PORTLAND PLAN

Evaluation of Economic Specialization

Acknowledgments

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PORTLAND PLAN

City of Portland Bureau of
Planning and Sustainability
Sam Adams, Mayor | Susan Anderson, Director

Evaluation of Economic Specialization in the City of Portland

Prepared for the Portland Development Commission

Terry Moore, Lorelei Juntunen, Whit Perkins

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Preface

This report evaluates economic specialization in the City of Portland for the purposes of identifying economic clusters. The report is intended to support policy decisions about economic development strategies in the City.[1]

ECONorthwest completed this project for the Portland Development Commission. Terry Moore was project director. Lorelei Juntunen was project manager. Large parts of the research were conducted by economists Bob Whelan and Alec Josephson. Whit Perkins provided research assistance.

ECONorthwest gratefully acknowledges the substantial assistance provided by staff at Portland Development Commission and the Bureau of Planning and Sustainability. We also asked for assistance in interpreting our results from other economist experts in the region. Sheila Martin (Portland State University), Joe Cortright (Impresa Consulting), Tim Priest (Greenlight Greater Portland), and Tom Potiowky (State of Oregon) all contributed to discussions about our methodology and what the results in this report imply for policy decisions in the region.

Despite all the assistance, ECONorthwest alone is responsible for the report's contents. The contents of this document do not necessarily reflect views or policies of the Portland Development Commission or any public entity or person associated with the project.

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[1] This report identifies sources of information and assumptions used in the analysis. Within the limitations imposed by uncertainty and the project budget, every effort was made to check the reasonableness of the data and assumptions. But any forecast of the future is uncertain. Evaluating those assumptions as reasonable does not guarantee they will prevail. ECONorthwest prepared this report based on its general knowledge of economic impact analysis, and information derived from government agencies, private statistical services, the reports of others, interviews of individuals, or other sources believed to be reliable. ECONorthwest cannot verify the accuracy of all data sources used in this report and makes no representation regarding their accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available.

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Executive Summary

The Portland Development Commission asked ECONorthwest to provide an analysis of economic specialization to support a conversation in the City about the policy choices it must make related to economic development, and to provide for the first time results that are specific to the City of Portland and its commercial core. This executive summary provides an overview of results and implications in the following sections:

- Background
- Overview of key findings
- Implications and next steps

BACKGROUND

This study is intended to support several citywide strategic planning processes that have prompted a new look at industry specialization:

- The City of Portland has begun work on the Portland Plan, one component of which is an update of the Central City Plan that was initially completed 20 years ago. The Portland Plan is a citywide, long-term planning effort.

- The City of Portland is creating a new strategic plan for economic development, which will build on past research and strategies to identify actions and partnerships that support and strengthen the City's economy and better position the City for future economic growth.

- A new City administration has made economic development a critical component of its agenda, in part as a response to an ongoing recession that is affecting the opportunity for economic growth in the City and the region.

The analysis summarized in this executive summary seeks to identify the biggest, most concentrated, and fastest-growing industry sectors in Portland: that information may be useful as the City develops specific economic development strategies. The analysis uses the following industry-specific measures of the local economy:

- *Location quotients for measures of economic activity* (LQs) measure the degree of specialization for each industry in the Portland economy relative to the surrounding region and the national economy, based on *value added.*

- *Value added* measures an industry's net contribution to the economy. It is the value of the labor and capital (land, buildings, equipment) used in production. Value added is approximately the same as the market value of the production of goods and services.

- *The amount of value added that is exported* provides a measurement of a term used a lot (and sometimes loosely) in economic development: *traded sector.* Traded sectors are important to a local economy because they bring new dollars into the region rather than just recycling existing dollars.

- *Employment (jobs)* are important in their own right (e.g., a region does not want a high unemployment rate), but they do not measure economic activity as well as value added or output, because some jobs create much more value added per employee than others. For that reason, the report also measures *wages.*

- *Shift-share analysis* measures changes in industry value added over time, and estimates the portion of that change that cannot be attributed to national trends for a particular industry.

Many of the results of this study are consistent with those of previous studies of economic specialization done in the Portland region. Given this report's different data sets and methods, however, it should not be surprising that it produced some results that are different. ECONorthwest and staff at the Portland Development Commission (PDC) and the City see the identification of industry concentrations as an interim step on the way to learning about the City's strengths and weaknesses in supporting desirable economic activity, and to making policy choices that retain and enhance the strengths and remediate the weaknesses.

ECONOMIC CONTEXT

Exhibit ES.1 provides a sector-level snapshot of the Portland economy. It plots national growth against local growth for industry sectors in Portland.[3] Each point represents a single industry; its location along the x-axis indicates its percent growth in value added in Portland between 2001 and 2007; its location along the y-axis indicates its percent growth nationally between 2001 and 2007. Any industry plotted below the dashed line grew more quickly locally than it did nationally. The Exhibit also indicates the average growth in value added for the national and the City economy.

Exhibit ES.1: National change and local change in value added, 2001-2007, industries in the City of Portland
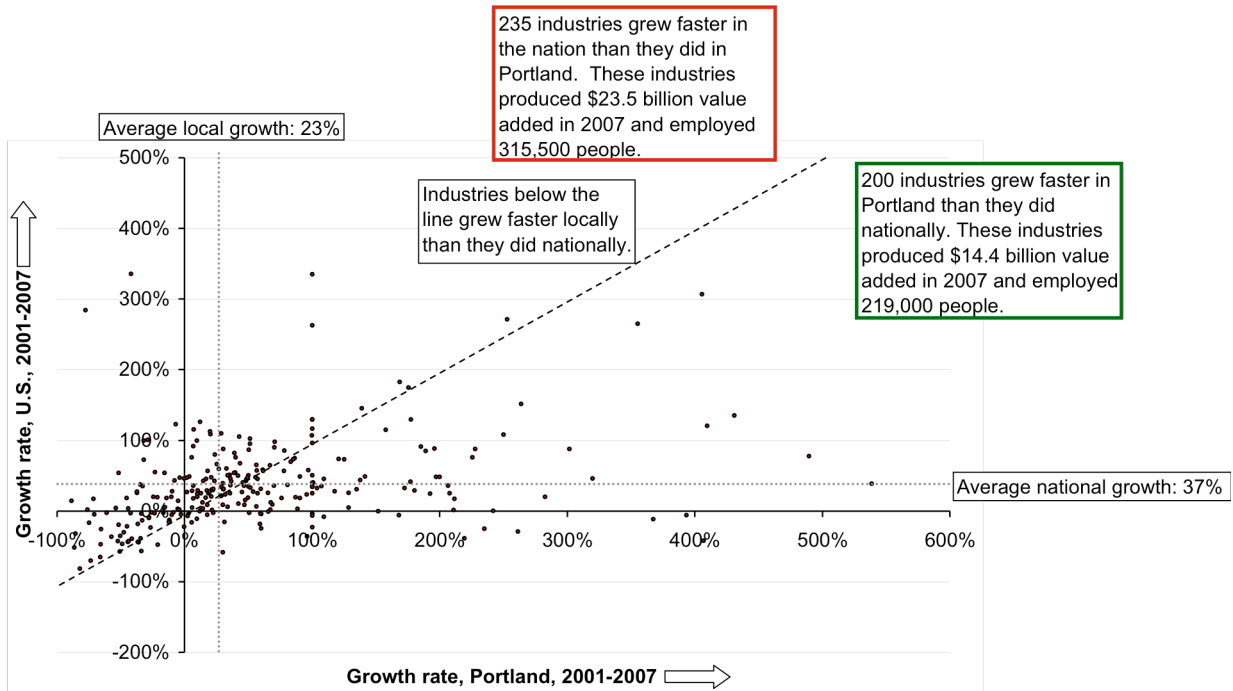
Source: ECONorthwest, based on sector-level data from IMPLAN, 2001 and 2007. City of Portland approximated by zip code boundaries.

[2] Region defined as: Clark and Skamania Counties in Washington State, and Clackamas, Multnomah, Marion, Polk, Washington, and Columbia Counties in Oregon.

[3] Note that not all industries can be properly displayed due to extreme relative growth (in some cases on the order of 30,000%) resulting in scaling issues. We found that most of the extreme growth was related to data errors and is irrelevant to the discussion.

Key findings related to Exhibit ES-1:

- In general, most of the industry sectors in Exhibit ES-1 are gathered along the dashed line indicating that, for the most part, industry sectors were growing at about the same rate in Portland as in the nation.

- About 54% of the industries are located above the diagonal dashed line (i.e., they grew faster nationally). More significantly, the industries above the line had about $23.5B in value added, compared to just $14.5B in value added for industries below the line. Not only are there more industries above the line than below it, but those that are above are larger industries than those below. This accounts for the slower growth experienced in the Portland economy when compared to the national economy.

- Most of the industries in the Portland economy that experienced very strong growth relative to the national economy were small in terms of value added. Because they were small to begin with, even small gains in value added will result in large percent increases. In other words, we found no large industries that were far outpacing national growth.

Later sections of this executive summary and the full report identify specific industries that are both large and growing quickly, or are not keeping pace with national trends.

SECTOR RESULTS OVERVIEW

Exhibit ES.2 identifies the 10% of industries in the Portland economy that are the largest, the most concentrated, and are growing the most quickly. To arrive at this list of industries, ECO created a simple index for identifying which industry sectors are the most important to the Portland area's economy:

- Value added LQ (25%)

- Total value added (15%)

- Amount of value added that is exported (as a measure of traded sector) (25%)

- Number of jobs (10%)

- Industry growth measured as local effect (shift-share) (25%)

For each industry, we report the results of a *shift-share analysis*, a standard technique for economic evaluation that is used to make a quantitative estimate of the relative contribution to observed local growth, by sector, of national economic growth, industry sector-specific growth, and local attributes. The columns In Table ES.2 are:

ECO ran the sector index model multiple times, each time changing the weighting of the individual input factors (see text for details). While we did get different results with each index run, we found that the following industries were in the top 10% of industries regardless of the weighting we chose:

• **Transport by truck**
• **Software publishers**
• **Insurance carriers**
• **Legal services**
• **Architectural, engineering, and related services**
• **Management of companies and enterprises**
• **Medical diagnostic labs and outpatient facilities**

These seven industries are concentrated, relatively large, and growing. Many of them are already under consideration for City policy initiatives. Exhibit ES-2 provides the results of the index run using our baseline weighting.

- *Actual change* and *percent change* show the amount of change in value added between 2001 and 2007

- *Expected change* shows the amount of change in value added that would have been expected if the industry had followed national trends

- *Local effect* is the difference between the actual change and the expected change. It quantifies the portion of the change that cannot be attributed to national economic trends (in the aggregate or by sector), and is thus arguably the result of some factor in the local economic context (public policy, comparative advantage associated with geographic location, etc.)

The red text in Exhibit ES.2 signifies an industry that underperformed relative to national growth, and green text signifies faster growth locally than nationally. Industries shaded in grey are those that are included in one of the clusters identified in the City's current draft of its economic development strategy (see the next section of this Executive Summary for details).

Exhibit ES.2. 2001-2007 value added shift-share results (in millions of dollars): top 10% of industry sectors in Portland based on an index of measures of economic specialization

Industry	Actual Change	Percent Change	Expected Change	Local Effect
Software publishers	$169.4	56%	$19.3	$150.1
Iron and steel mills and ferroalloy manufacturing	$199.0	410%	$58.6	$140.4
Insurance carriers	$509.2	86%	$440.6	$68.6
Architectural, engineering, and related services	$169.8	29%	$126.6	$43.2
Ferrous metal foundries	$78.7	45%	$47.7	$31.0
Data processing, hosting, ISP, web search portals	$99.6	101%	$40.1	$59.5
Other state and local government enterprises	$8.0	2%	-$24.7	$32.7
Medical and diagnostic labs and outpatient and other	$287.3	158%	$209.8	$77.5
Management of companies and enterprises	$650.0	56%	$758.3	-$108.3
Legal services	$331.3	49%	$320.5	$10.8
Food services and drinking places	$312.9	48%	$278.9	$34.0
Transport by truck	$132.8	50%	$93.0	$39.7
Scenic and sightseeing transportation and support	$78.9	35%	$115.7	-$36.8
US Postal Service	$163.4	85%	$141.4	$22.0
Specialized design services	$61.5	96%	$15.0	$46.5
Cutlery, utensil, pot, and pan manufacturing	$70.4	N/A	$0.0	$70.4
Other support services	$75.5	65%	$29.5	$46.0
Other Federal Government enterprises	$108.2	125%	$63.4	$44.8
All other miscellaneous professional and scientific	$352.0	176%	$350.3	$1.7
Natural gas distribution	$42.3	18%	$134.8	-$92.4
Federal govt. electric power	-$221.5	-45%	-$214.8	-$6.6
Wholesale trade businesses	$721.3	30%	$741.4	-$20.1
Real estate establishments	$737.1	39%	$1,562.9	-$825.8
State & local govt. education	$555.2	100%	$354.6	$200.5
Offices of physicians, dentists, and other health	$238.9	29%	$287.2	-$48.3
Federal government - non-military	$350.3	81%	$159.7	$190.5
Material handling equipment manufacturing	$60.0	4228%	$0.3	$59.7
Dental equipment and supplies manufacturing	$43.7	1421%	$1.7	$42.0
Community food, housing, and other relief services	$58.8	121%	$35.9	$22.9
Transport by air	$24.5	10%	$51.0	-$26.5
Telecommunications	$55.0	10%	$135.3	-$80.3
Private hospitals	$182.2	35%	$264.0	-$81.8
Securities, commodity contracts, and investments	$78.6	22%	$110.6	-$32.0
Automotive repair and maintenance, except car wash	-$217.7	-51%	-$246.0	$28.4
Advertising and related services	$19.4	7%	$52.7	-$33.3
Retail Nonstores - Direct and electronic sales	$217.3	169%	$235.2	-$17.9
Asphalt shingle and coating materials manufacturin	$86.9	253%	$93.2	-$6.3
Steel product manufacturing from purchased steel	$27.9	104%	$8.8	$19.1
Truck trailer manufacturing	$28.0	200%	$6.8	$21.3
Flat glass manufacturing	$23.5	970%	$0.9	$22.6
Asphalt paving mixture and block manufacturing	$56.5	20059%	$1.3	$55.3
Primary smelting and refining of nonferrous metal	$25.1	N/A	$0.0	$25.1
Electric power generation, transmission, and distribution	$114.2	24%	$385.2	-$271.0
Other private educational services	$64.6	107%	$21.4	$43.2

Source: IMPLAN data for the nation and the City of Portland (based on zip codes) for 2001 and 2007. Calculations by ECONorthwest. Note: All figures in millions of current dollars. Red text signifies underperforming industries relative to national growth rates, even for industries that were growing. Green text signifies industries that outperformed national growth rates. Table is sorted by descending index value (most important to least important).

Key findings related to Exhibit ES.2:

- Many of the strong local sectors are already under consideration for City policy initiatives.

- Nearly all of the sectors in the top 10% grew, but many did not grow as fast as would have been expected based on national trends for that industry.

- The top 10 sectors are a mix of knowledge, service, and manufacturing.

RESULTS FOR CITY OF PORTLAND CLUSTERS

The sector-level analysis in this report was conducted to support and complement the City's parallel analysis of industry clusters for its ongoing creation of its economic development strategy. The *Draft Economic Development Strategy* available at the time the analysis in this report was conducted identified four clusters that are increasingly important to the Portland economy: activewear and outdoor gear, advanced manufacturing, software, and cleantech. [4] This section of the executive summary aligns the results of its sector-level analysis with the City's identified clusters.

Exhibit ES.3 shows the following information for the target clusters that the City is currently evaluating: (1) total value added in 2007 (size of the bubble); (2) rate of local growth relative to national growth between 2001 and 2007 (location of bubble); and (3) 2007 location quotient (listed as a ratio in the legend). Data are for the City of Portland (not the entire Portland region). To allow for comparison across the documents ECO defined the clusters using the same NAICS codes that the City of Portland / PDC used for its analysis.

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[4] More information about the clusters and the draft policy actions is available online at www.pdc.us.

Exhibit ES.3. City of Portland industry clusters: 2007 value added (in millions of dollars), local and national growth rate (from 2001 to2007); and location quotient 2007
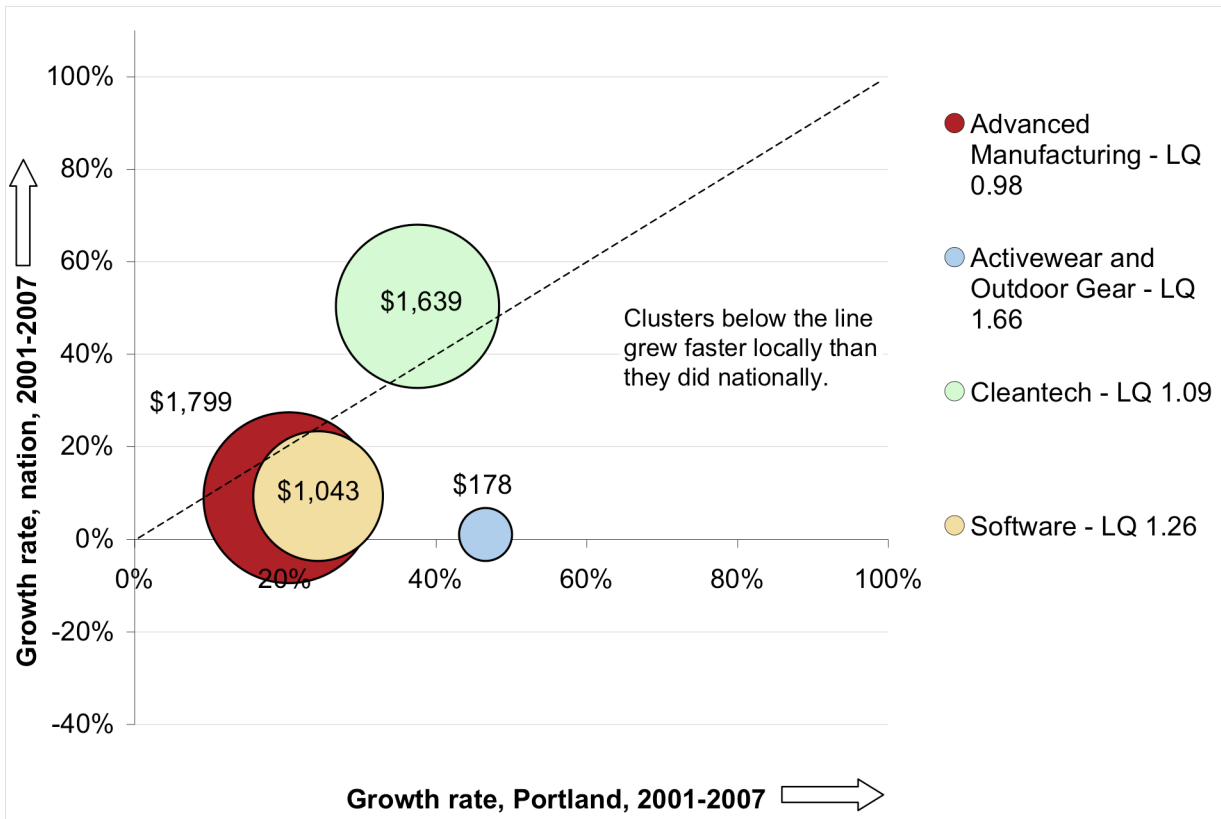
Source: IMPLAN data for the nation and the City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest

Note: Size of bubble shows value added in 2007. Each legend label shows the cluster's 2007 Portland:U.S. value added location quotient. The dotted arrow has a slope of 1; clusters located below the line grew faster in Portland than in the nation between 2001 and 2007.

The City of Portland identified its clusters using the North American Industry Classification System (NAICS), and ECO used IMPLAN data, which is based on NAICS data but has its own classification system. These differing industry classification systems resulted in a less-than-perfect translation of the industries in PDC's clusters. In some cases, a five-digit NAICS category only matched up with a portion of an IMPLAN industry sector, resulting in overstated values. In other cases, there is no good IMPLAN match for a four- or five-digit NAICS industry sector and no values are given. In all, however, translation issues arose in only 14 of the 153 IMPLAN industry sectors used in Exhibit ES.3. Due to translation issues, size of activewear cluster is underestimated, cleantech cluster is overestimated, and all other clusters were well-matched. Figures in millions of 2007 dollars.

Findings related to Exhibit ES.3:

- In Exhibit ES.3, a cluster with a large bubble located below the dashed line and with an LQ over 1.0 would be considered a strong cluster. Most of PDC's clusters either meet those criteria, or come very close to meeting them.

- Nearly all of the clusters outpaced average growth in the total Portland economy (23% increase), and some (especially activewear and outdoor gear) outpaced the average growth in the national economy (37% increase).

- Activewear and outdoor gear probably performs best on all measures. It has the highest LQ at 1.66, the biggest differential in value added growth between Portland and the nation, and a local effect of $55M (2007 dollars).

- Cleantech is the only cluster with a negative local effect (-$140M), indicating that it did not grow as fast in Portland as it did in the nation. But it is also the biggest cluster in terms of total value added, and very nearly matched national growth rates. Additional research could help to identify why this cluster is not keeping up with national trends, as well as the degree to which data errors contribute to our lack of understanding of the true performance of this cluster.

ANALYSIS OF SECTOR GROUPINGS

While the focus of ECO's work was sector level, we did consider some possible combinations of sectors to see if there might be other potential clusters that the City should consider as it moves forward with its economic development strategy.

ECO did NOT complete a full analysis to identify clusters based on the value added data; this would have required qualitative and other research that was outside of our scope. But given the breadth and depth of data available to us, we did complete a purely quantitative exercise to identify the groups of sectors that appear to be: (1) making the strongest contribution to the Portland economy in terms of value added, and (2) to be most concentrated in the City relative to the nation. We identified groups of industries that have a location quotient of at least 1.5 and make up at least 0.25% of the City's total value added. Exhibit ES.4 provides an overview of the results.

Exhibit ES-4. City of Portland industry groups based on value added, 2007
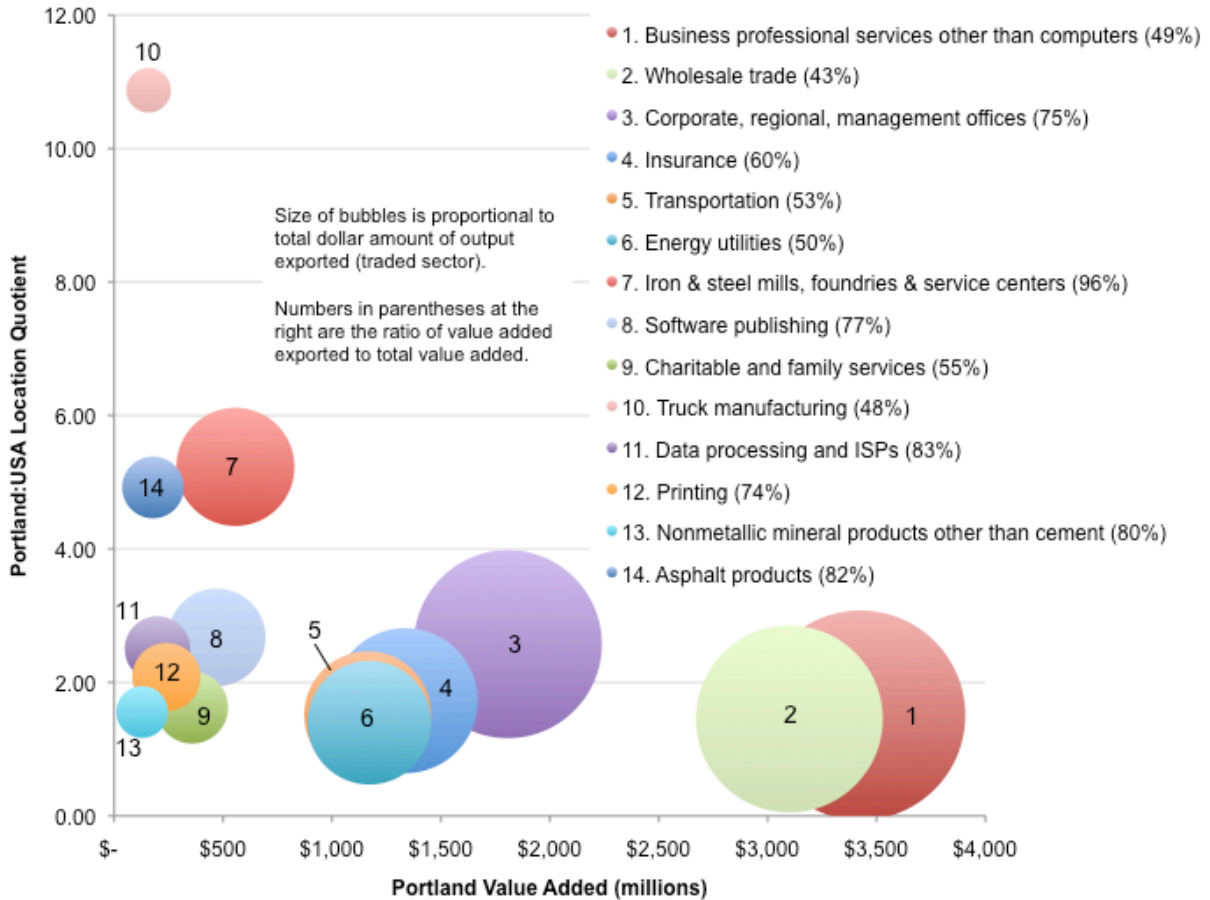
Source: ECONorthwest, 2009, based on 2007 IMPLAN data. See text of full report and appendices for information about methods and assumptions.

ECO also evaluated conducted shift-share analyses for these 14 industry grouping, and found that business and professional services, insurance, transportation, iron and steel mills, software publishing, data processing and ISPs, nonmetallic mineral products other than cement, and asphalt products all grew at a rate faster than would have been expected given national trends for the industry groupings. These industry groupings are large, concentrated, and growing more quickly than national averages.

IMPLICATIONS AND NEXT STEPS

The results of this analysis generally support the clusters that the City has identified.

- The clusters perform well on nearly every measure of specialization considered in this study. Most of them grew faster in Portland than in the nation. Most have strong LQs, indicating concentration of

value added in Portland relative to the nation. Most grew faster than the Portland economy as a whole.

- At the industry level, many of the ten top sectors (based on an index that combines all measures of specialization considered in this evaluation) are included in one of the City's clusters.

The sector-level analysis suggests several other strong and growing industry sectors (or groupings of industry sectors) that the City might also consider for policy initiatives.

- Several of the biggest (in terms of value added and employment) and most concentrated groupings of industry sectors are not included in any of the City's clusters.[5] Business and professional services, insurance, asphalt products, and transportation are examples. These are sectors that support other sectors; growth in the City-identified clusters might indirectly cause, or at least facilitate, growth in these sectors. Because they are so large and concentrated, however, a more specific strategy might be appropriate to support the continued strength of these sectors.

- More discussion would be needed about exactly what type of policies might be appropriate to support these potential industry groupings, and how the City might help target growth in them.

More work should be done to identify the cause of changes in value added.

- An advantage of a shift-share analysis is that it quantifies the portion of change in an industry that occurred at a local level that cannot be attributed to national trends. In other words, it identifies the amount of change that was caused by some factor in the local environment (which could be an economic development policy, a comparative advantage, or the presence of a particularly strong firm with strong leadership that captures a broad market share). While the data and results are interesting in the aggregate, interviews or qualitative research would be necessary to understand what is happening in Portland that is causing an industry to grow differently here than nationally. Such an evaluation might be particularly important for the industry sectors that are in the City's clusters, as it may suggest additional policy initiatives that would help to support growth in the clusters.

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[5] Wholesale trade is NOT a good example of this; IMPLAN lumps together many smaller NAICS industries in this "sector" with out a good avenue for disaggregation. Some of the smaller NAICS codes that are joined into the IMPLAN code for wholesale trade probably ARE included in some of PDC's clusters.

