. One of two hypotheses may explain this phenomenon.

The first hypothesis has a positive tone. The Lehigh Valley exhibits characteristics of higher growth cities in both the industry diversity and in the high technology analyses. This may imply that the conditions needed for the Lehigh Valley to experience higher growth may already be in place. This hypothesis suggests that the Lehigh Valley is currently in a transitional period and will realize high growth in the near future.

This study found data that supports this claim. Figure 10 portrays the Lehigh Valley as having high-tech industry growth similar to the high growth cities. However, further analysis of the data shows that this growth came entirely during the 1990-95 period. Prior to this time, the high-tech location quotient of the Valley declined steadily. If Figure 10 depicted the 1970-90 change in the Lehigh Valley high-tech location quotient instead, it would show the Valley lying

along the curve near the other low growth regions. The major cause in high-tech growth from 1990 to 1995 was a large increase in the income of the Chemicals and Allied Products industry. This growth almost doubled the high-tech location quotient over the five-year span. If the positive correlation between high-tech industry growth and total economic growth holds true, the addition of these chemical industries should, over time, raise the Lehigh Valley's growth to levels comparable to Charlotte and Portland.

The diversity of the Lehigh Valley's industry mix also suggests that it should be experiencing higher growth. Figure 8 shows a strong logarithmic relationship between most study cities. However, the Lehigh Valley deviates from this relationship. It has much lower growth for its diversity than what the trend predicts. Again, this may be due to a current transitional period for the Lehigh Valley. Although most of its industry components show a decline relative to national growth, it does have significant relative growth in finance, insurance and real estate, as well as modest relative growth in both services and government. It may be that the Lehigh Valley has been able to diversify over time, but has not yet been able to enjoy the growth due from this level of diversification.

The second hypothesis is not as optimistic. It predicts that the Lehigh Valley is not in a transitional period. This hypothesis states that the Valley lies exactly where it belongs in both Figures 8 and 10, and that some disadvantage inherent in the region may be the cause for this growth below predicted levels. Data from Figure 12 supports this second hypothesis. The Lehigh Valley has relative declines in almost all of its industry components. Although it has some relative growth in services, FIRE and government, it has large relative declines in retail, wholesale, construction, and manufacturing. Although the region experiences great industry diversity, consistent declines and meager growth throughout its industry profile counteract this advantage. These declines may suppress any opportunity the Valley has to achieve its predicted economic growth.

Figure 13 provides further support for the less optimistic hypothesis. Although the Lehigh Valley exhibits higher relative growth in its industry components than Lancaster does, it displays significantly lower overall growth. This may indicate that something other than the industry composition is also affecting growth in the Valley. One suggestion by Rusk (1995) identifies the efficiency (or inefficiency) of government as a major factor in the robustness of a region's economy. This is just one of many non-economic factors that could cause below average economic growth.

Future Considerations

In benchmarking the Lehigh Valley to other regions, this study has raised several new questions and suggested avenues of further research. The correlation between industry diversity and employment growth is strong. Further research into this correlation, with a larger sample size, would not only aid in policy decisions for the Lehigh Valley, but may also identify new implications for urban development in general. In addition, identification of the causality of this relationship will assist in its explanation. The relationship between high-tech industry growth and income growth is another avenue of further research. Examples of continued analysis in this area include impact studies of high skill and high wage labor on a region, as well as studies on regional demand for high-tech industry. Also, the definition of high-tech industry used for this study was somewhat outdated. Further research based on an updated basket of high-tech industries may draw different conclusions. Finally, research into other factors contributing to growth, both economic and non-economic, may either explain the relationships already identified more fully or may depict new correlations to economic growth.

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