- Some of the biggest sectors, in terms of value added, are underperforming relative to national trends. Management of companies and enterprises, real estate establishments, and wholesale trade businesses are examples. The fact that these large industry sectors did not keep up with national trends accounts for a significant portion of Portland's lower overall growth rate relative to the nation. Because these industry sectors contribute a relatively big part of the total value added in Portland's economy and are relatively concentrated in Portland and its downtown core, additional analysis should be done to determine why they are growing more slowly in Portland than in the nation.

Chapter 1   Introduction

1.1   BACKGROUND AND APPROACH

The City of Portland's economic development planning practice has included cluster analysis (the identification of groups of firms or industry sectors that share similar suppliers, skills, markets, and workers) for years. The City has used the results of cluster analysis to better understand the regional economy, to focus its economic development agenda, and to identify industry partners.

Now, several citywide strategic planning processes have prompted a new look at industry specialization:

- The City of Portland has begun work on the Portland Plan, one component of which is an update of the Central City Plan that was initially completed 20 years ago. The Portland Plan is a citywide, long-term planning effort. The Portland Plan will build on VisionPDX, a recent effort to describe shared values for development and community.

- The City (PDC) is creating a new strategic plan for economic development, which will build on past research and strategies to identify actions and partnerships that support and strengthen the City's economy and better position the City for future economic growth.

- A new City administration has made economic development a critical component of its agenda, in part as a response to an ongoing recession that is affecting the opportunity for economic growth in the City and the region.

The City asked ECONorthwest to provide a sector-level analysis of economic specialization in Portland that summarizes previous analyses and supports a fuller conversation in the City about the policy choices it must make related to economic development, and to provide, for the first time, results that are specific to the City of Portland and its commercial core.

Defining and measuring economic concentration is both science and art. Results depend heavily on definitions, assumptions, and the data sets used for measurement. Different studies will get different results—that should be expected and viewed as additional perspective, not necessarily as inconsistency. This report is different from studies of Portland clusters in three important ways:

- This study focuses on sector-level analysis and results. Though it complements the City's previous cluster analyses, it is not a cluster analysis.

- This study focuses on the value added of an industry, not its employment and payroll. Value added is approximately the same as the market value of the production of goods and services. It takes into consideration not just payroll and employment, but also the work of the self-employed and the contributions of capital, land, and property. The next chapter explains the advantages of using value as the primary metric of economic activity by sector.

- Previous studies have relied on data that are available only at the county level, and have reported results at the county or regional level. This study reports results for the City of Portland, with a more detailed look at downtown Portland.

Many of the results of this study are consistent with those of previous cluster studies done in the Portland region. But given its different data sets and methods, it should not be surprising that this study produced some results different from those of other cluster studies. The reason the City does cluster analysis is not to pick winners or losers among industry sectors, but to learn more about the factors that make businesses successful in Portland, and how public policy can encourage that success. Thus, ECONorthwest and staff at PDC and the City see the identification of industry concentrations as an interim step on the way to learning about the City's strengths and weaknesses in supporting desirable economic activity, and to making policy choices that retain and enhance the strengths and remediate the weaknesses.

1.2 ORGANIZATION OF THIS REPORT

This report provides economic analysis relevant to discussions now occurring regarding (1) a refined strategy for economic development for the City of Portland, and (2) the City's broader planning efforts, including the Portland Plan and the Central City Plan. It has the following chapters:

- **Chapter 2: Methods** describes the approach to the sector-level analysis used in this report and provides an overview of methods.

- **Chapter 3: Sector Analysis Results** provides output from the sector-level analysis and discussion.

- **Chapter 4: Implications** describes the results in Portland's policy and planning context and suggests possible policy outcomes.

Detailed results and additional information is provided in appendices:

- **Appendix A: Summary of previous studies** provides an overview of cluster studies and economic development-related work that have recently been done in the region and have bearing on this research.

- **Appendix B: Economic Context** discusses some of the key economic trends that are likely to affect Portland's future.

- **Appendix C: Detailed Sector-Level Results** provides detailed results of the sector-level analysis.

- **Appendix D: Quantitative Analysis of Sector Groupings** provides a detailed explanation of ECO's work to translate sector-level results into combinations of sectors (or groups of sectors).

- **Appendix E: Terms and Definitions**

Chapter 2   Methods

This chapter provides an overview of methods. Economic terms and concepts are defined in this chapter, and in more detail in Appendix E.

2.1   IDENTIFYING INDUSTRY-SECTOR SPECIALIZATION

The analysis uses several industry-specific measures of the local economy to identify biggest and most concentrated industry sectors:

- *Location quotients for measures of economic activity* (LQs) measure the degree of specialization for each industry in the Portland economy relative to the surrounding region and the national economy, based on *value added.*

- *Value added* measures an industry's net contribution to the economy. It is the value of the labor and capital (land, buildings, equipment) used in production.

- *Economic output* measures the value of production for each industry sector. It is related to value added, but different. [6]

- *The amount of value added that is exported* provides a measurement of a term used a lot (and sometimes loosely) in economic development: *traded sector).* Traded sectors are important to a local economy because they bring new dollars into the region rather than just recycling existing dollars. In concept if two sectors had the same LQ and value added, but one exported most of its value added and the other did not, the former would be more valuable to the local economy (other things being equal): it would have a greater *multiplier effect* on the local economy.

- *Employment (jobs)* provide yet another measure of economic activity for each industry sector. Jobs are important in their own right (e.g., a region does not want a high unemployment rate), but they do not measure economic activity as well as value added or output, because some jobs create much more value added per employee than others.

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[6] Output is a useful measure for an individual industry sector but may be misinterpreted if used in the aggregate. Since industries buy goods and services from one another, hidden in the output of any one industry is some of the output reported by others. A candy factory, for example, may have bought fruit from a local farmer, packaging from a local paper mill, and advertising in the city newspaper. All three of these were counted as output by those suppliers, but then are counted again as contributing to the output of the candy factory itself. Therefore, when totalling the output of all the industries in a city, a lot of double and triple counting occurs. To avoid this, economist use *value added* instead for aggregate measures.

- *Location quotients (LQs) for measures of occupation* provide a measure of specialization in the work force, identifying occupations for which Portland has high concentrations of workers. ECO used employment data organized by standard occupational codes (SOCs). The dataset for this measure is different from the others in the list so it is not directly comparable – it measures employment at the regional level rather than for the City and is categorized by occupation rather than by industry—but it provides another way to understand the economy.

- *Shift-share analysis* measures changes in industry value added over time, and estimates the portion of that change that cannot be attributed to national trends for a particular industry.

2.1.1 TASKS IN THE ANALYSIS

Task 1. Calculate LQs, value added, and other measures of specialization for all sectors in the Portland economy, and in Portland's downtown.

Traditionally, LQs have been calculated using payroll (employment) data as a proxy for economic importance. This source, while easy to access and relatively current, has some limitations. First, about 11% of the labor income in Portland is not counted in the payroll data that the state collects. Second, industry identifiers in the payroll data are often inaccurate. Third, high levels of employment do not necessarily indicate successful industries: businesses that have declining labor productivity and are nearing failure may have high levels of employment.

To avoid the problems with employment data, ECO chose to measure LQs by using the *value added* by industry for 2007 using economic impact modeling data.[7] Value added is the net contribution to economic value of all labor (including the self-employed), capital, land, and property used in the production of goods and services. It is approximately the same as the market value of the production of goods and services. When calculated for the entire country, value added is equal to the gross domestic product or GDP the United States. GDP is the standard measure of economic activity and economists use it to track economic growth, recessions, and production.[8]

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[7] ECO used an economic input-output model called IMPLAN to calculate value added. IMPLAN uses four-digit NAICS data for employment and wages as an input, so the base data for our analysis is the same as base data for most other cluster studies. IMPLAN estimates value added based on employment and wages by sector at the zip code level.

[8] An unrealistically simple but clear example clarifies the definition. Assume the City of Portland imports macadamia nuts from Hawaii and cane sugar from Puerto Rico to make specialized candies. To make and sell those candies it adds local labor, capital, and entrepreneurial skill. The cost of the

The value added for 2007, by sector, was assembled for the four economic regions used in the cluster analysis. The data cover 440 unique industries, also called sectors, and all sources of economic production: businesses, farms, government establishments, and non-profits. The geographies covered are:

- United States

- The "Portland region," defined as the official U.S. Census consolidated metropolitan statistical area: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, and Polk Counties

- Multnomah County

- The City of Portland. The value added or GDP of the City's economy had to be estimated because economic data are available at the county and the zip code levels, and do not align with City boundaries exactly. In total, this analysis estimated the Portland economy by combining data for 25 zip codes[9]

- For downtown Portland, the analysis used an area defined as zip codes 97201, 97204, 97205, and 97209.

The raw results of the analysis compared the citywide shares of value added by all industry sectors in the Portland economy to the national shares of value added for the same sectors. For full results, refer to Appendix B.

Task 2. Conduct a shift-share analysis.

A shift-share analysis is a way of showing how an industry sector has grown over time, and of estimating how much of that growth is a result of local factors as opposed to broader changes in the national economy or in the particular industry. In this study, shift-share analysis compares the actual change (how the industry's value-added grew or declined between 2001 and 2007[10]) and the expected change (how the industry would have

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local labor, capital, and skill is a measure of the value Portland has added to the total value of the final product; Portland does not get credit for the value of the nuts and sugar, which were produced elsewhere and were therefore not a net contribution to the Portland economy.

[9] Demographic data show that the population residing in those zip codes equaled 99.4% of City's population in 2007, so boundaries are fairly accurate even if they don't align perfectly. Although most zip codes are completely or nearly entirely within the city limits, there are some that are not. Therefore, only those with more than half of their economic activity in Portland were used.

[10] We picked these years for both practical and technical reasons. There are few translation issues between the datasets in 2001 and 2007. Additionally, both of these were relatively strong years in the Portland economy, leading to fair comparisons across time.

been expected to grow locally between 2001 and 2007 if it had growth at the same rate that industry grew nationally). The results are reported as local effect, which quantifies the portion of the change in value added that is not plausibly explained by larger national trends.

Task 3: Consider possible groupings of industries and compare results to other similar cities.

While this report does not conduct a full cluster analysis, we did consider possible groupings of industries to support ongoing conversations at the City about directions for future cluster analysis. ECO conducted a quantitative analysis to (1) determine how industries might logically be grouped together, and (2) how those groupings stack up against thresholds that measure their size and concentration. Chapter 3 identifies 14 industry groupings that have an LQ over 1.5 and make up at least 0.25% of the 2007 GDP.

Certain industries tend to concentrate in cities as the regional economic hubs, as opposed to in suburbs, smaller towns, or rural areas. Because ECO's geogprahy of comparison up to this point had been the nation (which includes cities as well as towns and rural areas) we added this task to ensure that our results are reflective of specialization in the Portland economy and not just the fact that Portland is City.

ECO identified all cities similar in size to Portland using objective parameters:

1. 2007 Census data show Portland to be the 30th largest City in population. ECO identified with the 15 next largest and smallest population cities, a total of 31 cities.

2. High data costs and a limited budget compelled ECO to acquire economic data on the county level.[11] Such data is a useful approximation of the subject city only if more than half the population of the county was inside the subject city. For example, the main county for Portland is Multnomah; about 79.7% of the County's population lives in Portland. We limited the list to those that had the majority of its population in one county.

Of the original 31 cities, a total of 21 cities and their main counties qualified for the analysis based on these criteria.

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[11] To get data at the city level, we'd have to approximate the boundaries of each city by zip code and then purchase data for each zip code separately. It would be prohibitively expensive at about $300 per zip code, with each city requiring a set of data made up of as many as 15 – 20 individual zip codes.

PDC then randomly selected ten cities[12] from the list for analysis. ECO analyzed *Austin, Charlotte, Baltimore, Boston, Nashville, Denver, Oklahoma City, Atlanta, Albuquerque, and Fresno.*

ECONorthwest built economic models of each and calculated the economic contribution of every industry sector for the combined 11-county sample. The City of Portland's industry shares were compared to the average industry shares in these cities to better understand Portland's economic specialization relative to mid-sized cities.

Task 4: Create a weighted index of all measures of economic specialization, for industries in the City of Portland and its downtown.

To identify the industries that are the largest, the most concentrated, and are growing, ECO created a weighted index of all the measures of economic specialization: location quotients, absolute measures of total value added, amount of value added that is exported, jobs, and local effect /shift-share.

2.2   LIMITATIONS

This analysis has two broad categories of limitations: data limitations and limitations of approach.

2.2.1   DATA LIMITATIONS

Most cluster analysis uses the North American Industry Classification System (NAICS) data as a starting point; this analysis does also. NAICS uses a multi-tiered coding system, which codes general industry categories (such as Manufacturing), and more specific activities within that industry (such as Animal Food Manufacturing).

The key difference is that ECO used IMPLAN (for IMpact Analysis for PLANning), a standard econometric model, to calculate value added based on the NAICS data[13]. An economic specialization analysis, by its very

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[12] Because the sample size is too small to be statistically valid, the results of this analysis do not describe a relationship between Multnomah County and all of its potential competitor cities. Instead, it describes the relationship only between Multnomah County and this particular set of competitor cities. All results from this analysis are carefully interpreted and explained in that context.

[13] IMPLAN provides area-specific estimates on production, consumption, employment, wages, small business income, rental and other income, and taxes for each of 440 business sectors. The IMPLAN model reports economic impacts on output, wages, business income, jobs (full- and part-time), and tax revenues for state and local taxing jurisdictions.
IMPLAN was developed by the Forest Service of the US Department of Agriculture in cooperation

nature, relies on businesses self-reporting what they do as their principal activity; i.e., reporting their NAICS codes. The use of NAICS data results in limitations that are common to most cluster analyses:

- Some firms use the wrong NAICS code. For example, a publisher of a farming magazine based in Portland lists itself under NAICS 1111, which is grain farming, rather than the appropriate code of 51112 for magazine publisher.

- More serious problems are created when companies pick the correct industry code, but use the wrong activity code. For Portland, and in particular downtown Portland, this occurs when a company engaged in manufacturing or services assigns the wrong NAICS code for a corporate office, which is in the same general industry, but houses different types of activities.

  Nike, for example, should not report as a footwear manufacturer in Washington County, but rather as a corporate office. This is appropriate from the standpoint of doing a cluster analysis because the skills needed at the Nike corporate campus are not those of running a factory making footwear, but rather those of corporate functions such as finance, human resources, marketing, planning, and administration. These are functions requiring workers with skills common to workers in corporate and regional offices of other firms in other industries. Although there are some specialized jobs unique to footwear design, most of the functions are characteristic of a corporate or branch office and the Nike office in Washington County would thus be assigned the NAICS code 551114.

The effect of the three above limitations can be compounded in a time-series analysis (such as shift-share analysis). If firms report information incorrectly one year, but then report correctly the next year, the effect could be overestimated growth or decline of a particular industry.

One limitation results from the use of IMPLAN. NAICS codes are organized to show vertical relationships among industries: "industrial mold manufacturing" is a subset of "fabricated metal manufacturing." IMPLAN provides results only to the four-digit NAICS codes. We would be able to see value added for fabricated metal manufacturing, but not for industrial mold manufacturing. This means that our cluster groups are often at a higher level, and sometimes include only one very large sector

with the Federal Emergency Management Agency and the Bureau of Land Management of the US Department of the Interior to assist federal agencies in their land and resource management planning.

(such as wholesale trade) because the data are not available at a more refined level.

2.2.2 APPROACH LIMITATIONS

Additional limitations result from conducting a cluster analysis at the City level or a smaller geography. Most cluster analyses cannot report results at a more specific geography than the county-level because proprietary firm-level data cannot be revealed. One advantage of using economic model data on value added is that researchers avoid the risk of revealing proprietary employment data. Value added estimates are publicly available, and are calculated figures that are, by themselves, estimates.

While confidentiality can be addressed by using value added or combining like industries to conceal company-specific information, LQs calculated for a small area, such as a city, are vulnerable to the effects of one large entity. This creates the distortion of having a high LQ in an industry cluster because of one big firm rather than a true group of firms that share similar suppliers, skills, markets, and workers, which is an accepted definition of a cluster.

This limitation is seen in the results for Portland. Of the 436 industries screened in this analysis, the one in Portland that had the highest LQ in 2007 was "federal government electric power." That single sector has an LQ of 29.4 — more than double the second highest industry. This is due entirely to the Bonneville Power Administration office in Northeast Portland. To the extent possible, we identify this type of problem as we present the results.

Sector Analysis Results

This chapter has the following sections:

- **Context for sector analysis** provides a sector-level overview of the Portland economy as context for understanding the remainder of the results in this section.

- **Absolute measures** provides results for Portland in 2007 that are not compared to another geography or time period: value added, traded sector value added, jobs, and output.

- **Relative measures** provides results relative to the nation and across time: location quotients, and shift-share analysis.

- **Comparison of Portland to 10 other cities** presents the results of an analysis comparing industry measures in Multnomah County to those in ten other similar-sized counties

- **Occupational codes: another measure of specialization** calculates location quotients based on standard occupational codes.

3.1   CONTEXT FOR SECTOR ANALYSIS

Exhibit 3.1 provides a sector-level snapshot of the Portland economy. It plots national growth against local growth for industry sectors in Portland.[14] Each point represents a single industry; its location along the x-axis indicates its percent growth in value added in Portland between 2001 and 2007; its location along the y-axis indicates its percent growth nationally between 2001 and 2007. Any industry plotted below the dashed line grew more quickly locally than it did nationally.

The Exhibit also indicates the average rate of increase in value added in the Portland economy (23%) and in the national economy during this time period (37%).

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[14] Note that not all industries can be properly displayed due to extreme relative growth (in some cases on the order of 30,000%) resulting in scaling issues. We found that most of the extreme growth was related to data errors and is irrelevant to the discussion.

Exhibit 3.1: National change and local change, industries in Portland, 2001-2007, industries in the City of Portland
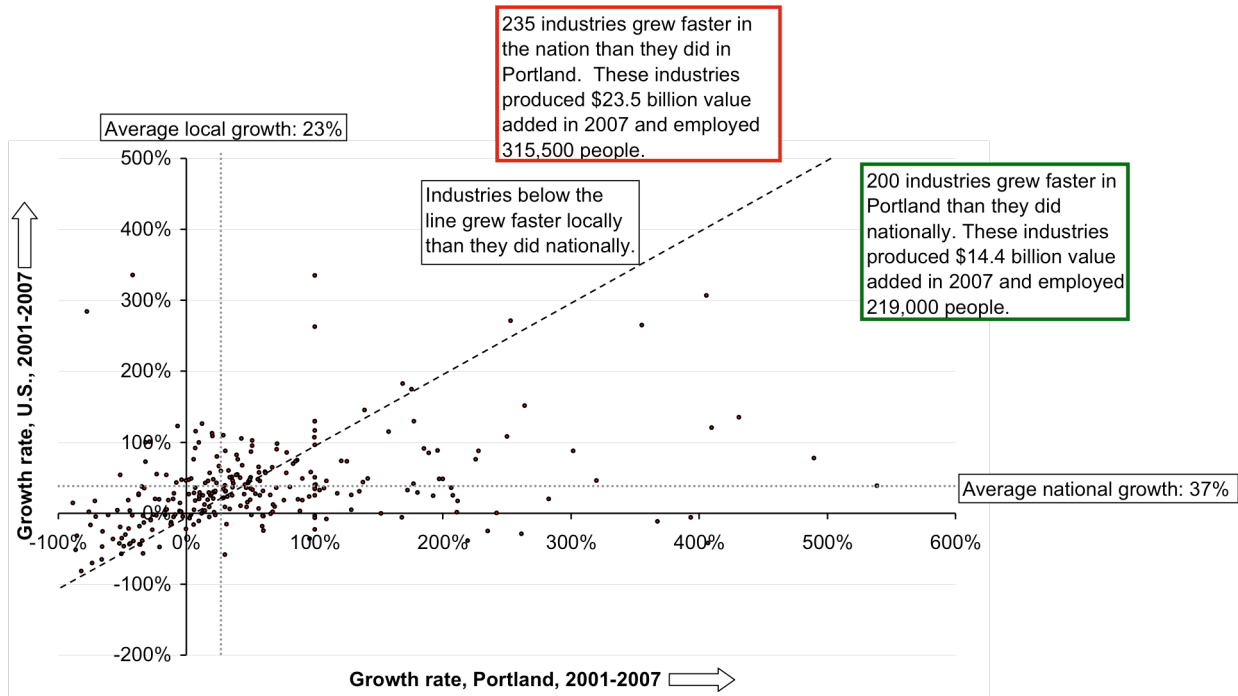
Source: IMPLAN data for the nation and City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest. City of Portland boundaries approximated by zip code.
Note: Industries with growth or decline beyond the boundaries of the chart and industries with zero value added in 2007 are not shown.

For the most part, sectors that have experienced dramatic growth or declines have done so primarily because they were small to begin with, and any changes in value added are therefore magnified. They are also particularly susceptible to data errors because they are small. One firm misreporting its employment in one year can have a dramatic effect. ECO was able to review firm-level confidential employment data to identify most of the large increases or decreases in value added that probably resulted from misreporting errors.[15]

Key findings related to Exhibit 3.1:

- The City economy totaled a little less than $40 billion in value added in 2007. This is about one-third of the total value added in the 9-county region in 2007[16]. Though data for downtown industries are

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[15] Paper mills is an example. In 2001, the IMPLAN data shows $0 in value added for this industry, and the dramatic jump seen by 2007 could not be attributed to the activity of any new paper mill constructed in Portland. We eliminated this sector from the analysis.

[16] Counties are: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, Polk.

not displayed in the Exhibit, the value added for industries located in downtown Portland total about one-third of the City economy.

- In general, most of the industry sectors in Exhibit ES-1 are gathered along the dashed line indicating that, for the most part, industry sectors were growing at about the same rate in Portland as in the nation.

- About 54% of the industries are located above the diagonal dashed line (i.e., they grew faster nationally). More significantly, the industries above the line had about $23.5B in value added, compared to just $14.5B in value added for industries below the line. Not only are there <u>more</u> industries above the line than below it, but those that are above are <u>larger</u> industries than those below. This accounts for the slower growth experienced in the Portland economy when compared to the national economy.

- Most of the industries in the Portland economy that experienced very strong growth relative to the national economy were small in terms of value added. Because they were small to begin with, even small gains in value added will result in large percent increases. In other words, we found no large industries that were far outpacing national growth.

Later sections of Chapter 3 identify specific industries that are both large and growing quickly, or are not keeping pace with national trends.

3.2   ABSOLUTE MEASURES

This section describes the Portland economy's strongest industries in terms of absolute measures (measures that are not compared to other geographies or timeframes): (1) value added, (2) traded sector value added, (3) jobs, and (4) output. The industries detailed below have the highest amount of value added, employment, output, and portion of value added that is exported (traded sector). Exhibit 3.2 shows the industries that appear in the top 5% in all four measures (Appendix C provides the detailed results for each measure). Those eight industries are wholesale trade businesses; real estate establishments; management of companies and enterprises; insurance carriers; offices of physicians, dentists, and other health; legal services; foot services and drinking places; and architectural, engineering, and related services.

Exhibit 3.2. Industries in the top 5% as measured by value added, traded sector, jobs, and output; City of Portland, 2007

Industry Name	Value Added	Traded Sector VA	Jobs	Output
Wholesale trade businesses	3,100	1,333	26,857	7,662
Real estate establishments	2,632	984	21,673	4,251
Management of companies & enterprises	1,807	1,349	13,895	5,108
Insurance carriers	1,100	803	9,937	4,798
Offices of physicians, dentists, & other health	1,070	373	12,989	2,416
Legal services	1,004	591	11,308	2,219
Food services & drinking places	964	364	32,939	2,994
Architectural, engineering, & related services	754	447	12,205	2,067

Source: IMPLAN. Calculations by ECONorthwest
Note: All figures in millions of dollars (except jobs).

Exhibit 3.3 shows the same analysis as Exhibit 3.2 for downtown zip codes (97201, 97204, 97205, and 97209). This table includes the fifteen industries that appear in the top 5% in each of the three available absolute measures. (Traded sector data were unavailable for smaller geographies). Industries shown in green text appeared in the top 5% of all measures in both downtown Portland and the city-wide geography. Every industry that performed well in the city-wide study area (as shown in Exhibit 3.2) also performed well in the smaller downtown area (as shown in Exhibit 3.3).

Exhibit 3.3. Industries in the top 5% for value added, jobs, and output; Downtown Portland, 2007

Industry Name	Value Added	Jobs	Output
Real estate establishments	1,361	11,205	1,659
Legal services	886	9,972	1,262
Insurance carriers	747	6,753	1,935
Management of companies & enterprises	527	4,049	911
Architectural, engineering, & related services	458	7,417	756
State & local govt. education	394	6,866	394
Securities, commodity contracts, & investments	376	5,975	1,109
Software publishers	370	2,038	678
Wholesale trade businesses	289	2,505	444
State & local govt. non-education	276	4,011	276
Food services & drinking places	249	8,498	492
Monetary authorities & depository credit interme	209	2,730	317
Offices of physicians, dentists, & other health	196	2,376	285
Advertising & related services	192	3,104	362
Accounting, tax preparation, bookkeeping	151	2,643	238

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars (except jobs). The downtown analysis did not include traded-sector value added, as that analysis yields the same results as the city-wide traded-sector value added. Industries in green were also in the top 5% of all measures in the city-wide analysis (Exhibit 3.2).

Exhibits 3.2 and 3.3 only show which industries are large, not which industries are concentrated in the local economy. Industry classification systems do not attempt to equalize the scope of every industry listed. For

example, wholesale trade businesses encompass a much larger portion of the national economy than oilseed farming businesses, though on the IMPLAN classification system they are each considered only one industry. Thus, it is not surprising to see industries such as wholesale trade, real estate establishments, and insurance carriers near the top of these lists, as they are typically necessary industries in urban areas. Nonetheless, these industries are large and concentrated in the City and its downtown.

3.3 RELATIVE MEASURES: COMPARISON OF PORTLAND TO NATIONAL ECONOMY

3.3.1 LOCATION QUOTIENT ANALYSIS

In this study, the location quotient (LQ) compares an industry sector's share of value added in the Portland economy to its share in the national economy.

Exhibit 3.4 shows the top 22 industries in the City of Portland in terms of value added LQ and the total value added for those industries.

Exhibit 3.4. Industries in the top 5%, measured by value added LQ, City of Portland, 2007

Industry Name	Value Added LQ	Value Added
Federal govt. electric power	29.39	$274.1
Heavy duty truck manufacturing	12.84	$115.9
Ferrous metal foundries	10.49	$254.1
Dental equipment and supplies manufacturing	8.48	$46.8
Broom, brush, and mop manufacturing	8.45	$27.3
Truck trailer manufacturing	7.65	$42.1
Asphalt shingle and coating materials manufacturing	6.66	$121.2
Primary smelting and refining of nonferrous metal	5.93	$25.1
Cutlery, utensil, pot, and pan manufacturing	5.90	$70.4
Footwear manufacturing	5.89	$13.7
Flat glass manufacturing	4.83	$25.9
Ground or treated mineral and earth manufacturing	4.67	$18.6
Fabricated pipe and pipe fitting manufacturing	4.58	$36.9
Iron and steel mills and ferroalloy manufacturing	4.01	$247.6
Alumina refining and primary aluminum production	3.75	$32.3
Local govt. passenger transit	3.72	$22.3
Fluid milk and butter manufacturing	3.71	$52.0
Cookie, cracker, and pasta manufacturing	3.70	$42.4
Glass container manufacturing	3.69	$25.2
Material handling equipment manufacturing	3.30	$61.4
Other leather and allied product manufacturing	3.24	$6.3
Asphalt paving mixture and block manufacturing	3.16	$56.8

Source: IMPLAN. Calculations by ECONorthwest.
Note: Value added in millions of dollars

Findings related to Exhibit 3.3:

- The high LQ industries shown in Exhibit 3.3 are all relatively small in terms of total value added. It would appear that the Portland economy is most specialized in smaller industries.

- Federal government electric power is highly concentrated in Portland relative to the nation. Most of this concentration can be attributed to the presence of a single employer: Bonneville Power Administration (BPA)

- Heavy duty truck manufacturing and ferrous metal foundries are the only other industries with an LQ above 10. Heavy duty truck manufacturing's high LQ is largely related to the presence of Freightliner, which has experienced significant declines in employment since 2007 (when these data were collected).

Exhibit 3.4 shows the top 22 industries in terms of value added LQ in Downtown Portland. Industries highlighted in green also appeared in the top 22 industries in terms of value added LQ in the city-wide economy.

Exhibit 3.4. Industries in the top 5% of value added LQ, Downtown Portland, 2007

Industry Name	Value Added LQ	Value Added
Federal govt. electric power	22.29	$66.1
Natural gas distribution	7.20	$278.4
Software publishers	6.61	$369.6
Legal services	5.13	$885.8
Coffee and tea manufacturing	4.60	$4.9
Semiconductor machinery manufacturing	4.53	$15.8
Insurance carriers	4.38	$747.2
Other leather and allied product manufacturing	4.25	$2.6
Newspaper publishers	4.09	$94.4
Advertising and related services	3.59	$191.6
Specialized design services	3.59	$57.2
All other miscellaneous professional and scientific	3.50	$280.5
Architectural, engineering, and related services	3.29	$458.3
Data processing, hosting, ISP, web search portals	3.10	$78.3
Scenic and sightseeing transportation and support	2.89	$121.2
Other personal services	2.89	$82.0
Local govt. passenger transit	2.82	$5.4
Museums, historical sites, zoos, and parks	2.71	$58.7
Radio and television broadcasting	2.54	$57.7
Fitness and recreational sports centers	2.46	$23.1
Management of companies and enterprises	2.36	$526.6
Performing arts companies	2.26	$16.9

Source: IMPLAN. Calculations by ECONorthwest.
Note: Value added in millions of dollars. Industries in green were also in the top 22 of city-wide value added LQ (Exhibit 3.5).

Findings related to Exhibit 3.4:

- Several of the more concentrated industries that are concentrated in the City (federal government electric power, other leather and allied product manufacturing, and local government passenger transit) are

also concentrated downtown, suggesting that a high proportion of economic activity in these industries takes place downtown.

- LQ analysis of downtown industries shows a high correlation with the industries that performed well downtown based on absolute measures in the previous section. Downtown Portland showed both absolute and relative specialization in software publishers; legal services; insurance carriers; advertising and related services; architectural, engineering, and related services; and management of companies and enterprises. This is partially attributable to scaling issues when using a small study area as small as a few zip codes, though it also shows that there exists a small number of powerful industries that encompass large shares of the local economy.

3.3.2 SHIFT-SHARE ANALYSIS

Exhibit 3.5 shows the top 5% of industries measured by shift-share analysis. The columns In Exhibit 3.5 are:

- *Actual change* and *percent change* show the amount of change in value added between 2001 and 2007

- *Expected change* shows the amount of change in value added that would have been expected if the industry had followed national trends

- *Local effect* is the difference between the actual change and the expected change. It quantifies the portion of the change that cannot be attributed to national economic trends (in the aggregate or by sector), and is thus arguably the result of some factor in the local economic context (public policy, comparative advantage associated with geographic location, etc.)

The industries shown in the Exhibit are those with the highest local effect, or, in other words, those that outperformed national trends by the highest dollar amount.[17] All of the industries in Exhibit 3.5 experienced growth both locally and nationally. A more in-depth analysis of industries with differing national and local growth patterns is in Appendix C.

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[17] For this reason, the size of the industry also matters: a larger industry might have a smaller percentage growth but a higher total dollar amount of increase. The Exhibit captures industries that are growing quickly but also that are large in absolute terms.

Exhibit 3.5. Industries in the top 5% when measured by local effect (value added shift-share analysis), City of Portland, 2001-2007

Industry Sector	Observed Growth	Expected Change	Local Effect
State & local govt. education	555.2	354.6	200.5
Federal government - non-military	350.3	159.7	190.5
Software publishers	169.4	19.3	150.1
Iron and steel mills and ferroalloy manufacturing	199.0	58.6	140.4
Federal government - military	141.7	44.4	97.3
Medical and diagnostic labs and outpatient and other	287.3	209.8	77.5
Cutlery, utensil, pot, and pan manufacturing	70.4	0.0	70.4
Insurance carriers	509.2	440.6	68.6
Material handling equipment manufacturing	60.0	0.3	59.7
Data processing, hosting, ISP, web search portals	99.6	40.1	59.5
Transport by rail	83.6	28.1	55.4
Asphalt paving mixture and block manufacturing	56.5	1.3	55.3
Motion picture and video industries	66.1	13.4	52.7
Waste management and remediation services	64.9	12.3	52.6
Specialized design services	61.5	15.0	46.5
Other support services	75.5	29.5	46.0
Other Federal Government enterprises	108.2	63.4	44.8
Architectural, engineering, and related services	169.8	126.6	43.2
Other private educational services	64.6	21.4	43.2
Dental equipment and supplies manufacturing	43.7	1.7	42.0
Transport by truck	132.8	93.0	39.7
Food services and drinking places	312.9	278.9	34.0

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars. Expected Change column is the amount by which an industry was expected to grow between 2001 and 2007, based on national trends.

3.4   COMPARISON OF PORTLAND TO 10 OTHER CITIES

One interpretation of the results presented in section 3.3 is that, because the data comparison was between Portland (a city) and the rest of the national economy (which includes substantial rural areas), the resulting analysis reflects the fact that Portland has an economy specialized in the sectors that one would expect in any urban economy. Corporate offices, insurance offices, transportation, and printing are all specializations you would expect to find in a city rather than a rural area. In other words, the results didn't tell us anything new about Portland's economic specialization relative to the cities with which it competes.

To test this hypothesis, ECO completed an analysis that compared industry measures in Multnomah County to those in ten other similar-sized counties.[18] The purpose of this analysis was to better understand Portland's

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[18] The analysis used counties as the unit of measurement because city-level data must be compiled at the zip code level, which is prohibitively expensive and labor-intensive. Ten is not a statistically valid sample, but data and labor costs are prohibitively high for this type of analysis. All results should be interpreted with this in mind.

economic specialization when compared to similarly-sized cities. The process of selecting these ten cities is described in detail in Chapter 2, but in essence, PDC selected the following ten cities from a pool of cities that had most of their population in one county and were similar in population to Portland:

- Austin (Travis County, TX)
- Charlotte (Mecklenburg County, NC)
- Baltimore (Baltimore County, MD)
- Boston (Suffolk County, MA)
- Nashville (Davidson County, TN)
- Denver (Denver County, CO)
- Oklahoma City (Oklahoma County, OK)
- Atlanta (Fulton County, GA)
- Albuquerque (Bernalillo County, NM)
- Fresno (Fresno County, CA)

ECO analyzed output, employment, wage, and value added data (and the subsequent location quotient measures) to compare these ten cities to Portland.

3.4.1 OVERVIEW OF COMPARISON RESULTS BY INDUSTRY SECTOR

ECO calculated each industry sector's relative share of Portland's total value added, and additionally each sector's share of value added in the aggregated economy of all 11 cities. Dividing Portland's relative share by the relative share of the 11 aggregated cities shows Portland's specialization when compared to these other cities. This results in a new location quotient based on value added, using the cities as a basis of comparison. Note that location quotients are most often calculated using the nation as a unit of comparison, and using the subset of cities instead leads to results that must be carefully interpreted. In this document, despite these issues with interpretation, we refer to the measure of specialization as a location quotient (LQ).

Exhibit 3.6 shows the 30 industry sectors with the highest relative share of value added in Portland when compared to the subset of cities, along with their nominal value added (in millions of dollars), traded sector output (in millions of dollars), and jobs.

Exhibit 3.6. Industry sectors with highest relative share of value added compared to a set of similar cities, Multnomah County, 2007

Industry	LQ - Multnomah County: 11 Counties	Value Added	Traded Sector	Jobs
199 Plumbing fixture fitting and trim manufacturing	14.12	$7.1	$19.9	65
176 Primary smelting and refining of nonferrous metal	13.58	$27.6	$93.9	103
294 All other transportation equipment manufacturing	12.97	$6.9	$12.6	11
290 Ship building and repairing	12.30	$73.2	$132.5	433
167 Ground or treated mineral and earth manufacturing	11.74	$20.5	$40.2	64
179 Ferrous metal foundries	11.54	$254.1	$547.2	2,112
92 Leather and hide tanning and finishing	11.14	$4.2	$17.0	81
428 Federal government electricity	10.96	$313.7	$205.2	1,085
201 Fabricated pipe and pipe fitting manufacturing	9.21	$36.9	$93.1	463
180 Nonferrous metal foundries	8.44	$29.7	$53.8	185
172 Alumina refining and primary aluminum production	8.25	$32.3	$134.4	172
274 Carbon and graphite product manufacturing	8.21	$6.7	$12.3	74
307 Dental equipment and supplies manufacturing	7.54	$46.8	$56.2	246
94 Other leather and allied product manufacturing	7.48	$6.3	$13.3	107
17 Commercial Fishing	7.38	$13.0	$15.7	375
280 Truck trailer manufacturing	7.25	$42.1	$89.3	648
155 Clay and nonclay refractory manufacturing	7.11	$1.6	$5.3	19
292 Motorcycle, bicycle, and parts manufacturing	7.02	$5.3	$15.2	33
318 Broom- brush- and mop manufacturing	6.87	$27.3	$60.2	364
228 Material handling equipment manufacturing	6.64	$61.4	$108.0	340
66 Coffee and tea manufacturing	6.27	$31.6	$202.5	413
289 Railroad rolling stock manufacturing	6.20	$9.2	$17.8	32
93 Footwear manufacturing	6.15	$13.7	$36.8	293
185 Handtool manufacturing	6.00	$3.8	$8.8	176
315 Gasket, packing, and sealing device manufacturing	5.93	$15.3	$34.8	210
423 Religious organizations	5.85	$107.7	$204.8	4,448
95 Sawmills and wood preservation	5.69	$19.1	$2.8	122
302 Showcase, partition, shelving, and locker manufacturing	5.39	$25.3	$33.2	455
225 Other engine equipment manufacturing	5.02	$4.6	$11.8	55
278 Heavy duty truck manufacturing	4.81	$115.9	$596.6	1,475

Source: IMPLAN. Calculations by ECONorthwest
Note: Value Added and Traded Sector in millions of dollars. LQs typically compare industry concentration in one geography to the concentration in the nation as a whole, but in this case, the comparison is to a set of 11 cities (including Portland). All data are at the county level (Multnomah County is a proxy for Portland).

Findings related to Exhibit 3.6:

- The majority of the industries with relatively high ratios are relatively small industries when measured by employment, value added, and output. The top three industries when ranked by this ratio measurement employ a total of just 179 people. One possible explanation for this is simply the mechanics of the calculation. Industries with small value added have low denominators (the industry value added in the total set of cities), which means that smaller increases in the numerator (the industry in Portland) have greater results. In other words, it takes less value added to double the ratio in a small industry than a large one.

- Related to the point above and as expected, some of the larger industries such as corporate offices, insurance offices, and transportation are no longer at the top of the list when compared to

other cities. However, Portland is still more specialized in these industries than the average of the ten other Cities we evaluated. The LQs are as follows:

- Corporate:
    - Portland – 2.24
    - 10 Cities – 1.10

- Insurance:
    - Portland – 1.59
    - 10 Cities – 1.25

- Transportation:
    - Portland – 1.52
    - 10 Cities - 0.98

- Wholesale Trade:
    - Portland – 1.32
    - 10 Cities – 1.03

The implication is that even when we control for Portland's "city-ness", we still find that these industries are more concentrated here relative to these other similarly sized cities.[19]

3.4.2   SUMMARY OF SECTOR-LEVEL ANALYSIS

As described in this section, ECO considered the industry sectors ranked by the individual variables. This exercise revealed the following:

- **Sectors that are high in value added were usually also high in output, jobs, and traded sector value added.** This would be expected, as each of these are different measures of the size of an industry. If we presented the top 10 list for each of these variables, the lists would look very similar, and would each contain (in no particular order): management of companies, insurance carriers, real estate establishment, legal services, architectural and engineering services, wholesale trade, and offices of physicians dentists and other health professionals.

- **Sectors that are high in LQ are not necessarily high in other measures.** When we order the list by LQ, we got very different results than when we order the list by any other measure. The top ten by LQ in Portland and downtown are shown in Exhibits 3.6 and

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[19] Given high data costs, we were not able to evaluate enough other cities to assure statistical significance of these results. We'd need to compare Portland to a larger base of cities to determine that this statement is true with any certainty.

3.7. Again, industries that are on both tables are highlighted in gray (in this case, only federal government electric power is highlighted).

- **Portland has high LQs in relatively low-impact sectors.** While we found no statistically significant relationship between LQ and any of the other measures, the highest LQ sectors overlap very little with the highest output and value added industries. This suggests the Portland's economic specialization is in smaller industries. Coffee and tea manufacturing, boom, brush, and mop manufacturing, and cutlery, utensil, pot, and pan manufacturing are examples.

- **Overall, the strongest sectors are those that would be strong in most cities:** management of companies and enterprises, wholesale trade, real estate, and the like. However, these industries are generally more concentrated in Portland than they are in the cities to which we compared Portland. Other strong sectors are probably more unique to Portland: software publishers and iron and steel mills and ferroalloy manufacturing.

- **Service industries are concentrated downtown, and manufacturing and production-related industries outside of downtown.** While this is probably true to some degree in any city, we suspect it is more pronounced in Portland because, relative to other cities, Portland's downtown has a greater concentration of employment of all types. Other cities might have insurance, real estate, and management companies spread throughout their city rather than concentrated in the core. In Portland, the relevant competition for uses in the core is most often located outside of the City limits, in suburban locations that are in different cities.

3.5 OCCUPATIONAL CODES: ANOTHER MEASURE OF SPECIALIZATION

To provide another measure of specialization in the economy, ECO calculated location quotients based on standard occupational codes (SOC). SOC codes are not directly comparable to NAICS codes, and the data are not available at the City level, but the results provide another interesting snapshot of specialization in the metro economy. The LQ quantifies the concentration of employees by occupation in the Portland metropolitan relative to the concentration of employees in the nation as a whole. Exhibit 3.8 provides the results.

Exhibit 3.8. LQs measured on standard occupational codes

Occupation	Regional employment	Average annual wage	LQ
Semiconductor processors	3,010	30,820	10.80
Directors, religious activities and education	860	36,120	7.66
Zoologists and wildlife biologists	1,030	61,380	7.60
Industrial engineering technicians	3,700	44,030	6.50
Clergy	1,970	44,710	6.33
Computer hardware engineers	3,070	86,200	5.09
Music directors and composers	320	42,510	4.62
Service station attendants	3,050	19,400	4.31
Religious workers, all other	180	36,230	4.29
Logging workers, all other	180	32,370	4.13
Coil winders, tapers, and finishers	620	24,420	3.66
Motorboat operators	90	40,370	3.64
Precision instrument and equipment repairers, all other	360	51,660	3.47
Soil and plant scientists	270	59,210	3.46
Urban and regional planners	890	63,670	3.34
Electrical and electronic equipment assemblers	5,440	27,000	3.31
Hoist and winch operators	80	44,310	3.27
Power distributors and dispatchers	230	77,910	3.22
Tank car, truck, and ship loaders	360	48,840	3.19
Life, physical, and social science technicians, all other	1,390	36,150	3.05
Anthropologists and archeologists	120	48,520	3.01
Epidemiologists	90	58,960	2.99
Recreational vehicle service technicians	310	44,780	2.91
Education, training, and library workers, all other	2,180	40,150	2.90
Cartographers and photogrammetrists	250	56,160	2.87
Anesthesiologists	670	NA	2.84
Materials engineers	470	80,160	2.82
Numerical tool and process control programmers	370	55,170	2.82
Tapers	790	45,440	2.79
Woodworkers, all other	240	26,070	2.75
Etchers and engravers	220	32,890	2.60
Interpreters and translators	660	47,920	2.58
Office and administrative support workers, all other	5,170	29,310	2.56

Source: Bureau of Labor Statistics occupational survey, May 2007. Data are for the Portland region labor market: Clackamas, Columbia, Multnomah, Skamania, Washington, and Yamhill counties.
Note: LQ is "location quotient"

The Portland region's labor market is highly specialized in occupations relevant to semiconductor and computer hardware production; several related occupations (semiconductor processors; industrial engineering technicians; computer hardware engineers, coil winders, tapers and finishers; electrical and electronic equipment assemblers; etc) having LQs over 3.0. The Portland region labor market is three to four times more concentrated with these types of employees than the national labor pool, and together, these occupations make up a large number of regional jobs, many or which are high paying. While we did not find a cluster in Portland directly related to these occupations, this result clearly supports the findings in regional studies that computer hardware and engineering is an important cluster contributing to the regional economy.

Another cluster of occupations is in natural sciences. Zoologists and wildlife biologists; soil and plant scientists; and life, science, and social

science technicians all have high LQs and relatively high employment in the Portland metropolitan area. Again, these results are not reflected in our cluster analysis for Portland based on value added, and may reflect a region with a confluence of characteristics: highly interested in conservation, having a significant timber and agriculture-based employment at the regional level, and having a concentration of government and corporate offices with employees focused on resource issues.

3.6   ANALYSIS OF POTENTIAL SECTOR GROUPINGS

While the focus of ECO's work was sector level, we did consider some possible combinations of sectors to see if there might be other potential clusters that the City should consider as it moves forward with its economic development strategy. This section presents results; details are in Appendix D.

ECO did NOT complete a full analysis to identify clusters based on the value added data reported in this chapter; this would have required qualitative and other research (described in Appendix D) that was outside of our scope. But given the breadth and depth of data available to us, we did complete a purely quantitative exercise to identify the groups of sectors that appear to be: (1) making the strongest contribution to the Portland economy in terms of value added, and (2) to be most concentrated in the City relative to the nation. We identified groups of industries that have a location quotient of at least 1.5 and make up at least 0.25% of the City's total value added. Exhibit D.1 provides an overview of the results. Because we did not complete the full cluster analysis, we are referring to the results as "industry groupings" rather than as "clusters."

The industry groupings are useful to the City as it continues to refine its Economic Development Strategy, in part because they suggest additional potential clusters that the City might evaluate for future policy initiatives. This section presents the results of the industry grouping analysis.

Exhibit 3.9 provides an overview of results.

Exhibit 3.9: Overview of Portland industry groups based on value added, City of Portland and Downtown Portland, 2007

Industry Group	Description	Total impact on Portland GDP ($ millions)	LQ (City / Downtown)
1. Business and professional services	Includes many sectors, such as legal services, specialized design services, environmental and other technical consulting services, etc., and firms such as ECONorthwest and Miller Nash LLP.	$5,309.46	1.51 / 3.10
2. Wholesale trade	Wholesale trade is a sector on its own. Adidas and IKON Office Solutions are examples.	$4,925.12	1.45 / 0.43
3. Corporate, regional, and management offices	Fred Meyer, Columbia Sportswear, and Pacificorp are examples. Comprised of one sector.	$2,951.46	2.57 / 2.36
4. Insurance	Includes insurance carriers and insurance agencies and brokerages; Standard Insurance is an example.	$2,587.89	1.73 / 3.60
5. Transportation	Includes transport by air, rail, water, and truck, as well as local government passenger transit. Employer examples are TriMet, Horizon Air, and the Port of Portland.	$2,108.76	1.51 / 0.89
6. Energy utilities	Includes natural gas distribution, federal government electric power, electric power generation; example firms are PGE and BPA.	$1,487.43	1.40 / 3.01
7. Iron and steel mills, foundries, and service centers	Composed of iron and steel mills and ferroalloy manufacturing, steel product manufacturing from purchased steel, and ferroalloy manufacturing. Columbia Steel Casing and Oregon Steel Mills are examples.	$1,066.21	5.23 / 0
8. Software publishing	Composed of one sector. Web MD and Oracle USA are examples of firms in this cluster.	$769.26	2.67 / 6.61
9. Charitable and family services	Sectors include individual and family services (Oregon Community Foundation), community food and housing services (Loaves and Fishes), and grantmaking and social advocacy organizations (Energy Trust of Oregon)	$620.91	1.62 / 1.56
10. Truck manufacturing	Heavy duty truck manufacturing and truck trailer manufacturing. Heavily reliant on one major employer, Freightliner	$524.98	10.86 / 0
11. Data processing and ISP	Surveymonkey.com, Oregonlive.com, and FIOS are examples of firms that are included in this cluster.	$386.04	2.50 / 3.10
12. Printing	The Oregonian is an example of a firm in this cluster, which includes the sectors printing and support activities for printing.	$367.12	2.08 / 1.78
13. Nonmetallic mineral products other than cement	This cluster includes a large number of sectors that are related to one another, such as pottery, ceramics, and plumbing fixture manufacturing; brick, tile and structural clay product manufacturing; and lime and gypsum product manufacturing. Owens Brockway Glass Container and InfinityStone.net are examples.	$230.56	1.56 / 0.06
14. Asphalt products	Portland has advantages for asphalt production because of its port, its proximity to an oil pipeline, and the demand for construction materials in the growing metropolitan area. This cluster includes asphalt paving mixture and block manufacturing, and asphalt shingle and coating materials manufacturing. Owens Corning Roofing and Asphalt is an example firm.	$230.32	4.92 / 0.25

Source: ECONorthwest, 2009, based on 2007 IMPLAN data
Notes: Total impact on Portland GDP includes a multiplier effect, which captures the induced spending in the economy that results from the presence of the cluster.

Findings related to Exhibit 3.9:

1. We did not find concentrations in some industry groupings that we expected to find, based on recent regional study results:

- **Footwear manufacturing**. Although this potential grouping had a high LQ, the value added from this sector did not meet the threshold for consideration.[20]

- **Cutlery and hand tool manufacturing**. This grouping too was too small in the City Portland in 2007 to meet our threshold criterion for value added, although the region has a significant cluster in this category.

2. We saw possibilities for potential industry groupings at the sector level, but did not find a justifiable way to combine them into logical clusters that met our thresholds:

- **Food manufacturing**. There were several food industries that had high LQs in Portland, including breweries, coffee, bread, ice cream, dairies, and cookie manufacturing. However, there were many with low LQs such as distilleries, pet food, flour, seafood, cheese, tortilla, and candy manufacturing. With no similarity to combine industries with high LQs, and with the overall food manufacturing industry having an LQ of just 1.0, no industry grouping was found for this analysis.

- **Medical equipment manufacturing.** Unless we created an industry grouping that includes dental labs and rejects surgical equipment, the LQ threshold cannot be reached. In total, the LQ for this sector is only 1.11.

- **Personal services.** Some personal service industries do have a high LQ, but in total the sector is well below the threshold used for this analysis.

3. We rejected some industry groupings for other reasons:

- **Government other than enterprises.** Because Portland is the largest city in Oregon, Portland is home to many major government offices. For the analysis, however, we rejected this sector because it has almost no traded-sector component (is not exported) and policy changes are unlikely to dramatically alter its economic impact. In other words, we have implicitly assumed that City government is

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20 It is not possible to group footwear manufacturing with the significant activity at Adidas in Portland to form a cluster because Adidas is classified as part of the wholesale sector which cannot be broken into smaller units of analysis. This may be an example of a potential cluster eliminated because of data limitations rather than objective measures of contributions to the economy.

more or less fulfilling its public mission with current employment, and that the City would probably not choose to employ significant numbers of additional workers just for the sake of increasing its own economic impact.

4. We found some industry groupings that seem to have less of an impact on the Portland economy than they once did:

- **Fabricated metal products**. Like food manufacturing there were several industries within this broad category that had a high LQ, but in combination their LQ did not support an industry grouping. Although we note that in past years fabricated metal products was a cluster in Portland, slow growth relative to the rest of the country has reduced the LQ to a nearly neutral 1.02.

- **Machinery manufacturing**. This potential grouping has followed a similar fate to that of fabricated metals. Its share of the Portland economy has fallen relative to other parts of the United States.

5. Finally, we found some potentially strong industry groupings that, upon further examination, resulted almost entirely from data errors.

- **Aircraft parts manufacturing.** This industry shows as significant in the raw data. However, Boeing has a plant in a Portland zip code but is outside of the city limits, and it is the largest company in the local industry.

- **Forestry.** A substantial logging and timber production cluster resulted from misreporting of the data. Companies that had statewide employment were misreporting that employment in the City of Portland and skewing the results.

6. Some of the industry groupings we identify here would not translate well to "clusters" as they are typically defined. Wholesale trade and corporate, regional, and management offices are examples. The datasets used for this analysis (and most cluster analyses) does not disaggregate these industries in a way that is useful for analysis; a corporate headquarters company for a metals manufacturing company and an environmental consulting firm might both be grouped together in the "corporate, regional, and management offices" sector with no way to understand the linkages between the two firms that might logically join them in a cluster. Qualitative analysis would be required to determine which portions of these sectors belonged in a cluster. Future analysis would need to address these concerns.

Exhibit 3.10 below summarizes the results of the industry grouping analysis described above, but displays some additional data in a different format. It shows City of Portland industry groupings and measures of their LQs based on value added (y-axis), total value added (x-axis), and the amount of industry output that is exported (size of the bubble).

Exhibit 3.10. City of Portland industry groups based on value added, 2007
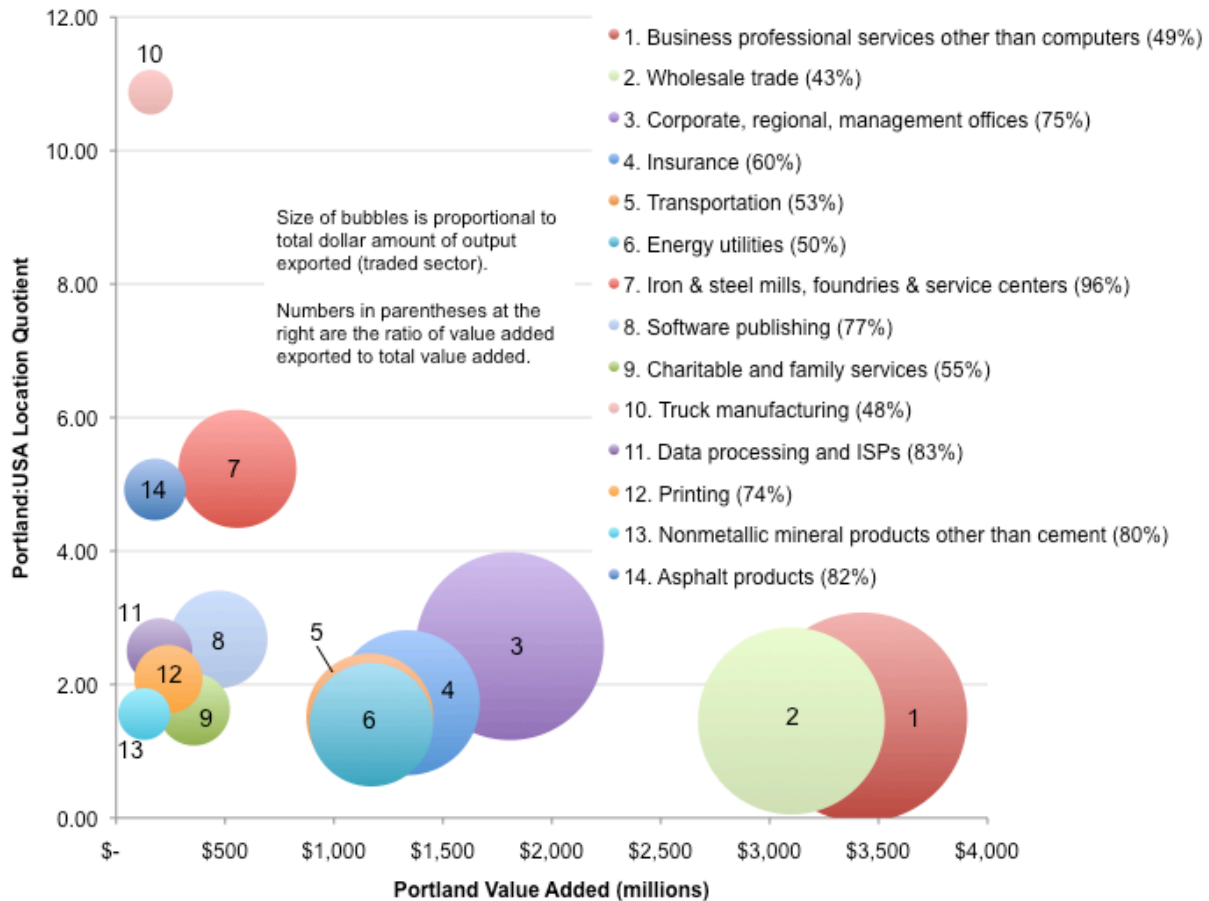
Source: ECONorthwest, 2009, based on 2007 IMPLAN data. See Appendix D for information about methods and assumptions.

In the display of the results in Exhibit 3.10, the industry grouping with the biggest economic impact would be shown as big bubbles in the upper right-hand quadrant of the figure. In fact, the data show results similar to our findings at the sector level:

- The industry groups in which Portland's 2007 economy was most highly specialized (truck manufacturing, iron and steel mills, insurance, software publishing) are all smaller clusters in terms of value added and amount of value added that is exported.

- Conversely, the industry groups with the biggest total value added and the largest traded sector impact have lower LQs, indicating that Portland is not much more specialized in these groups than the nation as a whole. Though all industry groups had to meet an LQ

threshold indicating at least some specialization (1.5) to be considered a cluster in this study, the biggest clusters in terms of value added are the clusters with the lowest relative LQ.

ECO also evaluated conducted shift-share analyses for these 14 industry groupings; results are provided in Exhibit 3.11.

Exhibit 3.11. City of Portland industry groups, 2001 - 2007 shift-share analysis

Cluster	Actual Change	Percent Change	Expected Change	Local Effect
Business, professional services other than computers	$1,122	48%	$989	$134
Wholesale	$721	30%	$741	-$20
Corporate, regional, management offices	$650	56%	$758	-$108
Insurance	$388	41%	$377	$11
Transportation	$343	42%	$318	$25
Energy Utilities	-$41	-3%	$783	-$823
Iron & steel mills, foundries & service centers	$306	122%	$177	$129
Software publishing	$169	56%	$19	$150
Charitable and family services	$191	116%	$208	-$17
Truck manufacturing	-$17	-10%	$12	-$29
Data processing and ISPs	$100	101%	$40	$60
Printing	-$27	-10%	-$8	-$19
Nonmetallic mineral products other than cement	$41	47%	$17	$24
Asphalt products	$143	414%	$119	$24

Source: ECONorthwest, 2009, based on 2007 IMPLAN data. See Appendix D for information about methods and assumptions.

This analysis found that business and professional services, insurance, transportation, iron and steel mills, software publishing, data processing and ISPs, nonmetallic mineral products other than cement, and asphalt products all grew at a rate faster than would have been expected given national trends for the industry groupings. These industry groupings are large, concentrated, and growing more quickly than national averages.

ECO analyzed specialization in industry sectors from many angles, and each angle suggested a different mix of industries that might be important for City policy to target and support. In this chapter, we pull together our various measures into one index, and discuss the implications of the analysis for the City's economic development strategy and the clusters it focuses on.

4.1   EVALUATION OF CITY OF PORTLAND *ECONOMIC DEVELOPMENT STRATEGY* CLUSTERS

The sector-level analysis in this report was conducted to support and complement the City's parallel analysis of industry clusters for the ongoing creation of its economic development strategy. The *Draft Economic Development Strategy* available at the time of this report identifies four clusters that are increasingly important to the Portland economy and a series of policy actions to support growth of those clusters. They are: activewear and outdoor gear, advanced manufacturing, software, and cleantech. A fifth potential cluster, biotechnology, has been considered as well but is not a focus cluster in the current draft of the Strategy.[21] This section aligns the results of this sector-level analysis with the City's clusters.

Exhibit 4.1 shows the following information for the target clusters that the City is currently evaluating: (1) total value added in 2007 (size of the bubble); (2) rate of local growth relative to national growth between 2001 and 2007 (location of bubble); and (3) 2007 location quotient (listed as a ratio in the legend). Data are for the City of Portland.

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[21] More information about the clusters and the policy actions is available online at www.pdc.us.

Exhibit 4.1: PDC industry clusters: 2007 value added (in millions of dollars), local and national growth rate (2001-2007); and location quotient

Source: IMPLAN data for the nation and the City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest

Note: Size of bubble shows value added in 2007. Each legend label shows the cluster's 2007 Portland:U.S. value added location quotient. The dotted arrow has a slope of 1; clusters located to the right of the line grew faster in Portland than in the nation between 2001 and 2007.

PDC identified its clusters using the North American Industry Classification System (NAICS), and ECO used IMPLAN data, which is based on NAICS data but has its own classification system. These differing industry classification systems resulted in a less-than-perfect translation of the industries in PDC's clusters. In some cases, a five-digit NAICS category only matched up with a portion of an IMPLAN industry sector, resulting in overstated values. In other cases, there is no good IMPLAN match for a four- or five-digit NAICS industry sector and no values are given. In all, however, translation issues arose in only 14 of the 153 IMPLAN industry sectors used in Exhibit 1. Due to translation issues, size of activewear cluster is underestimated, cleantech cluster is overestimated, and all other clusters were well-matched. Bio-sciences had the most serious translation issues, and is discussed separately in a footnote.

Figures in millions of 2007 dollars.

    In Exhibit 4.1, a cluster with a large bubble located below the dashed line and with an LQ over 1.0 would be considered a strong cluster. Most of PDC's clusters and niches either meet those criteria, or come very close to meeting them.[22] For context when evaluating the Exhibit (and others

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[22] The City is considering a cluster in Biosciences. ECO chose to exclude the Biosciences cluster from consideration for Exhibit 2 because the translation between classification systems (NAICS and IMPLAN) resulted in a high level of uncertainty in the composition of the cluster. ECO observed both overestimation and omission of potentially important industry sectors. These data errors resulted in a shift-share analysis that was in all likelihood not representative of the Biosciences cluster. That said, the results that we did get were very positive for Biosciences. It showed an increase of nearly 150% for the cluster between 2001 and 2007 which, even if only partly accurate,

that follow): the City of Portland economy grew by about 23% in terms of value added, while the national economy grew by about 37%. Even so, nearly all of the clusters outpaced growth in the general Portland economy, and some (especially activewear and outdoor gear) outpaced the average growth in the national economy.

ECO used the City's definitions of each of the clusters in Exhibit 4.1 for its analysis. We used the same NAICS codes to compose the clusters (see note on Exhibit 4.1 for clarification), and acknowledge the same data and measurement issues that the City is itself grappling with as it develops its economic development strategy. The cleantech cluster, defined generally by the City as green building, alternative energy, energy efficiency, and environmental consultation and remediation services, has some special measurement issues.[23] Several of the component parts of the cluster have no NAICS code definitions, while others have NAICS codes that broadly capture firms that may have some "green" agenda but are not generally following sustainable business practices.

To provide additional information about the cleantech cluster and show how component parts of the cluster have grown and changed, Exhibit 4.2 shows the component parts of the cluster using the same format as Exhibit 4.1 above.

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outperformed the local economy, most of the other clusters, and the Biosciences cluster measured nationally.

[23] In its overview of the cleantech cluster, PDC has stated "There are no federal, state or local definitions to distinguish "green" companies from their counterparts…" and "Voids in NAICS and SOC codes make it impossible to separate [cleantech] firms from their non-green cohorts and standardize definitions for cluster". The NAICS codes categories include firms that may have components that practice "green" business, but that are not generally considered "sustainable."

Exhibit 4.2: PDC industry cluster – cleantech: 2007 value added (in millions of dollars), local and national growth rate (2001-2007); and location quotient

Source: IMPLAN data for the nation and the City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest

Note: Size of bubble shows value added in 2007. Each legend label shows the cluster's 2007 Portland:U.S. value added location quotient. The dotted arrow has a slope of 1; clusters located to the right of the line grew faster in Portland than in the nation between 2001 and 2007.

The fastest growing components of the cleantech cluster are: (1) environmental and other technical consulting services, (2) waste management and remediation services, and (3) turbine and turbine generator set manufacturing. Turbine manufacturing was small in terms of total value added, but grew very quickly in value added between 2001 and 2007 (over 20,000%). While some of this growth could be attributed to data errors[24], it is nonetheless significant given that the industry declined in the nation as a whole.

Exhibit 4.3 shows the results of a shift-share analysis for the same set of clusters above, measured in value added. (A shift-share analysis is a way of showing how an industry sector has changed over time, and of estimating how much of that growth is a result of local factors as opposed to broader changes in the national economy or in the particular industry.) A guide to reading the Exhibit:

[24] Because it is a small industry that probably has few component firms in Portland, one firm misreporting its earnings and employment in either 2001 or 2007 could skew the results quite dramatically. ECO could find no evidence of a data error, but given the magnitude of its growth relative to the nation and to other industry sectors, has reason to suspect one.

- The "Actual Change" column shows how the industry's value added grew or declined between 2001 and 2007.

- The "Expected Change" column shows how the industry would have been expected to grow locally between 2001 and 2007 if it had grown at the same rate that the industry grew nationally.

- The local effect quantifies the portion of the change in value added that is not plausibly explained by larger national trends.

For example, based purely on national trends, the value added of the advanced manufacturing cluster would have been expected to grow by $134 million between 2001 and 2007, but it actually grew by $306 million. The inference is that the $172 million that the cluster grew beyond expected trends resulted from some factor (successful economic development initiatives; comparative advantages such as location of the industry relative to market, presence of skilled workforce, etc.; or local policies) that is specific to Portland.

All of these clusters, with the exception of advanced manufacturing, outpaced the local economy of Portland (which grew at 23% during this time period). Most matched or nearly matched growth in the national economy (which grew 37% during the same period).

Exhibit 4.3. Value added shift-share results for City of Portland clusters and a breakdown of the cleantech cluster, 2001-2007

Cluster	Actual Growth	Expected Growth	Percent Change	Local Effect
Advanced Manufacturing	$306.1	$133.7	20%	$172.3
Software	$204.3	$78.1	24%	$126.2
Activewear	$56.6	$1.3	47%	$55.3
Cleantech	$447.8	$599.1	38%	-$151.3
Cleantech industries				
Electric power generation, transmission, and distribution	$114.2	$385.2	24%	-$271.0
Turbine and turbine generator set units manufacturing	$8.1	$0.0	21724%	$8.1
Water, sewage and other treatment and delivery systems	-$3.3	$1.2	-100%	-$4.5
Scientific research and development services	$20.9	$24.1	37%	-$3.2
Environmental and other technical consulting services	$73.1	$42.1	264%	$31.0
Architectural, engineering, and related services	$169.8	$126.6	29%	$43.2
Waste management and remediation services	$64.9	$12.3	172%	$52.6

Source: IMPLAN data for the nation and the City of Portland as defined by zip codes, 2001 and 2007. Calculations by ECONorthwest
Note: Figures in millions of dollars. See note on Exhibit 4.1 for details about translation between NAICS and IMPLAN figures for the clusters. See text regarding cleantech for caveats on growth in the Turbine Manufacturing sector.

4.2 PULLING IT ALL TOGETHER: INDEX OF MEASURES AND POSSIBLE INDUSTRY GROUPINGS

Chapter 3 describes Portland's strongest industries in terms of multiple measures, both absolute and relative. The problem of multiple measures cannot be separated from the problem of *weighting*: if ranks on different variables are combined, is each measure as important as every other variable? And related: if some of the measures overlap (as value added, output, and exports do), should they have lower weights so as not to overwhelm other considerations?

There is no agreement on the right answer to these questions and there never will be. The best any study can do—and what we have tried to do here—is to be clear about the assumptions and methods being used to get to an overall ranking.

ECO created a simple index for identifying which industry sectors are the most important to the Portland area's economy:

- Location quotient for value added (25%)

- Total value added (15%)

- Amount of value added that is exported (as a measure of Traded Sector) (25%)

- Number of jobs (10%)

- Industry growth measured as local effect (shift-share) (25%)

Exhibit 4.4 shows the summarized results for the value added shift-share analysis, but displays the results only for a subset of the industry sectors present in Portland. Exhibit 4.4 displays the 10% of industries that rose to the top of this weighted index. Industries are ordered by their rank according to the index.

The red text signifies an industry that underperformed relative to national growth, and green text signifies faster growth locally than nationally. Industries shaded in grey are those that are included in one of the clusters identified in the City's current draft of its economic development strategy (see Exhibits 4.1 – 4.3 for details).

Exhibit 4.4. 2001-2007 shift-share results (in millions of dollars): top 10% of industry sectors in Portland based on an index of measures of economic specialization

Industry	Actual Change	Percent Change	Expected Change	Local Effect	VA LQ	Value Added	Traded Sector	Jobs
Software publishers	$169.4	56%	$19.3	$150.1	2.67	$ 470.6	$ 364.0	2,595
Iron and steel mills and ferroalloy manufacturing	$199.0	410%	$58.6	$140.4	4.01	$247.6	$229.5	853
Insurance carriers	$509.2	86%	$440.6	$68.6	2.05	$1,099.6	$802.7	9,937
Architectural, engineering, and related services	$169.8	29%	$126.6	$43.2	1.72	$754.1	$446.7	12,205
Ferrous metal foundries	$78.7	45%	$47.7	$31.0	10.49	$254.1	$253.8	2,112
Data processing, hosting, ISP, web search portals	$99.6	101%	$40.1	$59.5	2.50	$198.7	$164.1	2,314
Other state and local government enterprises	$8.0	2%	-$24.7	$32.7	2.27	$365.7	$174.1	2,692
Medical and diagnostic labs and outpatient and other	$287.3	158%	$209.8	$77.5	1.67	$469.5	$233.4	4,608
Management of companies and enterprises	$650.0	56%	$758.3	-$108.3	2.57	$1,807.4	$1,349.0	13,895
Legal services	$331.3	49%	$320.5	$10.8	1.85	$1,004.4	$591.2	11,308
Food services and drinking places	$312.9	48%	$278.9	$34.0	1.23	$964.4	$364.4	32,939
Transport by truck	$132.8	50%	$93.0	$39.7	1.12	$398.7	$89.9	5,791
Scenic and sightseeing transportation and support	$78.9	35%	$115.7	-$36.8	2.33	$307.3	$177.1	4,165
US Postal Service	$163.4	85%	$141.4	$22.0	1.43	$356.0	$180.4	4,043
Specialized design services	$61.5	96%	$15.0	$46.5	2.50	$125.6	$81.6	1,892
Cutlery, utensil, pot, and pan manufacturing	$70.4	N/A	$0.0	$70.4	5.90	$70.4	$63.7	214
Other support services	$75.5	65%	$29.5	$46.0	2.19	$191.1	$103.5	2,151
Other Federal Government enterprises	$108.2	125%	$63.4	$44.8	2.19	$194.7	$104.2	1,435
All other miscellaneous professional and scientific	$352.0	176%	$350.3	$1.7	2.19	$552.4	$343.9	2,418
Natural gas distribution	$42.3	18%	$134.8	-$92.4	2.29	$278.4	$166.1	691
Federal govt. electric power	-$221.5	-45%	-$214.8	-$6.6	29.39	$274.1	$127.2	948
Wholesale trade businesses	$721.3	30%	$741.4	-$20.1	1.45	$3,100.1	$1,332.8	26,857
Real estate establishments	$737.1	39%	$1,562.9	-$825.8	1.06	$2,632.4	$984.0	21,673
State & local govt. education	$555.2	100%	$354.6	$200.5	1.01	$1,632.9	$43.1	28,484
Offices of physicians, dentists, and other health	$238.9	29%	$287.2	-$48.3	1.12	$1,070.2	$372.9	12,989
Federal government - non-military	$350.3	81%	$159.7	$190.5	1.22	$784.1	$4.0	7,243
Material handling equipment manufacturing	$60.0	4228%	$0.3	$59.7	3.30	$61.4	$47.5	340
Dental equipment and supplies manufacturing	$43.7	1421%	$1.7	$42.0	8.48	$46.8	$32.6	246
Community food, housing, and other relief services	$58.8	121%	$35.9	$22.9	2.29	$107.5	$70.2	4,494
Transport by air	$24.5	10%	$51.0	-$26.5	1.76	$275.3	$245.1	3,226
Telecommunications	$55.0	10%	$135.3	-$80.3	0.78	$619.4	$249.3	2,708
Private hospitals	$182.2	35%	$264.0	-$81.8	0.92	$698.9	$96.9	10,786
Securities, commodity contracts, and investments	$78.6	22%	$110.6	-$32.0	0.66	$431.1	$147.9	6,842
Automotive repair and maintenance, except car wash	-$217.7	-51%	-$246.0	$28.4	1.26	$211.6	$75.4	3,643
Advertising and related services	$19.4	7%	$52.7	-$33.3	1.85	$310.0	$92.1	5,022
Retail Nonstores - Direct and electronic sales	$217.3	169%	$235.2	-$17.9	1.35	$346.1	$157.5	4,836
Asphalt shingle and coating materials manufacturin	$86.9	253%	$93.2	-$6.3	6.66	$121.2	$103.0	199
Steel product manufacturing from purchased steel	$27.9	104%	$8.8	$19.1	2.68	$54.8	$50.7	386
Truck trailer manufacturing	$28.0	200%	$6.8	$21.3	7.65	$42.1	$26.9	648
Flat glass manufacturing	$23.5	970%	$0.9	$22.6	4.83	$25.9	$21.0	206
Asphalt paving mixture and block manufacturing	$56.5	20059%	$1.3	$55.3	3.16	$56.8	$42.7	92
Primary smelting and refining of nonferrous metal	$25.1	N/A	$0.0	$25.1	5.93	$25.1	$23.7	93
Electric power generation, transmission, and distribution	$114.2	24%	$385.2	-$271.0	0.90	$594.9	$279.3	719
Other private educational services	$64.6	107%	$21.4	$43.2	1.40	$124.7	$73.8	4,544

Source: IMPLAN data for the nation and the City of Portland (based on zip codes) for 2001 and 2007. Calculations by ECONorthwest

Note: All dollar figures in millions of current dollars. Red text signifies underperforming industries relative to national growth rates, even for industries that were growing. Green text signifies industries that outperformed national growth rates. Table is sorted by descending value added in 2007.

To test the sensitivity of our index, we ran the index a number of times, each time changing the weighting of the individual input factors. While we did get different results with each index run, we found that the following industries were in the top 10% of industries regardless of the weighting we chose:

- Transport by truck
- Software publishers

- Insurance carriers

- Legal services

- Architectural, engineering, and related services

- Management of companies and enterprises

- Medical and diagnostic labs and outpatient facilities

These seven industries are concentrated, relatively large, and growing. Many of them are already under consideration for City policy initiatives.

While the focus of ECO's work has been at the sector-level, we did consider some possible combinations of sectors to see if there might be other potential clusters that the City should consider as it moves forward with its economic development strategy. Detailed results are presented in Chapter 3 and Appendix D, but Exhibit 4.5 provides a summary results that combines all measures. Again, ECO identified groups of industries that have a location quotient of at least 1.5 and make up at least 0.25% of the City's total value added. The details of this analysis are contained in Appendix D.

Note that a fourteenth group of industries, asphalt products, grew at a much faster rate over the period and could not fit within the scale of the chart. Asphalt products grew by 414% locally and 344% nationally. Portland's LQ in this group of industries was 4.92 and the total value added of the group was $178 million. This group was relatively small in terms of economic impact, but qualitative analysis shows it is one of Portland's specialties.

Exhibit 4.5. Groupings of sectors based on quantitative analysis: 2007 value added (in millions of dollars), local and national growth rate (2001-2007); and location quotient
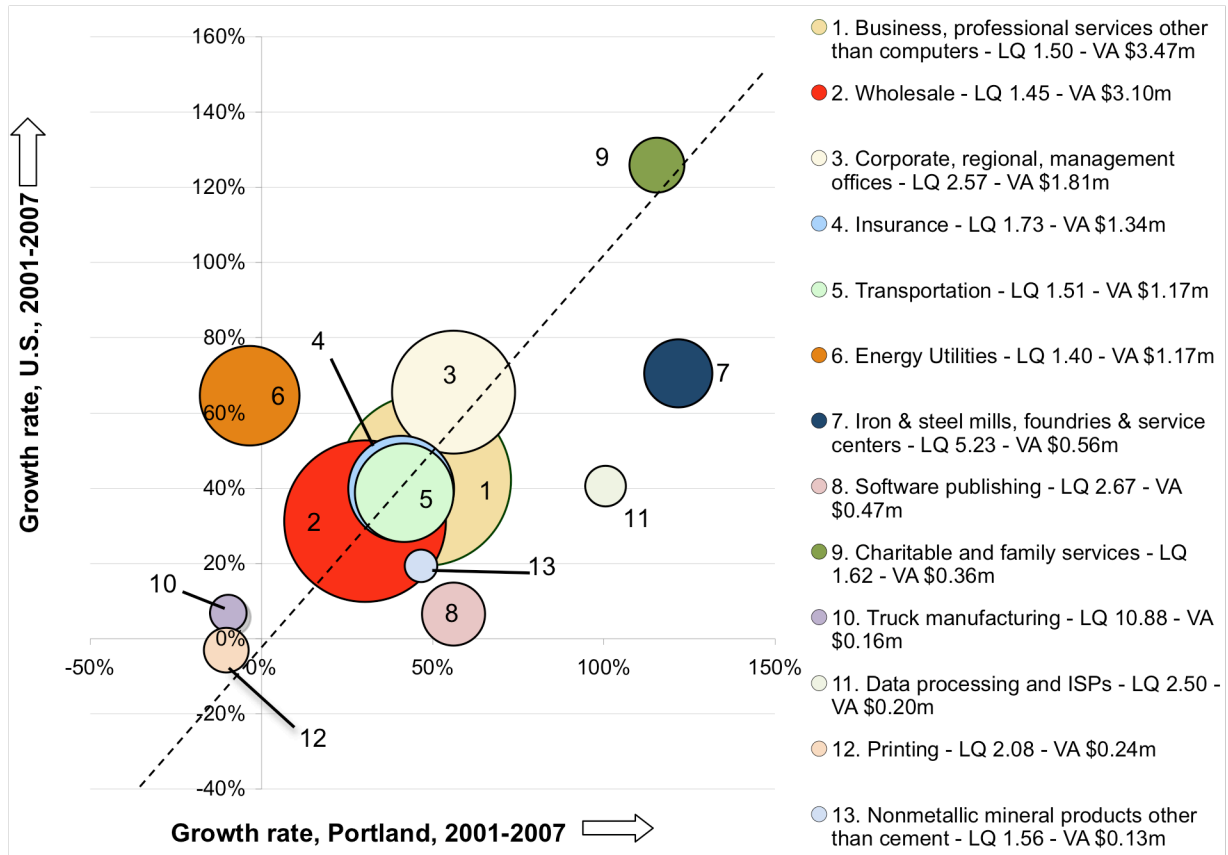
Source: IMPLAN data for the nation and the City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest
Note: Bubbles are groupings of industries based on a purely quantitative methodology; ECO did not complete a full cluster analysis to identify clusters based on value added data.
NOT SHOWN: A potential grouping in asphalt production, which grew at a much faster rate over the period and could not fit within the scale of the chart. Asphalt products grew by 414% locally and 344% nationally.
Size of bubble shows value added in 2007. Each legend label shows the cluster's 2007 Portland:U.S. value added location quotient and 2007 value added. The dotted arrow has a slope of 1; clusters located to the right of the line grew faster in Portland than in the nation between 2001 and 2007.
Detailed methodology and analysis contained in Appendix D.

Many of these groupings of industries are already contained in the City's identified clusters. Energy utilities and iron and steel mills, for example, are both part of the City's cluster in advanced manufacturing.

Several others are grouped together in the data but would not necessarily make logical clusters from a policy perspective. Wholesale trade and corporate headquarters, for example, are both large in terms of value added and concentrated in the City's economy. However, firms that are otherwise unrelated might be grouped together in the datasets that define wholesale trade and corporate headquarters. For example, Adidas and IKON Office Solutions are both considered wholesale trade firms, but

do not have similar supply chains or customer bases to meet the typical definition of a "cluster" and to require a cohesive public policy strategy.

Others, however, are unique groupings of industries that the City might consider in future iterations of its strategy. Transportation, data processing and ISPs, and insurance all fall into this category.

4.3 IMPLICATIONS AND NEXT STEPS

The results of this analysis generally support the clusters that the City has identified.

- The clusters perform well on nearly every measure of specialization considered in this study. Most of them grew faster in Portland than in the nation. Most have strong LQs, indicating concentration of value added in Portland relative to the nation. Most grew faster than the Portland economy as a whole.

- At the industry level, many of the ten top sectors (based on an index that combines all measures of specialization considered in this evaluation) are included in one of the City's clusters.

- Activewear and outdoor gear probably performs best on all measures. It has the highest LQ at 1.66, and the biggest differential in value added growth between Portland and the nation, with a local effect of $55M (2007 dollars).

- Cleantech is the only cluster with a negative local effect (-$140M), indicating that it did not grow as fast in Portland as in the nation. However, it is also the biggest cluster in terms of total value added, and very nearly matched national growth rates. Additional research could help to identify why this cluster is not keeping up with national trends, as well as the degree to which data errors contribute to our lack of understanding of the true performance of this cluster.

The sector-level analysis suggests several other strong and growing industry sectors that the City might also consider for policy initiatives.

- Several of the biggest (in terms of value added and employment) and most concentrated industry sectors are not included in any of the City's clusters, and could be more carefully evaluated.[25] Legal

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[25] Wholesale trade is NOT a good example of this; IMPLAN lumps together many smaller NAICS industries in this "sector" with out a good avenue for disaggregation. Some of the smaller NAICS codes that are joined into the IMPLAN code for wholesale trade probably ARE included in some of PDC's clusters.

services, insurance carriers, and transportation by truck and air are examples. These are sectors that support other sectors; growth in the clusters might indirectly cause growth in these sectors. However, because they are so large and concentrated, a more specific strategy might be appropriate.

- More discussion would be needed about exactly what type of policies might be appropriate to support these clusters, and how PDC might help target growth in them.

More work should be done to identify the cause of changes in value added.

- An advantage of a shift-share analysis is that it quantifies the portion of change in an industry that occurred at a local level that cannot be attributed to national trends. In other words, it identifies the amount of change that was caused by some factor in the local environment (which could be an economic development policy, a comparative advantage, or the presence of a particularly strong firm with strong leadership that captures a broad market share). While the data and results are interesting, interviews or qualitative research would be necessary to understand what is happening in Portland that is causing it to grow differently here than nationally. This might be particularly important for the industry sectors that in the City's clusters, as it may suggest additional policy initiatives that would help to support growth in the clusters.

- Some of the biggest sectors, in terms of value added, are underperforming relative to national trends. Management of companies and enterprises, real estate establishments, and wholesale trade businesses are examples. The fact that these large industry sectors did not keep up with national trends accounts for a portion of Portland's relatively lower growth rate relative to the nation. Because these industry sectors are such a relatively big part of the total value added in our economy and are relatively concentrated in Portland and its downtown core, additional analysis should be done to determine why this is occurring, and how much of a concern it really is.

Appendix A Summary of Previous Studies

This appendix contains a summary of ECO's review and evaluation of documents that present recent relevant information about economic specialization in the Portland region as well as recent documents that highlight strategies for economic development in. The purpose of this exercise is to research and review cluster analysis methodology, as well as any key data and policies that may impact this cluster study. ECO reviewed two types of documents:

- **Cluster documents** contains recent studies—including the identification and analysis—on industry clusters in the Portland region (and one for Seattle).
- **Economic development documents** covers relevant City and regional plans that implement business and industry specific policies or strategies that may affect the size and growth of area clusters.

Exhibit A.1 below is a summary matrix of the key Portland area cluster studies that ECO has reviewed. Below are key finding from the document review.

Exhibit A.1. Summary matrix of key Portland area cluster analyses

Study	Author	Year	Clusters Identified	Methodology	Consideration of Sustainability
Economic Development Target Industry Plan: Fiscal Year 2006/2007	Portland Development Commission	FY 2006/2007	• Activewear/Outdoor Gear • Biosciences • Creative Services • Distribution and Logistics • Food Processing • High Tech • Metals and Transportation Equipment • Professional Services • Sustainable Industries	• Identifies clusters as groups of industry sectors that are important contributors to the region, and have high growth potential, in addition to employment concentration. • **LQs:** Measures specialization using LQs, comparing employees in the Portland area to the West Coast states. It uses NAICS based employment data. • Includes support businesses and suppliers, in addition to the producers of final goods and services, in clusters	Includes a Sustainable Industries cluster. The PDC study defines this cluster as, "traded sector businesses which produce a product or service in a more environmentally-responsible and/or energy efficient manner than standard production methods." The document breaks this cluster into sub-clusters: Energy Industries, Green Building, and Recycled Products.
Greater Portland MSA Industry Cluster and Workforce Analysis	Greenlight Greater Portland	March 2008	• Alternative Renewable Energy • Apparel and Active/Outdoor Gear • Biosciences • Computer Hardwear and Electronics • Computer Software and IT Services • Creative Services • Distribution and Logistics • Environmental Services and Recycling Technology • Financial Services • Food Processing • Metals, Machinery, and Transportation Manufacturing • Professional Services	• Identifies clusters as groups of industries where the region has a strong comparative advantage, a high employment concentration, and high wages. It also considers areas where the region's strength is expected to grow. • **LQs:** Calculates industry specialization using LQs, comparing employees in the region versus the nation; it does not specify data source or industry codes. • Looks at future trends in its determination of specialization. Looked at trends in number of firms, growth in wages and employment, and venture capital investment to help determine what industry sectors have a strong outlook now and in the future. • Considers a human capital component to determine where the region's skill set lies, what type of workforce the Portland area has, and what industries benefit from this. • Considers where venture capital in the region is headed to determine what industries have high growth potential.	Concludes that recruitment initiatives should be created in order to attract more businesses in the Alternative/Renewable Energy and Environmental Services and Recycling Technology clusters. This is because (1) the current workforce can transistion into these specialities; (2) significant venture capital is flowing towards these clusters; (3) there is regional momentum towards these types of businesses; and (4) the incentives are already in place.

Source: ECONorthwest.

Exhibit A.2. Summary matrix of key Portland area cluster analyses (cont.)

Study	Author	Year	Clusters Identified	Methodology	Consideration of Sustainability
Portland Competiveness: An Analysis of Comparative and Absolute Advantage	ECONorthwest	March 2004	This study did not necessarily cluster industry sectors. It did find that Multnomah County has a comparative advantage over the Portland-Vancouver PMSA in the following industry catagories: • Heavy manufacturing involving metals • Professional Services • Speciality retailers • Creative Services • Financial Services • Tourism • Educational Services • Government • Health and Human Services	• Identifies where Portland has comparative advantages relative to other locations within the region, as well as an assessment of their importance to Portland's overall competitiveness. • **LQs:** Computes industry concentrations using LQs, comparing total labor income (employer payroll plus the wages of the self-employed) in Multnomah County versus the Portland-Vancouver PMSA (which emcompasses 5 counties). It uses NAICS based employment data. • Ranks all Multnomah County industries by LQ and derives policy implications: marketing efforts to attract high rank industries should be successful; policies that improve competitiveness of lower ranked industries could be pursued as long as higher ranked industries are not adversely affected. • Conducts a shift-share analysis to determine the causes of industry growth in Multnomah County between 1997 and 2002: increased specialization or other macro economic sources (e.g., tax increase, or change in land availability).	This document does not make special consideration for businesses or industry sectors that are sustainable or environmentally friendly.

Source: ECONorthwest.

Exhibit A.3. Summary matrix of key Portland area cluster analyses (cont.)

Study	Author	Year	Clusters Identified	Methodology	Consideration of Sustainability
Comprehensive Economic Development Strategy for the Portland-Vancouver Metropolitan Region	ECONorthwest	June 2005	• Apparel and Sporting Goods • Creative Services • Distribution and Logistics • High Technology • Food Processing • Forest Products • Metals, Machinery, and Transportation Equipment • Nursery Products • Professional and Business Services • Food Services and Accommodation	• Identifies traded sector clusters that have the largest impact on the Portland-Vancouver economy in terms of: (1) direct employment impacts in terms of new hiring and construction; and (2) spending multipliers that positively impact suppliers of goods and services to these industries, in addition to employees. The methodology behind the selection of these industry clusters is not discussed in this document.	This document does not make special consideration for businesses or industry sectors that are sustainable or environmentally friendly.

Source: ECONorthwest.

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Key document review findings:

- **The methodology used to create the location quotients (LQs) differed in each of the cluster documents.** Each of the documents reviewed calculates LQs using either total employment or total labor income. The ECO analysis, however, identifies its relevant clusters using LQ concentration measures of total value added rather than employment, which provides a better measure of an industry's significance in an economy. Studies also differ on what geography to compare the Portland area to. However, all studies use NAICS based data.

- **Some studies consider sustainable or "green" industry clusters while others do not.** The definition of what a sustainable cluster is appears fluid among the documents. However, they generally agree that sustainable businesses are an important factor in the Portland economy because there is regional momentum towards these types of businesses, incentives to attract sustainable businesses are already in place, and venture capital is encouraging economic development in these areas.

- **Each document combines the LQ analysis with other factors to determine which Portland area industrial sectors are "important."** The studies in the table above consider other measures of comparative advantage: recent high employment and wage growth, how the local area's skill set aligns with the skill set necessary to be successful in each industry, how external factors may contribute to specialization (e.g., local taxes, land availability, political climate). In addition to calculating LQs, ECO is examining each industry's share of value added associated with exports (traded sector), total jobs, and separate LQs for specific categories of jobs to help define important industries. ECO is also following up its analysis with interviews of industry representatives and cluster analysis practitioners.

- **None of the studies agree completely on which clusters are most important in Portland**. However, there are a number of similarities across documents. Biosciences and Activewear/Outdoor Gear is found in multiple studies, although these clusters did not meet ECO's threshold. Other clusters found consistently in the studies (as well as ECO's) are: Creative Services, Professional Services, and Financial Services. This is understandable because all downtown areas are good at producing these services. Clusters relating to manufacturing or high tech products and services are included in each study but the precise activities are not consistent. This is largely due to differences in methodology and definitions.

- **It would be advantageous for the City to coordinate the results of the cluster studies with future planning efforts.** Planning documents note that while many creative ideas are cultivated in Portland, many young people leave because research and development funding is lacking. On the other hand, the cluster studies note that many of the emerging high tech clusters depend on young talent. Recognizing these facts and coordinating policy may help encourage growth in Portland's clusters. However, even though high tech industries are emerging in the area and provide high paying jobs, it is important to continue to support those sectors that Portland has a strong comparative advantage.

Appendix B Economic Context

Most experts agree that the economic outlook for 2009 is, at best, uncertain. In the Portland metropolitan region, several major employers (Freightliner, Intel) and many smaller employers have reduced staff or shut down entirely. Unemployment has reached 9%, and many expect it to continue to increase. State and local governments are facing major budget shortfalls.

In 2007, however, the most recent year for which data are available for the analysis in this report, the Portland economy stronger. This appendix provides context for understanding and interpreting the results in the remainder of the report. It describes the 2007 Portland economy relative to the region, and identifies some of the major trends affecting the Portland economy. It answers the following questions, using the results of the IMPLAN analysis:

- How do the Portland and downtown Portland economy differ from the regional economy?

- How do the City and the region share its labor pool? How do wages compare?

- How did employment change between 2000 and 2007?

We consider the data for three geographies: downtown Portland, the City of Portland, and the region (defined in the Methods overview section).

B.1   HOW DO THE PORTLAND AND DOWNTOWN PORTLAND ECONOMIES DIFFER FROM THE REGIONAL ECONOMY?

The economies are different in scale, of course, but are also different in terms of industry and employment composition and wages. The differences suggest different policy and economic development approaches. The tables that follow will show that the regional as a whole produces far more services than goods, and that this patterns is even more pronounced in the City and its downtown. It will also show that downtown Portland is a major center of regional employment, whether measured by number of jobs or by value added.

Exhibit B.1 provides a comparison of GDP in the economies of the downtown, City, region, and country. Portland's downtown makes up about 32% of the City GDP, and the City makes up about 34% of the regional GDP.

Exhibit B.1. Overview of area economies, 2007

	United States	Nine County Region	Portland Zip Codes	Downtown Portland Zip Codes
2007 Gross Domestic Product (MN $)	$13,807,600	$110,818	$38,229	$12,150
Sectors reporting output	436	391	328	208
Inactive sectors	-	45	108	228
Resident population	301,290,332	2,517,938	587,504	45,056
GDP per capita	**$45,828**	**$44,011**	**$65,070**	**$269,671**

Notes: City of Portland boundaries approximated based on zip codes. Downtown Zip Codes are 97201, 97204, 97205, and 97209. The Nine County region is composed of the following counties found in the Portland-Vancouver CMSA: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, and Polk.

Exhibit B.2, below, displays total employment, by category of industrial sector, for these geographies.[1] The bars show total employment found in the CMSA for each category of IMPLAN data.

Exhibit B.2. Employment by industry sector, Downtown, Portland, and the Portland CMSA, 2007
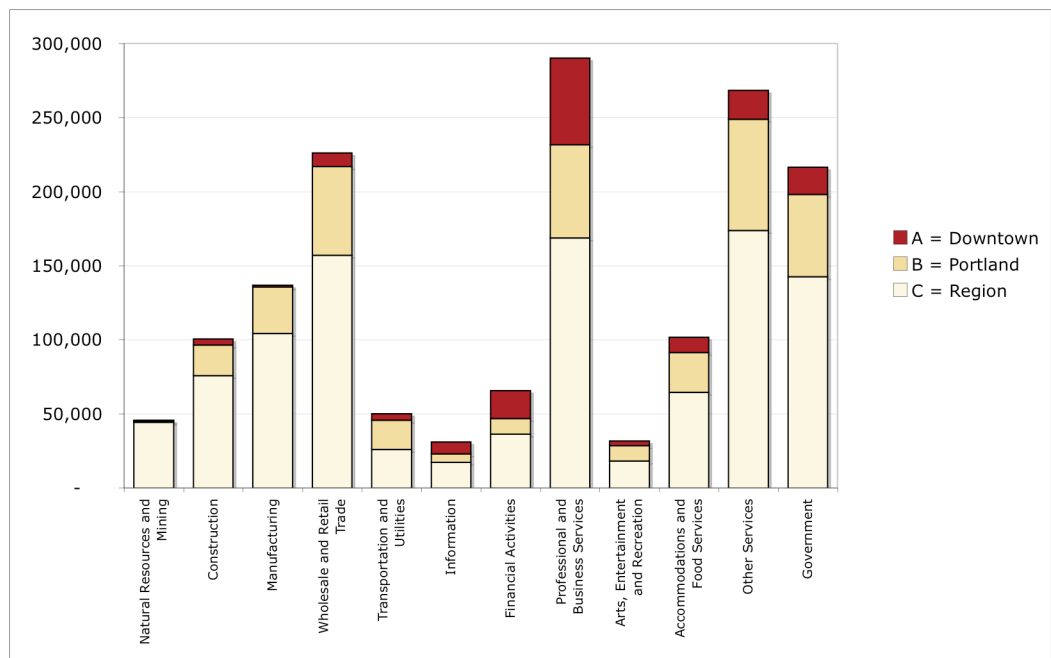
Source: ECONorthwest using IMPLAN data, 2009.
Notes: The Downtown area is made up of the ZIP Codes: 97201, 97204, 97205, and 97209 Portland geography approximated by zip code boundaries, as described in other parts of this report. The region is composed of the following nine counties in the Portland-Vancouver CMSA: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, and Polk.

Exhibit B.3 shows the total value added, by category of industrial sector, for the three geographies.[2] The bars add to the total value added in the CMSA economy, or the regional GDP.

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[1] Includes covered and uncovered employment, as well as the self-employed.

Exhibit B.3. Value added by industrial sector, Downtown, Portland, and the Portland CMSA, 2007 (in millions of 2007$)
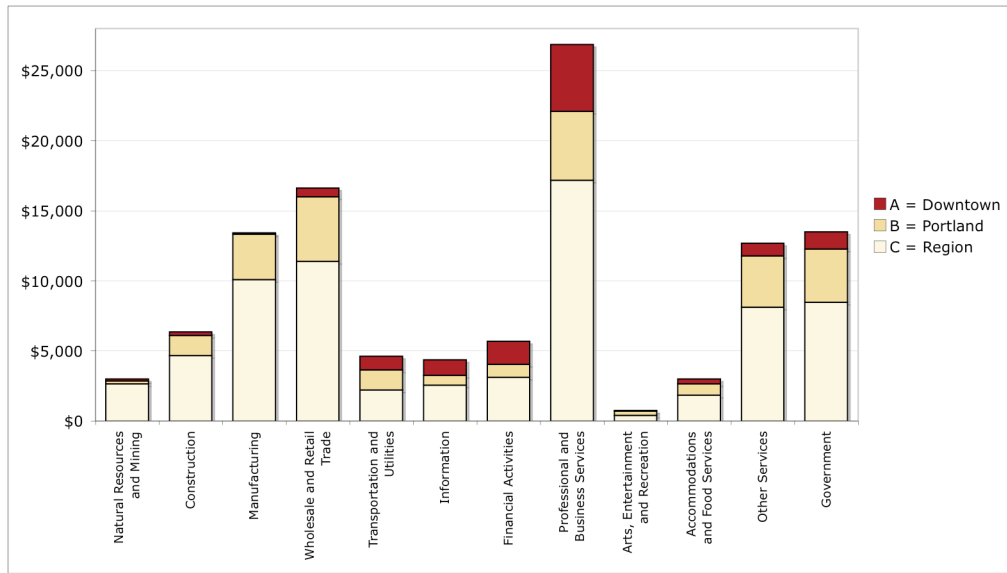
Source: ECONorthwest, 2009, using 2007 IMPLAN data
Notes: The Downtown area is made up of the ZIP Codes: 97201, 97204, 97205, and 97209 Portland geography approximated by zip code boundaries, as described in other parts of this report. The region is composed of the following nine counties in the Portland-Vancouver CMSA: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, and Polk.

Exhibit B.4 below displays these data differently. It shows the share of employment and value added that each of the three geographies in the figures above make up of the CMSA region. It categorizes the industrial sectors by goods and service producing.[3]

Exhibit B.4. Employment and value added share by industry sector, Downtown, Portland, and CMSA region, 2007

		Downtown	Portland	CMSA Region
Economic Indicator	**Industry Type**	**A**	**B**	**D**
Employment	Goods	0.4%	3.4%	18.1%
	Services	9.6%	20.9%	81.9%
	Total	**10.0%**	**24.3%**	**100.0%**
Value Added	Goods	0.5%	4.4%	20.6%
	Services	10.5%	19.1%	79.4%
	Total	**11.0%**	**23.5%**	**100.0%**

Source: ECONorthwest using IMPLAN data, 2009.
Note: *Goods producing* industries are: Natural Resources and Mining (NAICS 11-21), Construction (23), Manufacturing (31-33). *Service producing* industries are: Wholesale and Retail Trade (42,44-45), Transportation and Utilities (22,48-49), Information (51), Financial Activities (52), Professional and Business Services (53-56),

[2] See the Methods section for the definition of value added.

[3] We distinguish goods producing industries from service producing industries because their needs are so dissimilar. In general terms, goods producing industries require more raw inputs and generally transport their products over long distances. Therefore, these industries demand freight mobility and locate near transportation hubs. Service producing industries generally require fewer inputs and rely on customers to come to their location. Therefore, these industries need to locate near an accessible customer base.

Arts, Entertainment and Recreation (71), Accommodations and Food Services (72), Other Services (61-62,81), Government (92).

Observations for Exhibits B.2, B.3, B.4:

- **The Downtown Portland study area accounted for roughly 10% of the total Portland CMSA economy** (whether measured by jobs or by value added). As expected, the Finance and Insurance, Retail Trade and Utilities sectors in Portland and Downtown Portland make up a relatively high share of the region's total employment and value added in these sectors.

- **The regional economy as whole produces more services than goods, and this pattern is even more pronounced in Portland and its downtown.** The majority of goods producing industries are located outside of the City limits.

B.2 HOW DO THE CITY AND THE REGION SHARE LABOR POOLS? HOW DO WAGES COMPARE?

This section will show that the region as a whole is relatively affluent, and that those employed in downtown Portland earn relatively high wages and do not live downtown. The data suggest that those that do live and work in Portland make lower wages than those who commute in to jobs in the City. In other words, the City is an importer of high wage earners. At the same time, the City has historically had higher unemployment than the nation as a whole, suggesting that the qualifications of the City's labor pool may not match the jobs available in the City.

Portland's GDP *per capita* was $65,070 in 2007 — substantially higher than either the country or the region. This is indicative of an affluent and prosperous city. Downtown is the focal point of the City's economic production and, as is clear from the GDP *per capita* of $269,671, it is a large net importer of labor (commuters). Indeed, while 32% of the City's GDP occurred downtown, only 8% of its population lived there in 2007, leading to an economic value per downtown resident that is extraordinarily high.

Higher GDP production should result in higher average incomes. The incomes of people living in Multnomah County averaged $38,529 per person in 2006 compared to $36,714 nationally and $33,299 statewide.[4]

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[4] Source: US Bureau of Economic Analysis. Personal income in this section includes cash income (e.g., wages, pensions, and self-employment), plus money made from property (e.g., dividends, rents, and interest). Only Multnomah County personal income is reported here because the BEA, which is the most up-to-date and accurate public source of income data, does not calculate city-

Thus, Portlanders made about 5% more than the average American, but were substantially more affluent (16%) than the average Oregonian. Overall, per capita incomes of Multnomah County residents ranked second highest in the state (Clackamas is the highest).

Exhibit B.5 describes the sources of personal income of those that lived in Multnomah County in 2006. Their total income was about $26.5 billion. Of that total, approximately $17.9 billion was labor income and 19.1% of that came from self-employment.

Exhibit B.5. Sources of personal income, Multnomah County residents, 2006

Sources of Local Personal Income	2006	% of Total
Labor earnings of locals:		
Wages and salaries paid by local employers	$20,019,385,000	75.6%
Local employer retirement & insurance contributions	2,911,254,000	11.0%
Locally owned farmers' net income	7,781,000	0.0%
Self-employed worker earnings	3,435,780,000	13.0%
Less government insurance taxes paid by workers	(1,610,039,000)	-6.1%
Less pay outflow to non-locals working in county	(10,806,567,000)	-40.8%
Plus pay inflow to residents working outside county	4,001,826,000	15.1%
Net labor earnings of local residents	$17,959,420,000	67.8%
Plus other sources of personal income:		
Dividends, interest, and rental income	$5,006,940,000	18.9%
Welfare, SSI, foster care, & other social services	368,753,000	1.4%
Retirement, unemployment & other	3,148,672,000	11.9%
Total Personal Income	$26,483,785,000	100.0%
Population	687,373	
Per capita income	$38,529	

Source: US Bureau of Economic Analysis.

Payrolls in 2006 totaled about $22.9 billion ($20.0 in wages and salaries plus another $2.9 in employer paid benefits). County residents made over 70% of their pay working in places inside the county. That is a high percentage. In comparison, only 37% of the payroll made by Clackamas residents came from work they did in their home county.

While residents overwhelmingly worked within the county, Multnomah and presumably Portland depended heavily on commuters from other places for labor. Pay to non-locals equaled an extraordinary $10.8 billion in 2006 — more than 47% of the total. That is a large amount since, according to the 2000 Census, just 39% of those working in the

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level income data. We contend that Multnomah County is a fair, albeit far from perfect, proxy for Portland. In the last US Census, the personal income reported by Portland residents equaled 80.2 percent of the total personal income of county residents.

county commute in from elsewhere. This suggests that those that do live and work in Portland make lower wages than those that commute in to jobs in the city.

Although personal income of workers in Portland outpaced both national and state figures, and while evidence suggests that the City imports a significant level of labor via commuters, unemployment rates in Portland have been high relative to the U.S. over the past decade. As seen in Exhibit B.6, in the last ten years the unemployment rate in the City of Portland has been worse than the national level in all but nine of the last 120 months. Yet, employers in the county depend heavily on residents from other counties to fill jobs that, on average, the data tell us are well paying.

Exhibit B.6. Unemployment rate, Portland and the United States October 1998- October 2008
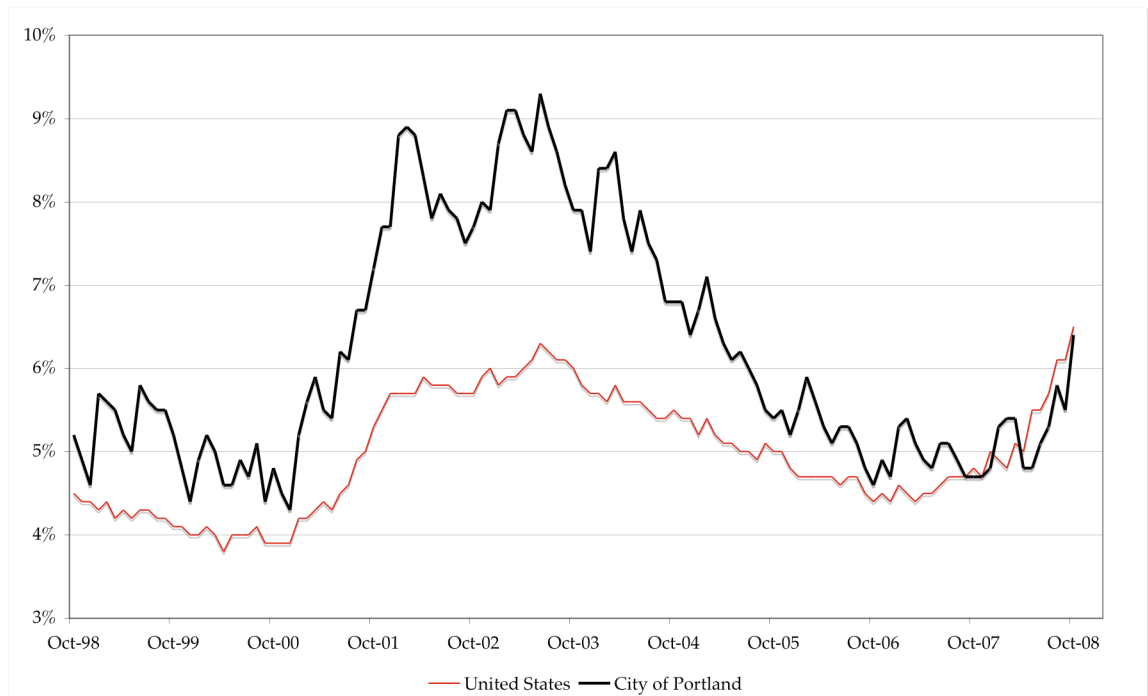
Source: US Bureau of Labor Statistics.

The unemployment data suggest one of two factors (or combination of both) are affecting the city's economy:

1. That too many local workers lack the qualifications for jobs offered by employers in Multnomah County.

2. That many higher skilled, higher wage earners prefer living outside of the county.

B.3 HOW DID EMPLOYMENT CHANGE BETWEEN 2000 AND 2007?

Exhibit B.7 displays total employment in Portland, by major industry sector for the period between 2000 and 2007, with corresponding change in average real wage. The industry sectors with the highest annual average growth during this period were Information, and Real Estate and Rental and Leasing (a sector that has been particularly hard hit in the current recession since 2007). Information also realized the highest change in average real wage. Conversely, employment and real wages dropped in the Utilities, Manufacturing, and Retailing sectors.

Exhibit B.7. Total employment by industry sector, Portland, 2000-2007

Industry	2000 Employment	2007 Employment	Change	AAGR	Change in Avg. Real Wage
Natural resources & agriculture	2,111	216	-89.8%	-27.8%	34.6%
Utilities*	9,268	2,579	-72.2%	-16.7%	-11.2%
Construction	18,642	19,961	7.1%	1.0%	-4.0%
Manufacturing*	42,305	35,019	-17.2%	-2.7%	-9.1%
Transportation & warehousing	41,351	37,938	-8.3%	-1.2%	7.3%
Wholesale Trade*	26,576	21,993	-17.2%	-2.7%	8.7%
Retailing	39,841	35,594	-10.7%	-1.6%	-9.4%
Information*	8,511	11,747	38.0%	4.7%	43.2%
Finance and Insurance	19,228	20,499	6.6%	0.9%	10.5%
Real Estate and Rental and Leasing	6,413	8,836	37.8%	4.7%	0.8%
Educational Services	31,405	35,163	12.0%	1.6%	10.4%
Health Care and Social Assistance	41,644	48,331	16.1%	2.2%	11.4%
Arts, Entertainment, and Recreation	5,187	6,195	19.4%	2.6%	-16.0%
Accommodation and Food Services	30,765	35,725	16.1%	2.2%	-0.6%
Services and management*	62,253	81,848	31.5%	4.0%	18.6%
Public Administration	14,370	17,119	19.1%	2.5%	10.0%
Total	**399,868**	**418,762**	**4.7%**	**0.7%**	**4.3%**

Source: ECONorthwest, 2009, based on 2000 and 2007 confidential ES202 employment data.
Note: Portland geography approximated by zip code boundaries, as described in other parts of this report. Services and management does not include health or education related employment.
*=Subject to changes due to major reclassifications of industries that cannot be fixed from the 2000 ES202 data.

Appendix C   Detailed Sector-Level Results

The following appendix describes the methodology and results of ECO's industry sector analysis in more detail than in the main report. The included sections and the additional levels of detail are:

- **Absolute measures.** Tables in this section show the top 22 industries in Portland in terms of four different measures, and additionally the top 22 industries in Downtown Portland in three different measures.

- **Location quotient analysis.** Tables in this section show the top 22 industries in Portland and in Downtown Portland in terms of three different LQs, value added (as shown in the main report), employment, and wages.

- **Shift-share analysis.** Tables in this section group industries together based on whether the industries grew or declined nationally and locally over the 2001-2007 time period.

C.1   ABSOLUTE MEASURES

Each table in this section shows the top 22 industries (5%) in the Portland economy in one given metric. Industries highlighted in grey are those that appear in the top 5% in all four categories, and subsequently in Exhibits 3.2 and 3.3 from the main report. Those eight industries are wholesale trade businesses; real estate establishments; management of companies and enterprises; insurance carriers; offices of physicians, dentists, and other health; legal services; foot services and drinking places; and architectural, engineering, and related services.

Exhibit C.1 shows the top 22 industries in Portland in terms of value added. Eight industry sectors added over one billion dollars of value in Portland in 2007.

Exhibit C.1. Top 22 industries in terms of value added, City of Portland, 2007

Industry Name	Value Added	Traded Sector VA	Jobs	Output
Wholesale trade businesses	3,100	1,333	26,857	7,662
Real estate establishments	2,632	984	21,673	4,251
Management of companies & enterprises	1,807	1,349	13,895	5,108
State & local govt. education	1,633	43	28,484	2,180
State & local govt. non-education	1,144	30	16,640	1,528
Insurance carriers	1,100	803	9,937	4,798
Offices of physicians, dentists, & other health	1,070	373	12,989	2,416
Legal services	1,004	591	11,308	2,219
Food services & drinking places	964	364	32,939	2,994
Federal government - non-military	784	4	7,243	1,054
Architectural, engineering, & related services	754	447	12,205	2,067
Private hospitals	699	97	10,786	1,973
Telecommunications	619	249	2,708	1,764
Electric power generation, transmission, & util.	595	279	719	1,076
All other professional, scientific-services	552	344	2,418	905
Monetary authorities & depository credit institutions	495	34	6,459	1,177
Construct new nonresidential commercial & health	488	59	7,712	1,582
Software publishers	471	364	2,595	1,362
Medical & diagnostic labs & outpatient & other	469	233	4,608	1,128
Securities, commodity contracts & invest. services	431	148	6,842	2,291
Construct new residential	426	-	5,357	1,750
Transport by truck	399	90	5,791	1,282

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars (except jobs). Grey highlighted rows represent industries in the top 5% of value added, traded sector value added, employment, and output.

Exhibit C.2 shows the top 22 industries in Portland in terms of traded sector value added. The eight previously mentioned industries in the top 5% in all four metrics were the top eight industries in Portland in terms of traded sector value added.

Exhibit C.2. Top 22 industries in terms of traded sector value added, City of Portland, 2007

Industry Name	Traded Sector VA	Value Added	Jobs	Output
Management of companies & enterprises	1,349	1,807	13,895	5,108
Wholesale trade businesses	1,333	3,100	26,857	7,662
Real estate establishments	984	2,632	21,673	4,251
Insurance carriers	803	1,100	9,937	4,798
Legal services	591	1,004	11,308	2,219
Architectural, engineering, & related services	447	754	12,205	2,067
Offices of physicians, dentists, & other health	373	1,070	12,989	2,416
Food services & drinking places	364	964	32,939	2,994
Software publishers	364	471	2,595	1,362
All other professional, scientific,services	344	552	2,418	905
Electric power generation, transmission, & util.	279	595	719	1,076
Ferrous metal foundries	254	254	2,112	836
Telecommunications	249	619	2,708	1,764
Transport by air	245	275	3,226	1,369
Medical & diagnostic labs & outpatient & other	233	469	4,608	1,128
Iron & steel mills & ferroalloy manf.	229	248	853	1,428
US Postal Service	180	356	4,043	671
Scenic & sightseeing transportation & support	177	307	4,165	667
Other state & local government enterprises	174	366	2,692	1,153
Natural gas distribution	166	278	691	922
Data processing, hosting, ISP, web search portals	164	199	2,314	796
Retail Nonstores - Direct & electronic sales	157	346	4,836	635

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars (except jobs). Grey highlighted rows represent industries in the top 5% of value added, traded sector value added, employment, and output.

Exhibit C.3 shows the top 22 industries in Portland in terms of employment. Food service and drinking places, the top-ranking industry, employed 32,939 people in 2007. Eleven industries in employed more than 10,000 people in Portland in 2007.

Exhibit C.3. Top 22 industries in terms of jobs, City of Portland, 2007

Industry Name	Jobs	Value Added	Traded Sector VA	Output
Food services & drinking places	32,939	964	364	2,994
State & local govt. education	28,484	1,633	43	2,180
Wholesale trade businesses	26,857	3,100	1,333	7,662
Real estate establishments	21,673	2,632	984	4,251
State & local govt. non-education	16,640	1,144	30	1,528
Employment services	14,594	368	98	714
Management of companies & enterprises	13,895	1,807	1,349	5,108
Offices of physicians, dentists, & other health	12,989	1,070	373	2,416
Architectural, engineering, & related services	12,205	754	447	2,067
Legal services	11,308	1,004	591	2,219
Private hospitals	10,786	699	97	1,973
Insurance carriers	9,937	1,100	803	4,798
Private junior colleges, colleges, universities	8,575	210	100	861
Nursing & residential care facilities	7,783	186	47	424
Construct new nonresidential commercial & health	7,712	488	59	1,582
Federal government - non-military	7,243	784	4	1,054
Private household operations	7,063	54	20	75
Securities, commodity contracts & invest. services	6,842	431	148	2,291
Individual & family services	6,771	141	65	420
Retail Stores - Food & beverage	6,525	279	35	655
Monetary authorities & depository credit institutions	6,459	495	34	1,177
Services to buildings & dwellings	5,876	162	32	489

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars (except jobs). Grey highlighted rows represent industries in the top 5% of value added, traded sector value added, employment, and output.

Exhibit C.4 shows the top 22 industries in Portland in terms of output. Wholesale trade businesses had over $7.6 billion in output in the City of Portland in 2007, $2.5 billion higher than the next-highest industry, management of companies and enterprises.

Exhiit C.4. Top 22 industries in terms of output, City of Portland, 2007

Industry Name	Output	Value Added	Traded Sector VA	Jobs
Wholesale trade businesses	7,662	3,100	1,333	26,857
Management of companies & enterprises	5,108	1,807	1,349	13,895
Insurance carriers	4,798	1,100	803	9,937
Real estate establishments	4,251	2,632	984	21,673
Food services & drinking places	2,994	964	364	32,939
Offices of physicians, dentists, & other health	2,416	1,070	373	12,989
Securities, commodity contracts & invest. services	2,291	431	148	6,842
Legal services	2,219	1,004	591	11,308
Heavy duty truck manf.	2,203	116	49	1,475
State & local govt. education	2,180	1,633	43	28,484
Architectural, engineering, & related services	2,067	754	447	12,205
Private hospitals	1,973	699	97	10,786
Telecommunications	1,764	619	249	2,708
Construct new residential	1,750	426	-	5,357
Construct new nonresidential commercial & health	1,582	488	59	7,712
State & local govt. non-education	1,528	1,144	30	16,640
Iron & steel mills & ferroalloy manf.	1,428	248	229	853
Transport by air	1,369	275	245	3,226
Software publishers	1,362	471	364	2,595
Transport by truck	1,282	399	90	5,791
Monetary authorities & depository credit institutions	1,177	495	34	6,459
Other state & local government enterprises	1,153	366	174	2,692

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars (except jobs). Grey highlighted rows represent industries in the top 5% of value added, traded sector value added, employment, and output.

Exhibits C.5 through C.7 show the same analysis as Exhibits C.1 through C.4, only the study area is confined to zip codes in Downtown Portland. Additionally, downtown industries with green text are also present in the top 5% of all industries in the same measurement in the *city-wide* analysis.

Exhibit C.5 shows the top 22 industries in downtown Portland in terms of value added. Only 5 were not also in the top 22 industries in terms of city-wide value added.

Exhibit C.5. Top 22 industries in terms of value added, Downtown Portland, 2007

Industry Name	Value Added	Jobs	Output
Real estate establishments	1,361	11,205	1,659
Legal services	886	9,972	1,262
Insurance carriers	747	6,753	1,935
Management of companies & enterprises	527	4,049	911
Architectural, engineering, & related services	458	7,417	756
Electric power generation, transmission, & dist	453	548	629
State & local govt. education	394	6,866	394
Securities, commodity contracts, & investments	376	5,975	1,109
Software publishers	370	2,038	678
Telecommunications	366	1,601	676
Wholesale trade businesses	289	2,505	444
All other professional, scientific services	281	1,228	359
Natural gas distribution	278	691	804
State & local govt. non-education	276	4,011	276
Food services & drinking places	249	8,498	492
Monetary authorities & depository credit interme	209	2,730	317
Offices of physicians, dentists, & other health	196	2,376	285
Advertising & related services	192	3,104	362
Federal government - non-military	189	1,746	189
Employment services	171	6,782	217
Accounting, tax preparation, bookkeeping	151	2,643	238
Nondepository credit intermediation & related	150	1,231	233

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added, employment, and output. Industries in green were also in the top 22 of city-wide value added.

Exhibit C.6 shows the top 22 industries in downtown Portland in terms of employment. Only six were not also in the top 22 industries in terms of city-wide employment.

Exhibit C.6. Top 22 industries in terms of employment, Downtown Portland, 2007

Industry Name	Jobs	Value Added	Output
Real estate establishments	11,205	1,361	1,659
Legal services	9,972	886	1,262
Food services & drinking places	8,498	249	492
Architectural, engineering, & related services	7,417	458	756
State & local govt. education	6,866	394	394
Employment services	6,782	171	217
Insurance carriers	6,753	747	1,935
Securities, commodity contracts, & investments	5,975	376	1,109
Management of companies & enterprises	4,049	527	911
State & local govt. non-education	4,011	276	276
Advertising & related services	3,104	192	362
Private junior colleges, colleges, universities	2,788	68	163
Monetary authorities & depository credit institution	2,730	209	317
Accounting, tax preparation, bookkeeping	2,643	151	238
Wholesale trade businesses	2,505	289	444
Offices of physicians, dentists, & other health	2,376	196	285
Other private educational services	2,193	60	111
Custom computer programming services	2,169	128	182
Private hospitals	2,156	140	247
Private household operations	2,075	16	16
Software publishers	2,038	370	678
Retail Stores - Clothing & clothing accessories	1,860	87	122

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added, employment, and output. Industries in green were also in the top 22 of city-wide value added.

Exhibit C.7 shows the top 22 industries in downtown Portland in terms of output. Only seven were not also in the top 22 industries in terms of city-wide output.

Exhibit C.7. Top 22 industries in terms of output, Downtown Portland, 2007

Industry Name	Output	Value Added	Jobs
Insurance carriers	1,935	747	6,753
Real estate establishments	1,659	1,361	11,205
Legal services	1,262	886	9,972
Securities, commodity contracts, & investments	1,109	376	5,975
Management of companies & enterprises	911	527	4,049
Natural gas distribution	804	278	691
Architectural, engineering, & related services	756	458	7,417
Software publishers	678	370	2,038
Telecommunications	676	366	1,601
Electric power generation, transmission, & dist	629	453	548
Food services & drinking places	492	249	8,498
Wholesale trade businesses	444	289	2,505
State & local govt. education	394	394	6,866
Advertising & related services	362	192	3,104
All other professional, scientific services	359	281	1,228
Monetary authorities & depository credit institution	317	209	2,730
Offices of physicians, dentists, & other health	285	196	2,376
State & local govt. non-education	276	276	4,011
Insurance agencies, brokerages, & related	264	139	1,715
Private hospitals	247	140	2,156
Accounting, tax preparation, bookkeeping	238	151	2,643
Nondepository credit intermediation & banking	233	150	1,231

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added, employment, and output. Industries in green were also in the top 22 of city-wide value added.

The previous seven tables show a high level of correlation, both among different measurements in the same geography and among the same measurements in the different geographies. These close correlations mean two different things.

1. The high cross-measurement correlation (grey shading) equates to a strong relationship between the variables selected. In other words, a large industry will typically have high values in multiple categories because an increase in the employment level of an industry should normally result in a similarly-scaled increase in output and value added. It requires unusual circumstances of labor efficiency to have a high-output industry with relatively low employment, or vice versa.

2. The high cross-geography correlation (green highlighting) suggests that downtown Portland is a balanced representation of the entire city in the top 5% of all industries.

C.2 Location quotient analysis

Each table in this section shows the top 22 industries in Portland or Downtown Portland based on one of three location quotients, value added, employment, or wages. All discussion of LQ in the main report is referencing value added LQ. ECO also performed analyses of employment LQ and wage LQ.

Exhibit C.8 shows the top 22 industries in the City of Portland in terms of value added LQ. Sixteen of these industries also appeared in the top 22 Portland industries in terms of employment LQ and wage LQ.

Exhibit C.8. Top 22 industries in terms of value added LQ, City of Portland, 2007

Industry Name	Value Added LQ	Jobs LQ	Wages LQ
Federal govt. electric power	29.39	25.44	27.12
Heavy duty truck manufacturing	12.84	14.45	11.89
Ferrous metal foundries	10.49	7.98	10.41
Dental equipment and supplies manufacturing	8.48	4.79	2.31
Broom, brush, and mop manufacturing	8.45	10.03	7.28
Truck trailer manufacturing	7.65	5.72	7.21
Asphalt shingle and coating materials manufacturing	6.66	5.28	5.09
Primary smelting and refining of nonferrous metal	5.93	4.16	5.81
Cutlery, utensil, pot, and pan manufacturing	5.90	6.35	5.32
Footwear manufacturing	5.89	5.15	5.49
Flat glass manufacturing	4.83	5.60	4.56
Ground or treated mineral and earth manufacturing	4.67	3.56	4.43
Fabricated pipe and pipe fitting manufacturing	4.58	4.58	4.25
Iron and steel mills and ferroalloy manufacturing	4.01	2.87	3.96
Alumina refining and primary aluminum production	3.75	3.92	3.71
Local govt. passenger transit	3.72	2.89	3.43
Fluid milk and butter manufacturing	3.71	3.49	3.42
Cookie, cracker, and pasta manufacturing	3.70	2.69	3.37
Glass container manufacturing	3.69	4.16	3.49
Material handling equipment manufacturing	3.30	1.43	3.04
Other leather and allied product manufacturing	3.24	2.38	3.11
Asphalt paving mixture and block manufacturing	3.16	2.20	2.46

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ.

Exhibit C.9 shows the top 22 industries in Portland in terms of employment location quotient. The notable drop from Exhibit C.8 is dental equipment and supplies manufacturing. This result implies that this industry is producing more value added than its employment level and total wages paid would suggest.

Exhibit C.9. Top 22 industries in Portland in terms of employment LQ, 2007

Industry Name	Jobs LQ	Value Added LQ	Wages LQ
Federal govt. electric power	25.44	29.39	27.12
Heavy duty truck manufacturing	14.45	12.84	11.89
Broom, brush, and mop manufacturing	10.03	8.45	7.28
Ferrous metal foundries	7.98	10.49	10.41
Cutlery, utensil, pot, and pan manufacturing	6.35	5.90	5.32
Truck trailer manufacturing	5.72	7.65	7.21
Flat glass manufacturing	5.60	4.83	4.56
Asphalt shingle and coating materials manufacturing	5.28	6.66	5.09
Footwear manufacturing	5.15	5.89	5.49
Dental equipment and supplies manufacturing	4.79	8.48	2.31
Fabricated pipe and pipe fitting manufacturing	4.58	4.58	4.25
Primary smelting and refining of nonferrous metal	4.16	5.93	5.81
Glass container manufacturing	4.16	3.69	3.49
Alumina refining and primary aluminum production	3.92	3.75	3.71
Ground or treated mineral and earth manufacturing	3.56	4.67	4.43
Fluid milk and butter manufacturing	3.49	3.71	3.42
Ophthalmic goods manufacturing	3.35	2.21	1.79
Dental laboratories manufacturing	3.14	3.04	2.24
Software publishers	3.09	2.67	2.55
Mens and boys cut and sew apparel manufacturing	3.04	1.75	1.37
Local govt. passenger transit	2.89	3.72	3.43
Specialized design services	2.87	2.50	2.10

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ.

Exhibit C.10 shows the top 22 industries in Portland in terms of wage location quotient. Sixteen of the top 17 industries in terms of wage LQ appeared in Exhibits C.8 through C.10, suggesting that high performance in value added and employment tends to follow high performance in wages.

Exhibit C.10. Top 22 industries in terms of wage LQ, City of Portland, 2007

Industry Name	Wages LQ	Value Added LQ	Jobs LQ
Federal govt. electric power	27.12	29.39	25.44
Heavy duty truck manufacturing	11.89	12.84	14.45
Ferrous metal foundries	10.41	10.49	7.98
Broom, brush, and mop manufacturing	7.28	8.45	10.03
Truck trailer manufacturing	7.21	7.65	5.72
Primary smelting and refining of nonferrous metal	5.81	5.93	4.16
Footwear manufacturing	5.49	5.89	5.15
Cutlery, utensil, pot, and pan manufacturing	5.32	5.90	6.35
Asphalt shingle and coating materials manufacturing	5.09	6.66	5.28
Flat glass manufacturing	4.56	4.83	5.60
Ground or treated mineral and earth manufacturing	4.43	4.67	3.56
Fabricated pipe and pipe fitting manufacturing	4.25	4.58	4.58
Iron and steel mills and ferroalloy manufacturing	3.96	4.01	2.87
Alumina refining and primary aluminum production	3.71	3.75	3.92
Glass container manufacturing	3.49	3.69	4.16
Local govt. passenger transit	3.43	3.72	2.89
Fluid milk and butter manufacturing	3.42	3.71	3.49
Cookie, cracker, and pasta manufacturing	3.37	3.70	2.69
Other leather and allied product manufacturing	3.11	3.24	2.38
Material handling equipment manufacturing	3.04	3.30	1.43
Religious organizations	2.81	3.05	2.80
Other aircraft parts and auxiliary equipment manufacturing	2.76	3.41	1.48

Source: IMPLAN. Calculations by ECONorthwest.
Note: Grey highlighted rows represent Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ.

Exhibits C.11 through C.13 show the same analysis as Exhibits C.8 through C.10, only the study area is confined to zip codes in Downtown Portland. In all, 18 industries in downtown Portland were consistently in the top 22 industries in each of the three location quotient measures. Additionally, downtown industries with green text are also present in the top 5% of all industries in the same measurement in the *city-wide* analysis.

Exhibit C.11 shows the top 22 industries in downtown Portland in terms of value added location quotient. Two industries, federal government electric power and local government passenger transit were also in the top 5% of industries in the city-wide value added location quotient analysis.

Exhibit C.11. Top 22 industries in terms of value added LQ, Downtown Portland, 2007

Industry Name	Value Added LQ	Jobs LQ	Wages LQ
Federal govt. electric power	**22.29**	**21.08**	**22.38**
Natural gas distribution	7.20	7.21	7.57
Software publishers	6.61	8.33	6.86
Legal services	5.13	6.32	4.80
Coffee and tea manufacturing	4.60	5.05	4.64
Semiconductor machinery manufacturing	4.53	6.83	3.96
Insurance carriers	4.38	4.72	4.46
Other leather and allied product manufacturing	4.25	3.41	4.44
Newspaper publishers	4.09	2.95	4.35
Advertising and related services	3.59	4.26	3.31
Specialized design services	3.59	4.49	3.27
All other miscellaneous professional and scientific	3.50	4.59	3.21
Architectural, engineering, and related services	3.29	3.92	2.96
Data processing, hosting, ISP, web search portals	3.10	3.29	3.04
Scenic and sightseeing transportation and support	2.89	2.82	2.87
Other personal services	2.89	3.38	3.15
Local govt. passenger transit	**2.82**	**2.39**	**2.83**
Museums, historical sites, zoos, and parks	2.71	1.99	2.73
Radio and television broadcasting	2.54	3.42	3.46
Fitness and recreational sports centers	2.46	2.74	2.36
Management of companies and enterprises	2.36	2.46	2.37
Performing arts companies	2.26	2.92	2.48

Source: IMPLAN. Calculated by ECONorthwest
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ. Industries in green were also in the top 22 of city-wide value added LQ.

Exhibit C.12 shows the top 22 industries in downtown Portland in terms of employment location quotient. Federal government electric power, software publishers, specialized design services, and men's and boy's cut and sew apparel manufacturing were the industries also in the top 5% of industries in the city-wide employment location quotient analysis.

Exhibit C.12. Top 22 industries in terms of employment LQ, Downtown Portland, 2007

Industry Name	Jobs LQ	Value Added LQ	Wages LQ
Federal govt. electric power	**21.08**	**22.29**	**22.38**
Software publishers	**8.33**	**6.61**	**6.86**
Natural gas distribution	7.21	7.20	7.57
Semiconductor machinery manufacturing	6.83	4.53	3.96
Legal services	6.32	5.13	4.80
Coffee and tea manufacturing	5.05	4.60	4.64
Insurance carriers	4.72	4.38	4.46
All other miscellaneous professional and scientific	4.59	3.50	3.21
Specialized design services	**4.49**	**3.59**	**3.27**
Advertising and related services	4.26	3.59	3.31
Architectural, engineering, and related services	3.92	3.29	2.96
Radio and television broadcasting	3.42	2.54	3.46
Other leather and allied product manufacturing	3.41	4.25	4.44
Other personal services	3.38	2.89	3.15
Mens and boys cut and sew apparel manufacturing	**3.33**	**1.75**	**1.49**
Data processing, hosting, ISP, web search portals	3.29	3.10	3.04
Securities, commodity contracts, and investments	3.29	1.81	1.80
Newspaper publishers	2.95	4.09	4.35
Performing arts companies	2.92	2.26	2.48
Scenic and sightseeing transportation and support	2.82	2.89	2.87
Fitness and recreational sports centers	2.74	2.46	2.36
Museums, historical sites, zoos, and parks	2.68	2.23	2.95

Source: IMPLAN. Calculated by ECONorthwest
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ. Industries in green were also in the top 22 of city-wide value added LQ.

Exhibit C.13 shows the top 22 industries in downtown Portland in terms of wage location quotient. Federal government electric power, other leather and allied product manufacturing, and local government passenger transit were the industries also in the top 5% of industries in the city-wide wage location quotient analysis.

Exhibit C.13. Top 22 industries in terms of wage LQ, Downtown Portland, 2007

Industry Name	Wages LQ	Value Added LQ	Jobs LQ
Federal govt. electric power	**22.38**	**22.29**	**21.08**
Natural gas distribution	7.57	7.20	7.21
Software publishers	6.86	6.61	8.33
Legal services	4.80	5.13	6.32
Coffee and tea manufacturing	4.64	4.60	5.05
Insurance carriers	4.46	4.38	4.72
Other leather and allied product manufacturing	**4.44**	**4.25**	**3.41**
Newspaper publishers	4.35	4.09	2.95
Semiconductor machinery manufacturing	3.96	4.53	6.83
Radio and television broadcasting	3.46	2.54	3.42
Advertising and related services	3.31	3.59	4.26
Specialized design services	3.27	3.59	4.49
All other miscellaneous professional and scientific	3.21	3.50	4.59
Other personal services	3.15	2.89	3.38
Data processing, hosting, ISP, web search portals	3.04	3.10	3.29
Architectural, engineering, and related services	2.96	3.29	3.92
Museums, historical sites, zoos, and parks	2.95	2.23	2.68
Scenic and sightseeing transportation and support	2.87	2.89	2.82
Local govt. passenger transit	**2.83**	**2.82**	**2.39**
Museums, historical sites, zoos, and parks	2.73	2.71	1.99
Performing arts companies	2.48	2.26	2.92
Management of companies and enterprises	2.37	2.36	2.46

Source: IMPLAN. Calculated by ECONorthwest
Note: Grey highlighted rows represent downtown Portland industries in the top 5% of value added LQ, employment LQ, and wage LQ. Industries in green were also in the top 22 of city-wide value added LQ.

These LQ analysis results are in one way similar to the absolute measurement analysis results and in another way different. As before, the cross-measurement correlation suggests the selected variables are strongly positively correlated. Industries are unlikely to show a high LQ in one measurement and a low LQ in another.

Unlike the absolute measurement analysis, this LQ analysis shows very little cross-geography correlation. Industries that ranked in the top 5% downtown in a given measurement usually did not rank as high in the city-wide LQ. This suggests that the industries that the top city-wide industries in terms of relative measures for the most part are not located downtown.

C.3 SHIFT-SHARE ANALYSIS

Shift share is a measurement that compares the relative growth or decline of employment of an industry in two study areas over a given period of time. Industries in a shift-share analysis fit into four categories depending on whether the industries grew or declined nationally and locally over a certain time period. Those categories are:

- Growth in the reference area (U.S.) but not the study area (Portland)
- Growth in the study area (Portland) but not the reference area (U.S)
- Growth in both areas
- Growth in neither area

The tables in this section provide three figures, the actual change in value added in an industry over the 2001-2007 period, the change that would have been expected had the local economy perfectly reflected national trends, and the local effect, or the difference between the two. Again, the local effect shows how an industry is performing locally in relation to the same industry nationally. A negative value shows underperformance.

Exhibit C.14 shows industries that grew in the U.S. but not in Portland. These industries deserve attention because they are not only underperforming when compared to the nation, but shrinking in absolute terms when the national industry is doing the opposite. It should be noted that this can be the result of one firm relocating out of the area, which is not as much a trend of a suffering industry as it is a single firm's decision affecting the data. It may also be the case that a positive national trend has not yet reached the local economy. The 29 industries shown each had a local effect of less than negative $5 million. Twenty-seven other industries matched the same growth criteria but had smaller local effects.

Exhibit C.14. Value added shift-share in millions of dollars, industries that expanded nationally and declined in Portland, 2001-2007.

Industry Sector	Observed Change	Expected Change	Local Effect
Imputed rental activity for owner-occupied dwellings	-1130.43	387.33	-1517.77
Monetary authorities and depository credit intermediaries	-265.75	284.72	-550.47
Commercial logging	-73.82	277.45	-351.27
Railroad rolling stock manufacturing	-32.14	117.44	-149.58
Office furniture and custom architectural woodwork	-8.72	69.66	-78.37
Employment services	-19.84	56.97	-76.81
Spectator sports companies	-36.59	33.61	-70.19
Cable and other subscription programming	-2.81	49.03	-51.84
Radio and television broadcasting	-7.88	42.61	-50.49
Office administrative services	-11.01	38.37	-49.38
Mining and oil and gas field machinery manufacturing	-19.14	17.97	-37.11
Pump and pumping equipment manufacturing	-15.29	6.14	-21.43
Metal can, box, and other metal containers	-3.54	12.24	-15.78
Machine shops	-0.11	13.37	-13.48
Other fabricated metal manufacturing	-5.39	6.98	-12.37
Support activities for printing	-4.07	7.73	-11.80
Copper rolling, drawing, extruding and alloying	-4.13	6.55	-10.68
Transit and ground passenger transportation	-8.37	2.31	-10.68
Commercial Fishing	-2.11	6.54	-8.65
Electromedical and electrotherapeutic apparatus ma	-6.24	2.11	-8.35
All other transportation equipment manufacturing	-3.38	3.61	-6.99
Other electronic component manufacturing	-5.82	0.94	-6.75
Audio and video equipment manufacturing	-6.39	0.24	-6.63
Promoters of performing arts and sports and agents	-4.48	1.55	-6.03
Concrete pipe, brick, and block manufacturing	-1.83	4.13	-5.96
Metal cutting and forming machine tool manufacturi	-5.30	0.59	-5.90
Alkalies and chlorine manufacturing	-3.89	1.90	-5.78
Bare printed circuit board manufacturing	-4.49	0.84	-5.33
Clay and nonclay refractory manufacturing	-4.98	0.15	-5.12

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars. Expected Change column is the amount by which an industry was expected to grow between 2001 and 2007, based on national trends.

Exhibit C.15 shows industries that grew in Portland but not in the U.S. This can usually be interpreted in two ways. The first is that local firms in the industry in question may have a competitive advantage that allows them to grow even when national demand for their product is shrinking. The hope for these industries is that there will be a constant level of demand (albeit smaller than in previous years) for their good or service that will exist indefinitely that they can continue to capitalize on. The other interpretation is that the factors that hurt this industry nationally have not yet reached the local area, and when they do, the local industry will shrink. The 16 industries shown each had a positive local effect of $5 million or greater. Twenty-one other industries matched the same growth criteria but had smaller local effects.

C.15. Value added shift-share in millions of dollars, industries that expanded in Portland and declined nationally, 2001-2007.

Industry Sector	Observed Change	Expected Change	Local Effect
Other state and local government enterprises	8.02	-24.69	32.71
Paper mills	24.45	-0.01	24.46
Fruit and vegetable canning pickling and drying	21.81	-0.20	22.01
Newspaper publishers	9.98	-11.55	21.53
Periodical publishers	14.99	-4.70	19.69
Private household operations	18.24	-0.82	19.06
Semiconductor machinery manufacturing	15.74	-0.00	15.74
All other chemical product and preparation manufacturing	11.84	-0.08	11.92
Breweries	7.48	-0.83	8.30
Turbine and turbine generator set units manufacturing	8.11	-0.01	8.11
Stationery product manufacturing	6.79	-0.52	7.30
Mens and boys cut and sew apparel manufacturing	2.37	-4.62	6.99
Confectionery manufacturing from purchased chocolate	6.19	-0.66	6.85
Ice cream and frozen dessert manufacturing	6.49	-0.13	6.62
Other pressed and blown glass and glassware manufacturing	6.40	-0.00	6.40
Other leather and allied product manufacturing	5.06	-0.52	5.59

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars. Expected Change column is the amount by which an industry was expected to grow between 2001 and 2007, based on national trends.

Table C.16 shows industries that grew in both areas. This category can be further split into two areas, overachievers and underachievers. Overachieving industries are those that outpace the nation, and may be indicative of a local advantage in an industry that is already growing nationally. Underachieving industries are growing, though not as quickly as national trends might suggest. This may be a sign of a positive national trend that has not yet affected the local economy. It may also be a sign of an industry that is at a disadvantage in Portland. The first 14 industries shown each had a local effect of over $50 million and the next 15 industries had a local effect of less than negative $50 million. One hundred fifty seven industries matched the same growth criteria but had less significant local effects (between negative $50 million and positive $50 million). Of the 200 industries that grew in both geographies, 134 overachieved and 66 underachieved in regard to national trends.

Exhibit C.16. Value added shift-share in millions of dollars, industries that expanded nationally and in Portland, 2001-2007.

Industry Sector	Observed Change	Expected Change	Local Effect
State & local govt. education	555.17	354.63	200.53
Federal government, non-military	350.27	159.74	190.54
Software publishers	169.38	19.26	150.12
Iron and steel mills and ferroalloy manufacturing	199.00	58.63	140.37
Federal government - military	141.69	44.44	97.26
Medical and diagnostic labs and outpatient	287.27	209.78	77.50
Cutlery, utensil, pot, and pan manufacturing	70.43	0.00	70.43
Insurance carriers	509.24	440.64	68.61
Material handling equipment manufacturing	60.00	0.26	59.74
Data processing, hosting, ISP, web search portals	99.63	40.10	59.53
Transport by rail	83.57	28.14	55.44
Asphalt paving mixture and block manufacturing	56.55	1.28	55.27
Motion picture and video industries	66.06	13.36	52.70
Waste management and remediation services	64.91	12.34	52.57
Retail Stores - Clothing and clothing accessories	70.27	134.40	-64.12
Nondepository credit intermediation and related	50.54	115.38	-64.84
Construct new nonresidential manufacturing structures	4.87	80.87	-76.00
Construct new nonresidential commercial and health	201.69	279.99	-78.30
Telecommunications	54.97	135.30	-80.33
Private hospitals	182.20	264.02	-81.82
Retail Stores - General merchandise	3.27	87.19	-83.92
Natural gas distribution	42.35	134.76	-92.42
Couriers and messengers	7.42	101.34	-93.92
Management of companies and enterprises	650.02	758.34	-108.32
Other aircraft parts and auxiliary equipment manufacturing	24.79	134.44	-109.65
Construct new residential permanent site single	86.06	225.99	-139.92
State & local govt. non-education	61.51	311.00	-249.49
Electric power generation, transmission, and distribution	114.18	385.16	-270.98
Real estate establishments	737.13	1562.90	-825.77

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars. Expected Change column is the amount by which an industry was expected to grow between 2001 and 2007, based on national trends.

Exhibit C.17 includes industries that declined in both Portland and the nation. Again, these industries can be further divided into overachievers and underachievers, though in this case overachieving means an industry is declining at a slower rate than national trends would predict. Underachieving industries in this category are undergoing a severe decline. Of particular note of the underachieving industries is insurance agencies, which declined by $108 million value added more than national trends would predict. The first 2 industries shown each had a local effect of over $20 million and the next 8 industries had a local effect of less than negative $20 million. Fifty four industries matched the same growth criteria but had less significant local effects (between negative $20 million and positive $20 million). Of the 64 industries that declined in both geographies, 11 overachieved and 53 underachieved in regard to national trends.

Table C.17. Value added shift-share in millions of dollars, industries that declined nationally and in Portland, 2001-2007.

Industry Sector	Observed Change	Expected Change	Local Effect
Automotive repair and maintenance, except car wash	-217.68	-246.04	28.36
Bread and bakery product manufacturing	-16.32	-36.76	20.43
Commercial and industrial machinery and equipment	-75.89	-48.20	-27.68
Heavy duty truck manufacturing	-44.80	-14.18	-30.62
Nursing and residential care facilities	-37.71	-5.59	-32.12
Communication and energy wire and cable manufacturing	-71.32	-25.01	-46.31
Custom computer programming services	-74.55	-25.39	-49.16
Semiconductor and related device manufacturing	-177.41	-126.56	-50.84
Business support services	-60.02	-4.46	-55.57
Insurance agencies, brokerages, and related activities	-121.20	-13.61	-107.59

Source: IMPLAN. Calculations by ECONorthwest.
Note: All figures in millions of dollars. Expected Change column is the amount by which an industry was expected to grow between 2001 and 2007, based on national trends.

Appendix D Quantitative Analysis of Sector Groupings

While the focus of ECO's work was sector level, we did consider some possible combinations of sectors to see if there might be other potential clusters that the City should consider as it moves forward with its economic development strategy. This appendix presents those results.

D.1 OVERVIEW OF RESULTS

ECO did NOT complete a full analysis to identify clusters based on the value added data reported in Chapter 3; this would have required qualitative and other research that was outside of our scope. But given the breadth and depth of data available to us, we did complete a purely quantitative exercise to identify the groups of sectors that appear to be: (1) making the strongest contribution to the Portland economy in terms of value added, and (2) to be most concentrated in the City relative to the nation. We identified groups of industries that have a location quotient of at least 1.5 and make up at least 0.25% of the City's total value added. Exhibit D.1 provides an overview of the results.

Note that a fourteenth group of industries, asphalt products, grew at a much faster rate over the period and could not fit within the scale of the chart. Asphalt products grew by 414% locally and 344% nationally. Portland's LQ in this group of industries was 4.92 and the total value added of the group was $178 million. This group was comparatively small in terms of size and economic impact, but quantitative analysis shows it is one of Portland's specialties.

A more detailed description of how ECO arrived at these industry groupings and how they are defined is contained later in this appendix.

Exhibit D.1. Groupings of sectors based on quantitative analysis: 2007 value added (in millions of dollars), local and national growth rate (2001-2007); and location quotient
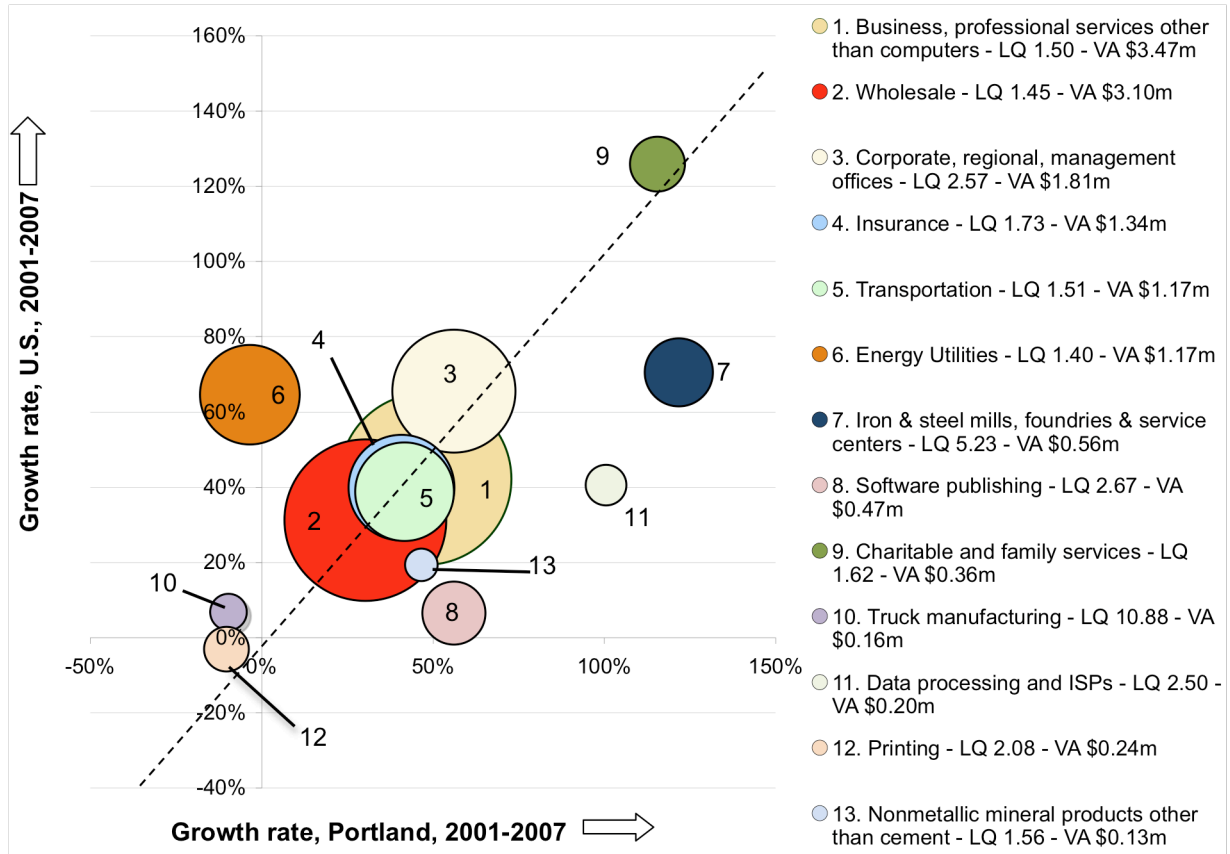
Source: IMPLAN data for the nation and the City of Portland (approximated by zip codes) for 2001 and 2007. Calculations by ECONorthwest

NOT SHOWN DUE TO SCALING ISSUES: A potential grouping of asphalt-production related industries grew by 414% locally and 344% nationally. Portland's LQ in this group of industries was 4.92 and the total value added of the group was $178 million

Note: Bubbles are groupings of industries based on a purely quantitative methodology; ECO did not complete a full cluster analysis to identify clusters based on value added data.

Size of bubble shows value added in 2007. Each legend label shows the cluster's 2007 Portland:U.S. value added location quotient and 2007 value added. The dotted arrow has a slope of 1; clusters located to the right of the line grew faster in Portland than in the nation between 2001 and 2007.

D.2 FRAMEWORK FOR CLUSTER ANALYSIS: HOW AND WHY CLUSTER ANALYSES ARE COMPLETED

The concept and importance of business clusters is now well established in the professional literature of economic development. That literature has expanded substantially over the last 15 years in response to Michael Porter's book, *Competitive Advantage of Nations* (1990). The theory in the literature has made its way to common practice: metropolitan areas around the country have funded research to identify their clusters—the Portland region has many such studies (summarized in Appendix A of this report).

The defining characteristics of a cluster are (1) multiple companies and institutions, (2) linked by interdependencies in the production of some related goods or services, and (3) operating in the same geographic region (usually defined as a metropolitan area or smaller). At the conceptual level, cluster theory is largely derived from and consistent with the basic tenets of urban and regional economics that have been established for 50 years: concentration (of people, resources, and activity) allows "economies of agglomeration." The whole is greater than the sum of its parts because of positive externalities that proximity facilitates: for example, access to specialized labor and suppliers; reduction of the costs of transportation, communication, and coordination; faster exchange of knowledge.

Clusters are not easily measured by standard economic data, which is organized by industrial / business sector (e.g., printing and publishing, aircraft manufacturing).[1] Though it depends on how an industrial sector is defined, in general it is unlikely that every business in a given sector is in the same cluster (unless the sector is defined very specifically so that there are only a few businesses all doing substantially the same thing),[2] and almost impossible that any sector would include every business or institution in the cluster. A cluster called "aircraft manufacturing," for

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[1] The standard term for research in economic development has been "industrial sector." Data available from government agencies about economic activity are typically available by industrial sector, and those sectors have been defined historically by Standard Industrial Classification codes or (since around 2000) by NAICS codes. But the term "industrial" sector can create some confusion in public discussion of policies because it connotes "heavy industry" and "manufacturing." Thus, we sometimes use the term "business sectors." Even this term is not completely accurate, because some of the employment and activity being reported comes from government and not-for-profit institutions. More accurate would be the term "employment sectors," but that term has the disadvantage of making but one measure of economic activity the title for all the data. In this report, we use the terms "industrial sector" and "business sector" as synonyms.

[2] For example, defining sectors at the six-digit level of the NAICS codes. Given the data set we are using for this analysis, we can go to only the four-digit level of detail.

example, could reasonably be defined to include more than the specific sector called aircraft manufacturing: it might include businesses in industrial sectors classified as fabricated metals, electronics, glass, shipping, legal services, financial services, and more.

Thus, there is no source that a region can use to just "look up" its clusters: it has to do its own research.

Step 1 of that research is to define the region and the level of geography for which it will try to identify clusters. Geographic boundaries matter because clusters are defined by some level of proximity among the businesses and institutions in the cluster. Most cluster studies are done at the regional level which usually means (given the practical constraints of data) at the county or multi-county level.

The next steps, however, are more difficult: how does one know what clusters are important if there are no data that define clusters? Moreover, the typical objective for local economic development policy is not to identify just any cluster, but rather clusters that are in some way important, which usually means that they are big (both relative to a comparison region and in absolute terms), have growth potential, bring relatively large amounts of money into the regional economy (the term "traded-sector" industry gets used here), have high-paying jobs, or are aligned in some other way with other local objectives.

The typical research strategy to resolve these issues has the following steps[3]:

- **Step 2**. Use the data that are available by industrial sector to try to find the sectors (not clusters) that are important to the economy. As noted, however, "important" can have many dimensions, and can require multiple measurements and judgments about their relative importance (this study addresses that problem specifically).

- **Step 3**. Use other techniques (e.g., literature review, interviews of businesses in the identified sectors) to identify other industrial sectors that have some significant linkages with the important sectors identified in Step '2.'

- **Step 4**. Cycle back to Step '2' to gather data about the industrial sectors now identified as related to the original sector identified as the core of the cluster.

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[3] In this study, ECO completed quantitative analysis in steps 1 and 2, but did NOT complete the qualitative steps in 3 and the subsequent analysis required in 4 and 5. The results of that purely quantitative analysis are contained in Exhibit D.1 and elsewhere in the report, but do not represent a complete cluster analysis.

- **Step 5**. Combine steps '2' and '4' to define and estimate the size of the cluster.

Often the desire of a local economic-development agency—sometimes explicit and sometimes not—is to use the cluster analysis to identify "target" clusters. Doing so goes beyond data collection and analysis to policy. A common presumption is that if the cluster evaluation has identified important clusters, then a local area should try to retain or expand these clusters by "targeting" them for special treatment (typically, with policy that will reduce their production costs by providing them with more, better, or less expensive public facilities and services).

This may be the case, but it may not—the reasons for that conclusion may be more important than the conclusion itself. We take some time here to explain them.

Typically embedded in Step 1 above (identifying important sectors) is the use of *location quotients* (LQ), which compare the relative size of an industrial sector in one region to its relative size in another region. If the Portland region, for example, has a higher percentage of some measure of economic activity in the electronics industry than some comparison region has (e.g., the state, the U.S.), then it will have a location quotient greater than 1.0, which suggests some degree of specialization relative to the average for the larger region.[4] Economists postulate that, over the long run and with enough activity to rule out the idiosyncrasies of just a couple large businesses, that specialization suggests *comparative advantage* (more to follow).

If that conclusion is recognized for what it is (a descriptive model) it can provide useful direction for the development of explanatory (causal) models and prescriptive models (about policies). Sometimes, however, local governments act as if the descriptive model is also both explanatory and prescriptive. That is a mistake: the identification of the industries that have strong enough linkages to define them as a cluster says nothing about why they exist, and without such an explanation of causes there is little ability to forecast cluster activity in a way that allows coherent discussion about possible futures.

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[4] For example, if the baking industry makes up five percent of a city's economy, but nationally it is only four percent of the country's economy, than the LQ for the baking industry in the city is 1.25 (ratio of five percent over four percent). An LQ over one means that an industry is more concentrated in the local economy than it is nationally. If an LQ were substantially above one, it would show that local economy specializes in the given industry.

To illustrate, suppose the data had shown that the Portland region had, in 1975, a strong cluster in the production of slide rules, in part because of its comparative advantage in metal fabrication. Then what? Should one have forecast that such a cluster would continue to grow, or not? Such a forecast should depend on some evaluation of the factors that allowed the cluster to grow in the past, some of which were local and potentially responsive to local action, and some of which were not (e.g., the international demand for slide rules in the face of the changing technology and growth in the electronics industry). If those factors had suggested that the cluster would continue to grow, why would any special policies be justified? Or, if they had suggested decline (which proved to be the case), would special policies to support an outdated cluster make any sense? Simply identifying slide-rule manufacturing as a cluster does not answer the key policy questions: more work must be done.

In the context of regional economics, comparative advantage does not mean that a region is good in some absolute sense at producing some good or service. It just means that it better at it than it is at producing other goods and services. Thus, there is a distinction between *comparative* advantage (the industrial sectors in a given region compared to one another, based on their comparison to a larger region) and *competitive* advantage (the industries in a region compared to in the same industries in other regions). Regional economic theory is clear that a region can specialize and trade to its advantage, even if it is not the most efficient producer of what it specializes in, because it allows other regions with greater efficiencies to specialize in the things that are most valuable.

When one region has a demonstrated comparative advantage in an industry it does not mean that it has a cost or productivity advantage over other regions. Rather, it means that compared to all other industries that function in the region, and for whatever reasons, relatively more of this industry's activity happens in the that region. That observation implies there may be certain advantages causing that situation, but it does not identify those advantages. Finding the cause of a comparative advantage requires additional work.

It is possible that there was no resource or economic cause that made a region specialize in a certain economic activity. Many industries start with the idea of local entrepreneur that grows into something larger, and that larger concentration stimulates an even larger one. Nike and Microsoft, two of the Northwest's largest employers and ones that have spawned countless spinoffs, did not start in the Northwest because of natural resources, a skilled labor force, proximity to markets, or lower shipping costs. They located in the Northwest, in large part, because that is where the founder was or wanted to be, and because the minimal requirements for starting a business were acceptable (land, labor, transportation (I-5 and international

airports), and so on. Once they started and took hold, however, then there were strong reasons (agglomerative economies) for subsequent decisions by existing and new corporations to locate in the same area. That concentration of similar businesses is a cluster that can be measured by a location quotient.

There are yet more difficulties in Step 1 and in defining "importance." We note the problem of multiple measures of importance. The LQ is one potential measure: if an industry or cluster is relatively more concentrated in a region, it is arguably more important to the region. But it is possible (and, as the data will show, it occurs in Portland) that an industry with a high location quotient could be a very small part of the regional economy. For example, anecdotal information and standard data sets show that beer brewing is a Portland specialty: it has a very high location quotient. But its contribution to regional value added and exports (traded-sector impact) is very small because it is a relatively small part of the regional economy. In contrast, things like management, legal services, and insurance have lower LQs but generate a lot of value added and exports because they are so big.[5]

A related point is that how clusters gets defined—and how broadly one extends the net of linkages—has a direct effect on the amount of value added, which is highly correlated with the amount of exports. Thus, by simply adding more sectors that interact with the core cluster to the overall definition of the cluster, one can substantially change the size of the cluster. There are no agreed-upon protocols for the technical, data-driven definition of clusters, so every study is free to make whatever arguments it thinks reasonable.

The last several paragraphs support an important conclusion for economic development policy and for the next steps of a cluster analysis: Steps 1 to 4 above can identify clusters, but the clusters they identify should not be considered "target industries" for public policy without more evaluation. We recommend:

- **Step 6**. Identify and describe (a) the reasons that the region has shown *in the past* a comparative advantage in the identified clusters; (b) the factors that seem likely to affect demand and local comparative advantage *in the future*. There are many ways to conduct this step, including a review of the professional literature, and interviews with businesses (in existing clusters, or in other

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[5] This specific example—beer brewing—suggests another point: that some clusters may not be as important for what they do in direct economic output, but for what they indicate about the overall economic environment. In the context of Richard Florida's work on the creative class, beer brewing (for one example) may indicate a lifestyle and entrepreneurial environment that makes it easier for larger clusters to attract and retain talented labor. It may help the tourism cluster. It is a cluster that benefits Portland, but is it a cluster that requires government help so that it can be bigger?

sectors that analysis suggests have potential to become future clusters) and researchers that have specialized knowledge about business sectors and clusters. The key here is that the focus is on the factors that have contributed to the growth of clusters in the past or seem likely to contribute to the growth of clusters in the future. That kind of information helps identify what might help the specific clusters, but it also has broad applicability across many other potential clusters and industries.

The general categories of factors important to businesses are well established and understood.[6] The effort in this step should be about establishing their relative importance to certain clusters and sectors in the context of the Portland region, City, and downtown.

- **Step 7**. Identify industrial sectors that might be able to take advantage of region's current comparative advantages and thus grow into significant new clusters. Groupings of these sectors might be called *potential or emerging clusters.*

- **Step 8**. Identify, describe, evaluate, and adopt policies (incentives and regulations) that seem to move cost-effectively in a desired direction. There is much more to this step than we will describe here. The main point in the context of this discussion is that judgments about "cost-effectiveness" and "desired direction" are going to be informed by the results of Steps 6 and 7, which are in part derived from the thinking about clusters that occurred in Steps 1 – 5.

Thus, in our view of economic-development policy the reason to evaluate clusters is not primarily to pick likely winners or big-return long-shots that should have first call on the resources of local economic-development programs and agencies. Rather, it is to gain more insight into the factors that are likely to be (1) of importance to businesses of various types in the future, and (2) capable of improvement through public policy (changes in investments and regulation).

Over 25 years ago regional economist Wilbur Thompson said:

"...all products wax and wane, and so the long-range viability of any area must rest ultimately on its capacity to invent or innovate or otherwise acquire new export bases. The economic base of the larger metropolitan area is, then, the creativity of its universities and research parks, the sophistication of its engineering firms and financial institutions, the persuasiveness of its public relations and advertising agencies, the flexibility of its transportation networks and utility systems, and all the other dimensions of infrastructure that facilitate the quick and orderly transfer from old dying bases to new growing ones."

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[6] *An Economic Development Toolbox: Strategies and Methods*, Terry Moore, Stuart Meck, and James Ebenhoh, American Planning Association, Planning Advisory Service Report Number 541, October 2006.

An implication of his observation is that it may be hard to predict exactly how an area will innovate—how new clusters will emerge—but there are some fundamental things that support innovation and change, and the growth of any cluster. A region may be able to do a lot to facilitate economic development without having to predict the specific clusters that will emerge and grow rapidly.

Thompson's statement suggests another point for economic-development policy and cluster analysis. It is a point found in the work of Richard Florida,[7] which suggests the importance of skilled, creative, and flexible labor that can quickly take advantage of rapidly changing opportunities in a global economy. The point, which we have not seen elsewhere in the literature on business clusters, is that it may be *employment / occupation* clusters that will be more important to future economies. As the next section describes, we propose some ways to begin some measurement.

The following diagram, from a study produced by the Institute for Metropolitan Studies at Portland State University, is consistent with Steps 1 – 8 above and with the specific methods we propose in the next section for this evaluation.

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[7] Richard Florida is the author most cited for his exposition on this topic: *The Rise of the Creative Class* (2002), *Cities and the Creative Class* (2005), and *The Flight of the Creative Class* (2005).

Exhibit D.2.   Framework for evaluating industry clusters
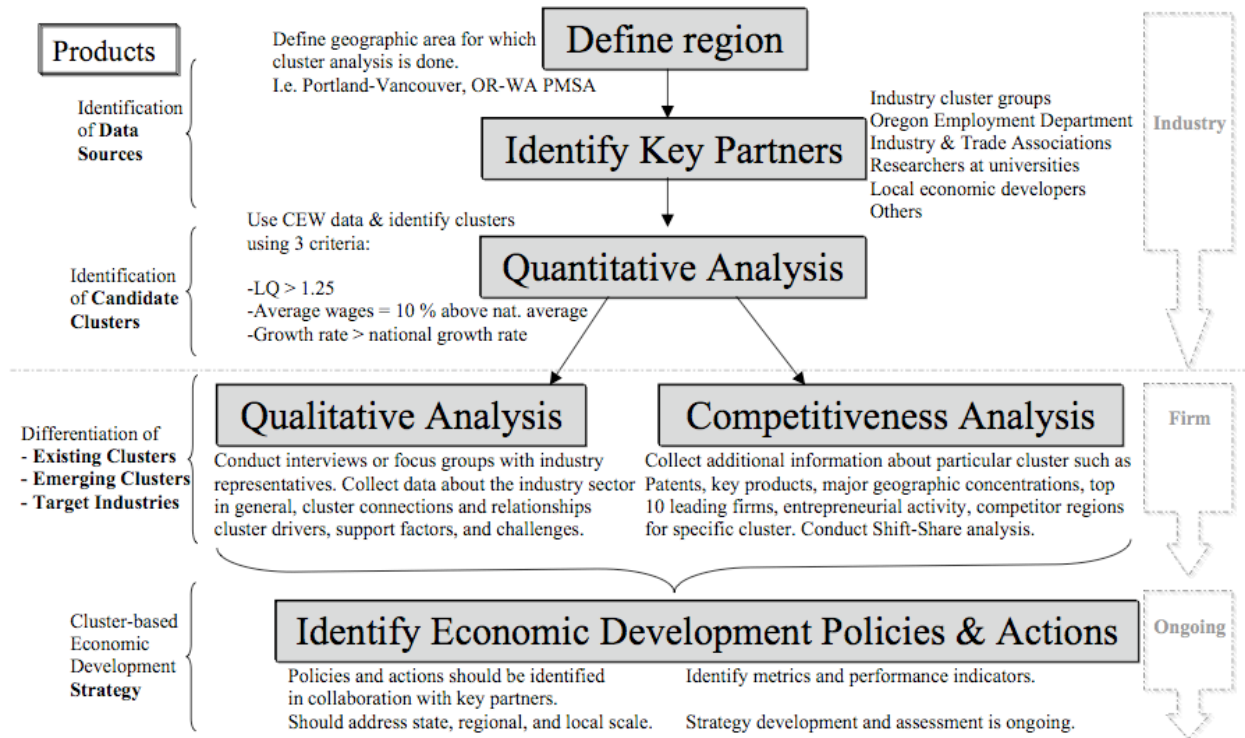
Source: Cluster Monitor: A Guide for Analyzing Industry Clusters in the Portland-Vancouver Metropolitan Region, New Economy Observatory. Institute of Portland Metropolitan Studies, College of Urban and Public Affairs. Portland State University. July 2003, http://www.upa.pdx.edu/IMS.

D.3   RESULTS OF PORTLAND INDUSTRY-GROUPING ANALYSIS

In this study, ECO did not complete the qualitative analysis described in the section above, but did complete some of the initial quantitative steps that the literature suggests as a first step in a cluster analysis. Because we did not complete the full cluster analysis, we are referring to the results as "industry groupings" rather than as "clusters." To identify the industry groupings, we grouped industries that could logically be combined and tested them against thresholds that measure the concentration and relative size of the grouping: to be included in this appendix, the groupings had to have an average LQ of at least 1.5 and contribute at least 0.25% to the city-wide economy.

The industry groupings are useful to the City as it continues to refine its Economic Development Strategy, in part because they suggest additional potential clusters that the City might evaluate for future policy initiatives. This section presents the results of the industry grouping analysis.

Exhibit D.3 provides a more detailed overview of the industry groupings presented in aggregate in Exhibit D.1. The text that follows describes findings related to the Exhibit.

Exhibit D.3: Overview of Portland industry groups based on value added, City of Portland and Downtown Portland, 2007

Industry Group	Description	Total impact on Portland GDP ($ millions)	LQ (City / Downtown)
1. Business and professional services	Includes many sectors, such as legal services, specialized design services, environmental and other technical consulting services, etc., and firms such as ECONorthwest and Miller Nash LLP.	$5,309.46	1.51 / 3.10
2. Wholesale trade	Wholesale trade is a sector on its own. Adidas and IKON Office Solutions are examples.	$4,925.12	1.45 / 0.43
3. Corporate, regional, and management offices	Fred Meyer, Columbia Sportswear, and Pacificorp are examples. Comprised of one sector.	$2,951.46	2.57 / 2.36
4. Insurance	Includes insurance carriers and insurance agencies and brokerages; Standard Insurance is an example.	$2,587.89	1.73 / 3.60
5. Transportation	Includes transport by air, rail, water, and truck, as well as local government passenger transit. Employer examples are TriMet, Horizon Air, and the Port of Portland.	$2,108.76	1.51 / 0.89
6. Energy utilities	Includes natural gas distribution, federal government electric power, electric power generation; example firms are PGE and BPA.	$1,487.43	1.40 / 3.01
7. Iron and steel mills, foundries, and service centers	Composed of iron and steel mills and ferroalloy manufacturing, steel product manufacturing from purchased steel, and ferroalloy manufacturing. Columbia Steel Casing and Oregon Steel Mills are examples.	$1,066.21	5.23 / 0
8. Software publishing	Composed of one sector. Web MD and Oracle USA are examples of firms in this cluster.	$769.26	2.67 / 6.61
9. Charitable and family services	Sectors include individual and family services (Oregon Community Foundation), community food and housing services (Loaves and Fishes), and grantmaking and social advocacy organizations (Energy Trust of Oregon)	$620.91	1.62 / 1.56
10. Truck manufacturing	Heavy duty truck manufacturing and truck trailer manufacturing. Heavily reliant on one major employer, Freightliner	$524.98	10.86 / 0
11. Data processing and ISP	Surveymonkey.com, Oregonlive.com, and FIOS are examples of firms that are included in this cluster.	$386.04	2.50 / 3.10
12. Printing	The Oregonian is an example of a firm in this cluster, which includes the sectors printing and support activities for printing.	$367.12	2.08 / 1.78
13. Nonmetallic mineral products other than cement	This cluster includes a large number of sectors that are related to one another, such as pottery, ceramics, and plumbing fixture manufacturing; brick, tile and structural clay product manufacturing; and lime and gypsum product manufacturing. Owens Brockway Glass Container and InfinityStone.net are examples.	$230.56	1.56 / 0.06
14. Asphalt products	Portland has advantages for asphalt production because of its port, its proximity to an oil pipeline, and the demand for construction materials in the growing metropolitan area. This cluster includes asphalt paving mixture and block manufacturing, and asphalt shingle and coating materials manufacturing. Owens Corning Roofing and Asphalt is an example firm.	$230.32	4.92 / 0.25

Source: ECONorthwest, 2009, based on 2007 IMPLAN data
Notes: Total impact on Portland GDP includes a multiplier effect, which captures the induced spending in the economy that results from the presence of the cluster.

More detail about each of these industry groupings is presented in the remainder of this section, but first a few findings related to the overall list:

1. We did not find concentrations in some industry groupings that we expected to find, based on recent regional study results:

- **Footwear manufacturing**. Although this potential grouping had a high LQ, the value added from this sector did not meet the threshold for consideration.[8]

- **Cutlery and hand tool manufacturing**. This grouping too was too small in the City Portland in 2007 to meet our threshold criterion for value added, although the region has a significant cluster in this category.

2. We saw possibilities for potential industry groupings at the sector level, but did not find a justifiable way to combine them into logical clusters that met our thresholds:

- **Food manufacturing**. There were several food industries that had high LQs in Portland, including breweries, coffee, bread, ice cream, dairies, and cookie manufacturing. However, there were many with low LQs such as distilleries, pet food, flour, seafood, cheese, tortilla, and candy manufacturing. With no similarity to combine industries with high LQs, and with the overall food manufacturing industry having an LQ of just 1.0, no industry grouping was found for this analysis.

- **Medical equipment manufacturing.** Unless we created an industry grouping that includes dental labs and rejects surgical equipment, the LQ threshold cannot be reached. In total, the LQ for this sector is only 1.11.

- **Personal services.** Some personal service industries do have a high LQ, but in total the sector is well below the threshold used for this analysis.

3. We rejected some industry groupings for other reasons:

- **Government other than enterprises.** Because Portland is the largest city in Oregon, Portland is home to many major government offices. For the analysis, however, we rejected this sector because it has almost no traded-sector component (is not exported) and policy changes are unlikely to dramatically alter its economic impact. In other words, we have implicitly assumed that City government is more or less fulfilling its public mission with current employment, and that the City would probably not choose to employ significant

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8 It is not possible to group footwear manufacturing with the significant activity at Adidas in Portland to form a cluster because Adidas is classified as part of the wholesale sector which cannot be broken into smaller units of analysis. This may be an example of a potential cluster eliminated because of data limitations rather than objective measures of contributions to the economy.

4. We found some industry groupings that seem to have less of an impact on the Portland economy than they once did:

- **Fabricated metal products**. Like food manufacturing there were several industries within this broad category that had a high LQ, but in combination their LQ did not support an industry grouping. Although we note that in past years fabricated metal products was a cluster in Portland, slow growth relative to the rest of the country has reduced the LQ to a nearly neutral 1.02.

- **Machinery manufacturing**. This potential grouping has followed a similar fate to that of fabricated metals. Its share of the Portland economy has fallen relative to other parts of the United States.

5. Finally, we found some potentially strong industry groupings that, upon further examination, resulted almost entirely from data errors.

- **Aircraft parts manufacturing.** This industry shows as significant in the raw data. However, Boeing has a plant in a Portland zip code but is outside of the city limits, and it is the largest company in the local industry.

- **Forestry.** A substantial logging and timber production cluster resulted from misreporting of the data. Companies that had statewide employment were misreporting that employment in the City of Portland and skewing the results.

6. Some additional findings related to these industry groupings:

- This study helps us understand how Portland's economy is different from the nation as a whole, but not how it is different from other cities. Part of what these results capture is the fact that Portland's economy is a city economy and not a rural economy. For example, if we did the same study in any city of about the same size as Portland, we might have found an industry grouping in corporate, regional, and management offices.

- This study is a snapshot in time (2007). The industry grouping we found in truck manufacturing may not exist in 2008 or 2009, given the recently-announced reduction in employment at Freightliner.

- Some of the industry groupings we identify here would not translate well to "clusters" as they are typically defined. Wholesale trade and corporate, regional, and management offices are examples. The datasets used for this analysis (and most cluster analyses) does not disaggregate these industries in a way that is useful for analysis; a corporate headquarters company for a metals manufacturing

company and an environmental consulting firm might both be grouped together in the "corporate, regional, and management offices" sector with no way to understand the linkages between the two firms that might logically join them in a cluster. Qualitative analysis would be required to determine which portions of these sectors belonged in a cluster. Future analysis would need to address these concerns.

One other grouping is notably missing from Exhibit 3-5: an industry grouping around sustainable industry or green development. A typical definition of this sector would be a group of businesses and industry sectors that: (1) produce goods that in their operation or application reduce energy or other resource use or reduce pollution; (2) provide professional services assisting other businesses institute systems, processes, and practices that are more sustainable; or (3) operate in a way that has a reduced impact on the environment.[9] Many in the Portland region and around the nation believe that there is great potential for growth in this sector, and that Portland is situated to grow its sustainable industries. Unfortunately, measuring this potential industry grouping in terms of goods, services sold, or number of people employed is difficult:

- There is no commonly accepted economic definition of "sustainable" or "green" industry.

- Many businesses that don't consider themselves (and probably would not be considered by others) to be "sustainable industries" nonetheless meet the definition in the paragraph above. A steel production firm, for example, could be a major recycler of steel, but not have environmental sustainability as an identifiable part of the company's mission.

- Even among professionals trying to define and develop sustainable industries, there is not likely to be easy agreement on the threshold of types and amounts of practices that classify as "sustainable".

Despite these difficulties, many researchers have found ways to define different a sustainable sector. Greenlight Greater Portland found an industry grouping called "Environmental Services and Recycling Technology," which includes industry codes related to environmental consulting and engineering as well as waste management, among others. PDC's 2006-07 Target Industry Plan defines sustainable industries as "traded sector businesses which produce a product or service in a more

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9 This definition is contained in Appendix 2-7F of the Economic Development Strategy of the City of Portland. The appendix was produced by ECONorthwest in 2002, and documented many of the difficulties with creating a sustainable industries cluster.

environmentally-responsible and / or energy efficient manner than standard production methods."

Sustainable industry is an important growth industry in the Portland metro area and a focus of PDC efforts. ECO calculated the value added in Portland for sustainable industries using the same NAICS codes that PDC used its Target Industry Plan. Exhibit D.4 provides the results.

Exhibit D.4. Sustainable Industries cluster results, 2007

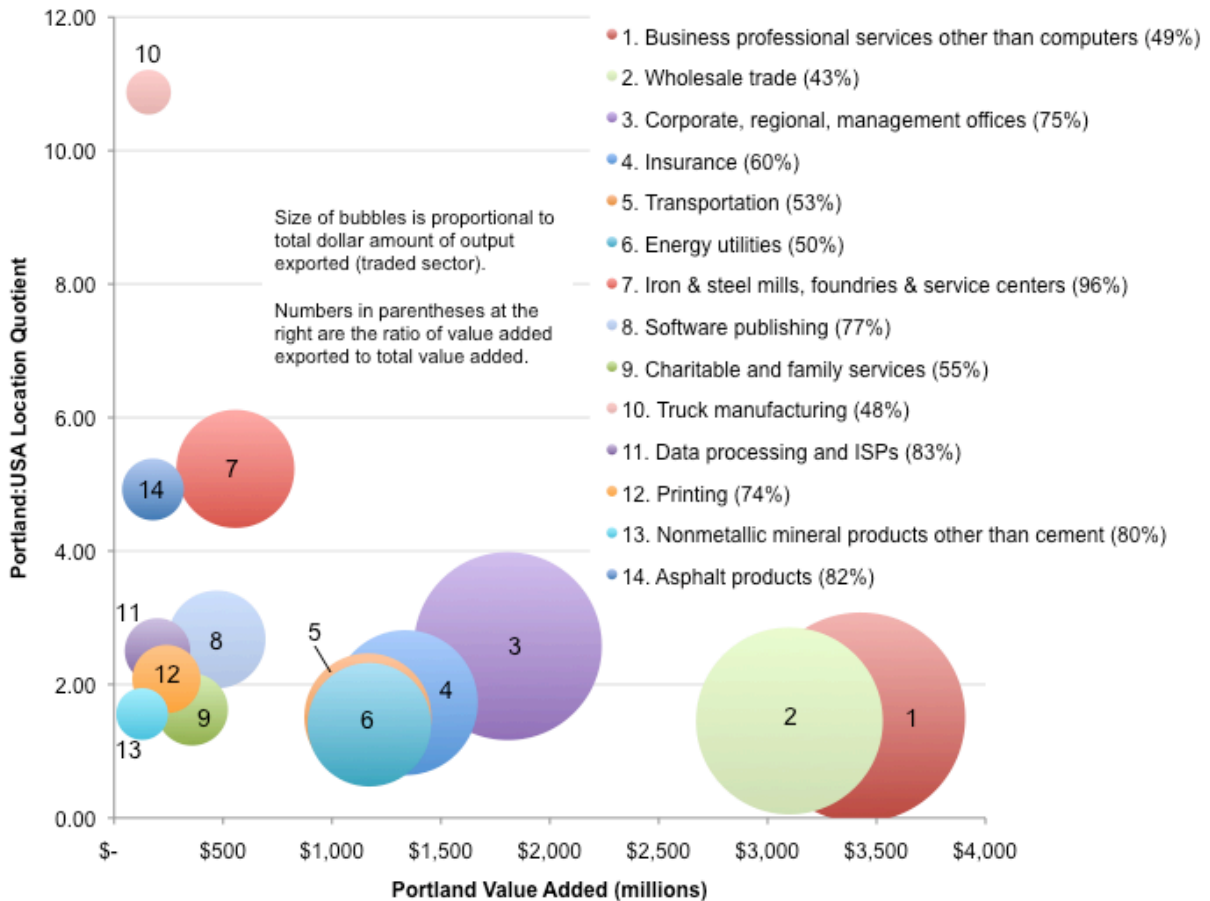| Sustainable Sectors	
Portland LQ	1.20
Downtown LQ	1.78
Portland value added	$1,092
Multiplier effect	1.70
Total impact on Portland GDP	$1,858
Sectors:	
HVAC & refrigeration equip. manufacturing	
Engine, turbine & power equip. manufacturing	
Electrical equip. and apparatus manufacturing	
Recyclable material wholesalers	
Architectural, engineering & related services	
Environmental consulting	
Scientific and R&D services	
Waste management & remediation services	

Source: ECONorthwest 2009, based on IMPLAN data from 2007 and NAICS codes identified by PDC in 2006-07 Target Industry Strategy.
Note: All $values in millions.

Because the LQ based on value added did not meet our threshold for specialization and because of the numerous problems of defining the sector described earlier, we did not include sustainable industries in our industry grouping list. However, the potential grouping deserves policy attention for a variety of reasons:

- The value added and total impact on Portland GDP would put this sector close to the top of the industry grouping list

- The LQ in downtown Portland is significant

- Portland has a national reputation as a leader in sustainable innovations, and is likely to see continued growth in jobs in related areas.

Exhibit D.5 below summarizes the results of the industry grouping analysis. It shows City of Portland industry groupings and measures of their LQs based on value added (y-axis), total value added (x-axis), and the amount of industry output that is exported (size of the bubble).

Exhibit D.5. City of Portland industry groups based on value added, 2007

Size of bubbles is proportional to total dollar amount of output exported (traded sector).

Numbers in parentheses at the right are the ratio of value added exported to total value added.

- 1. Business professional services other than computers (49%)
- 2. Wholesale trade (43%)
- 3. Corporate, regional, management offices (75%)
- 4. Insurance (60%)
- 5. Transportation (53%)
- 6. Energy utilities (50%)
- 7. Iron & steel mills, foundries & service centers (96%)
- 8. Software publishing (77%)
- 9. Charitable and family services (55%)
- 10. Truck manufacturing (48%)
- 11. Data processing and ISPs (83%)
- 12. Printing (74%)
- 13. Nonmetallic mineral products other than cement (80%)
- 14. Asphalt products (82%)

Source: ECONorthwest, 2009, based on 2007 IMPLAN data. See text of full report for information about methods and assumptions.

In the display of the results in Exhibit D.5, the industry grouping with the biggest economic impact would be shown as big bubbles in the upper right-hand quadrant of the figure. In fact, the data show results similar to our findings at the sector level:

- The industry groups in which Portland's 2007 economy was most highly specialized (truck manufacturing, iron and steel mills, insurance, software publishing) are all smaller clusters in terms of value added and amount of value added that is exported.

- Conversely, the industry groups with the biggest total value added and the largest traded sector impact have lower LQs, indicating that Portland is not much more specialized in these groups than the nation as a whole. Though all industry groups had to meet an LQ threshold indicating at least some specialization (1.5) to be considered a cluster in this study, the biggest clusters in terms of value added are the clusters with the lowest relative LQ.

To evaluate the possibility that the results were capturing industry groups that are strong in Portland because they are industries that normally

concentrate in any city, we compared the concentration of the industry groupings in Portland to other cities.

ECO used the city-comparison data to further evaluate the industry groupings we identified with City-level data. We compared Portland's LQ (relative to the nation) to the average LQ of the ten cities to determine whether Portland has a greater specialization than the subset of cities chosen.

ECO identified all cities similar in size to Portland using objective parameters:

1. 2007 Census data show Portland to be the 30th largest City in population. ECO identified with the 15 next largest and smallest population cities, a total of 31 cities.

2. High data costs and a limited budget compelled ECO to acquire economic data on the county level.[10] Such data is a useful approximation of the subject city only if more than half the population of the county was inside the subject city. For example, the main county for Portland is Multnomah; about 79.7% of the County's population lives in Portland. We limited the list to those that had the majority of its population in one county.

Of the original 31 cities, a total of 21 cities and their main counties qualified for the analysis based on these criteria.

PDC then randomly selected ten cities[11] from the list for analysis. ECO analyzed *Austin, Charlotte, Baltimore, Boston, Nashville, Denver, Oklahoma City, Atlanta, Albuquerque, and Fresno.*

ECONorthwest built economic models of each and calculated the economic contribution of every industry sector for the combined 11-county sample. The City of Portland's industry shares were compared to the average industry shares in these cities to better understand Portland's economic specialization relative to mid-sized cities.

Exhibit D.6 summarizes the results. Because our sample of cities is too small to be statistically valid, these results are not conclusive. But they do

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[10] To get data at the city level, we'd have to approximate the boundaries of each city by zip code and then purchase data for each zip code separately. It would be prohibitively expensive at about $300 per zip code, with each city requiring a set of data made up of as many as 15 – 20 individual zip codes.

[11] Because the sample size is too small to be statistically valid, the results of this analysis do not describe a relationship between Multnomah County and all of its potential competitor cities. Instead, it describes the relationship only between Multnomah County and this particular set of competitor cities. All results from this analysis are carefully interpreted and explained in that context.

indicate a greater specialization in these clusters in Portland than in the comparison cities.

Exhibit D.6: Output, jobs, wages, value added, traded sector, and national LQ for industry groupings, Portland and average values for ten reference cities, 2007

Cluster / City	Output	Jobs	Wages	Value Added	Traded Sector	City: Nation LQ
Business, professional services other than computers						
Portland	$ 5,834	47,903	$ 1,918	$ 3,692	$ 2,626	1.37
Average of Ten Other Cities	$ 6,917	48,099	$ 2,867	$ 4,440	$ 3,323	1.25
Wholesale						
Portland	$ 5,038	28,393	$ 1,674	$ 3,277	$ 1,930	1.32
Average of Ten Other Cities	$ 5,144	25,711	$ 1,870	$ 3,370	$ 2,071	1.03
Corporate, regional, management offices						
Portland	$ 3,171	14,085	$ 1,476	$ 1,832	$ 2,266	2.24
Average of Ten Other Cities	$ 2,017	8,471	$ 961	$ 1,194	$ 1,093	1.10
Insurance						
Portland	$ 3,488	13,985	$ 951	$ 1,430	$ 2,025	1.59
Average of Ten Other Cities	$ 3,341	13,610	$ 1,034	$ 1,494	$ 1,772	1.25
Transportation						
Portland	$ 3,248	19,791	$ 1,084	$ 1,362	$ 1,903	1.52
Average of Ten Other Cities	$ 2,871	15,170	$ 880	$ 1,163	$ 1,725	0.98
Energy Utilities						
Portland	$ 2,180	2,700	$ 284	$ 1,249	$ 1,058	1.28
Average of Ten Other Cities	$ 1,569	2,002	$ 250	$ 886	$ 488	0.69
Iron & steel mills, foundries & service centers						
Portland	$ 1,696	3,351	$ 330	$ 557	$ 1,618	4.50
Average of Ten Other Cities	$ 284	359	$ 30	$ 67	$ 267	0.41
Software publishing						
Portland	$ 876	2,633	$ 260	$ 478	$ 666	2.33
Average of Ten Other Cities	$ 782	1,985	$ 211	$ 447	$ 590	1.65
Charitable and family services						
Portland	$ 725	14,580	$ 382	$ 384	$ 372	1.50
Average of Ten Other Cities	$ 615	11,289	$ 321	$ 324	$ 227	0.96
Truck manufacturing						
Portland	$ 1,660	2,123	$ 134	$ 158	$ 686	9.35
Average of Ten Other Cities	$ 241	287	$ 22	$ 27	$ 102	1.20
Data processing and ISPs						
Portland	$ 473	2,333	$ 146	$ 200	$ 385	2.17
Average of Ten Other Cities	$ 482	2,272	$ 158	$ 214	$ 404	1.75
Printing						
Portland	$ 441	4,107	$ 194	$ 247	$ 323	1.84
Average of Ten Other Cities	$ 256	2,284	$ 109	$ 143	$ 171	0.81
Nonmetallic mineral products other than cement						
Portland	$ 346	1,247	$ 61	$ 140	$ 269	1.46
Average of Ten Other Cities	$ 181	525	$ 35	$ 85	$ 158	0.67
Asphalt products						
Portland	$ 306	301	$ 28	$ 184	$ 240	4.37
Average of Ten Other Cities	$ 154	48	$ 2	$ 96	$ 127	1.72

Source: ECONorthwest, based on IMPLAN data, 2009.
Note: All values except LQs are in millions of $2007. Location quotient for other ten counties was a recalculated quotient that, for each industry, summed the value added from all cities and compared to the value added for the entire nation, rather than averaging the individual LQs for each city. All data are at the county level (See Exhibit 2-2 for city-county pairings).

Findings from Exhibit D.6:

Appendix E Terms and Definitions

Analysis of economic specialization and industry sectors uses a lot of terminology and abbreviations. The following appendix lists and defines the terms and concepts used in the report.

E.1 INDUSTRY SECTORS

- **Industry sector.** An industry sector is a group of businesses that provide an identical or similar good or service. Industry sectors have varying levels of classification, ranging from broad (manufacturing) to narrow (frozen specialty food manufacturing). For example, two different businesses that manufacture frozen specialty food are in the same industry sector. A business that produces automobiles is in the same industry sector in one regard, but they are clearly different industries.

- **NAICS.** The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.[1]

- **IMPLAN.** Impact analysis for planning (IMPLAN) is a set of data and software used to perform input-output analysis. IMPLAN uses a set of 440 industry sectors based off of NAICS codes. The 440 industries used by IMPLAN are the basis of our evaluation of Portland's economic specialization.

E.2 INDUSTRY MEASURES

- **Output.** In the context of IMPLAN, output is representative of the value of production attributed to Portland's industry sectors. Output is the most aggregate measure of economic activity. For some industry sectors, such as retail and wholesale, it represents only the margin of sales.[2] Broadly, *output* as measured in this report is an

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[1] U.S. Census Bureau. http://www.census.gov/eos/www/naics/

[2] Output equals the sum of the value of intermediate goods and services, wages, business income, other income, and indirect business taxes.

approximate measure of the money that construction drops into the local economy to be spent on local goods, services, and wages.[3]

- **Value added (VA).** In the context of IMPLAN, value added is very similar to gross domestic product (GDP). It includes four components: wages, business income, other income, and indirect business taxes. Therefore, it accounts for the value of work, land, and capital. For example, businesses purchase raw or intermediate products and repackage or transform them into new products to be sold to consumers. The difference between the cost of the intermediate goods and the final product is the amount by which businesses have added value in production, and, hence, to the economy. Therefore, a business that takes existing products and repackages them (i.e., a wholesaler) creates less added value for the economy than a business that takes inputs, and utilizes labor services to creates something new (i.e., an airplane).[4] The four components are defined as follows:

  1. *Wages.* The sum of workers' wages and salaries as well as benefits, including health and life insurance, gratuities, bonuses and retirement payments.

  2. *Business income.* Income received by local businesses and the self-employed; it is also called proprietor's income. Depending upon local economic conditions, between five and 15 percent of the earnings by individuals comes from self-employment.

  3. *Other income.* These are payments to individuals in the form of rents received on properties, royalties from contracts, dividends paid by corporations, and profits earned by corporations.

  4. *Indirect business taxes.* Federal, State and local excise, property, and sales taxes as well as taxes on other business-related activities or equipment, such as taxes related to motor vehicles.

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[3] Gross Domestic Product (GDP), at the national level, and Gross State Product (GSP), at the state level, is sometimes confused with output. Total output, as calculated by IMPLAN, is not the same thing as GDP. GDP only considers the <u>final</u> cost of goods and services (the total of four value added components: wages, business income, other income, and indirect business taxes), and excludes the value of intermediate goods in order to avoid double counting. IMPLAN's measure of total value added, not total output, is the most comparable measure of GDP or GSP. With output, IMPLAN is attempting to capture the broadest measure of economic activity in an area. Since many intermediate goods are produced locally for local businesses, IMPLAN includes the value of these goods in addition to the traditional definition of economic activity (value added) to achieve this encompassing picture of activity. This table shows both value added (broken into its four components) and output estimates.

[4] We assume that what businesses spend beyond the cost of material and intermediate products translates directly into additional value. The largest pieces of this additional value are actually costs: wages and taxes. The difference between cost of production and the sales price is profit, which is captured in the remaining value added categories: business income and other income.

- **Traded sector (TS).** Traded sector provides a measurement of the amount of value added that is exported outside the local area. Traded sectors are important to a local economy because they bring new dollars into the region rather than just recycling existing dollars. In concept if two sectors had the same LQ and value added, but one exported most of its value added and the other did not, the former would be more valuable to the local economy (other things being equal): it would have a greater *multiplier effect* on the local economy.

- **Location quotient (LQ)**. Location quotients describe the extent to which a particular industry is concentrated in one area relative to a larger area. A location quotient is simply a ratio of ratios–– specifically, the ratio of an area's employment in one industry to its employment in all industries, divided by the ratio of a larger area's employment in that same industry to this larger area's employment in all industries. Location quotients greater than one indicate that the industry is more represented in the smaller area (e.g., the region) than it is in the larger area (e.g., the nation), while location quotients less than one indicate that the industry is less represented in the smaller area than it is in the larger area. If, for example, mitten manufacturing accounts for 5% of employment in the Portland metropolitan region, and also for 5% of employment in the United States, the location quotient is one. If mitten manufacturing accounts for 10% of employment in the region, the location quotient is two. If mitten manufacturing accounts for 2.5% of employment in the region, the location quotient is one-half. Putting the last example another way, the region has half the mitten manufacturing employment one would expect if its employment were distributed across industries at the same proportion as national employment. In short, the higher the location quotient, the more concentrated the employment in that industry is in the area.

  Location quotients are interesting, but their interpretation is not straightforward. One common interpretation is that location quotients show the comparative advantage of an area in attracting and retaining various industries, and that they reflect the degree to which firms find an area advantageous. While this interpretation is probably correct, it is not clear that location quotients tell much about *trends*. A high regional location quotient in an industry might signal that the region is "tapped out," and employment growth in that industry might stagnate unless there is national growth in that industry. A low location quotient might, in contrast, indicate untapped potential. In any case, location quotients do show, at a point in time, the concentration of an industry in an area.

Although employment is the most common measurable used in location quotient analysis, other measures of an industry's strength in an area, such as value added, total output, or wages paid, can be used.

- **Shift-share analysis.** Shift-share analysis is used to decompose growth or decline of industries in a local area within a specified timeframe. By comparing change in economic activity (usually employment) in the base study area (Portland) with that of a reference area (the nation) over the specific time period, the analysis calculates the retrospective expected change in the local area during the same timeframe. Comparing the actual change in the measurable with the calculated expected change allows analysts to differentiate between industries that are changing in accordance with national trends from those that are changing due to more localized factors.

  - **National growth effect.** The national growth effect multiplies the nation-wide growth rate by the base level of employment or output in the local economy. This calculates expected growth simply from natural, nation-wide growth in the economy.

  - **Industrial mix effect.** The industrial mix effect multiplies nation-wide growth in a specific industry (minus nation-wide growth to avoid double-counting) by the base level of employment or output in that industry. This calculates expected growth in each industry explained by growth of that sector in the national economy.

  - **Local effect.** The local effect is the difference between the actual local change and the expected change stemming from activity at the national level. The local effect is the most important, as it shows how the study area differs from the nation as a whole.

  Unlike a location quotient analysis that can be easily summarized with one number, shift-share analysis is best represented by reporting both the expected change and the local effect. Displaying the results of a shift-share analysis as an "all-in-one" ratio can be misleading because an industry that is shrinking in both geographies (negative divided by negative) can appear identical to one that is growing in both geographies (positive divided by positive). Reporting both the expected change and the local effect illustrates national trends (expected change), local performance against those trends (local effect), and an absolute measure of growth (the sum of the two).

E.3   GEOGRAPHY

The IMPLAN analysis presents results for multiple different geographies, some of which appear similar but are not. The following geographies are used in the report.

- **United States**

- **Portland region.** The Portland region is defined as the official U.S. Census consolidated metropolitan statistical area: Clark, Skamania, Columbia, Multnomah, Washington, Clackamas, Yamhill, Marion, and Polk Counties.

- **Multnomah County**

- **The City of Portland.** The value added or GDP of the City's economy had to be estimated because economic data are available at the county and the zip code levels, and do not align with City boundaries exactly. In total, this analysis estimated the Portland economy by combining data for 25 zip codes[5]

- **Downtown Portland.** The analysis used an area defined as zip codes 97201, 97204, 97205, and 97209 to approximate downtown Portland.

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[5] Demographic data show that the population residing in those zip codes equaled 99.4% of City's population in 2007, so boundaries are fairly accurate even if they don't align perfectly. Although most zip codes are completely or nearly entirely within the city limits, there are some that are not. Therefore, only those with more than half of their economic activity in Portland were used.

- In all fourteen industry groupings, Portland's LQ is higher than the averaged LQ for the ten comparison cities. The hypothesis that led us to this analysis (that the clusters reflect only the fact that Portland is a city, and not economic specialization relative to other cities) appears to be false based on these results. While selecting different cities might return a different answer (the sample is not statistically valid)[12], we can say that Portland is more specialized than these competitor cities in these clusters.

- The LQs in corporate, regional, and management offices; transportation; iron and steel mills, foundries, and service centers; software publishing; truck manufacturing; printing; and asphalt products are especially high relative to this set of cities.

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[12] Of particular note is the truck manufacturing cluster. Nashville (Davidson County) has a national LQ of 12.39 in the cluster which greatly increases the reference area denominator in the eleven county reference area. If a different county had been randomly selected that had an average LQ, the results would show that Portland is much more specialized in truck manufacturing than the current table depicts.