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DATE: Jan. 2, 2018
SUBJECT: 2017 ALLIANCE - ANALYSIS FOR IDENTIFYING PEER METROS

This memorandum presents the methods and results of the analysis ECONorthwest (ECO) for the 2017 Portland Business Alliance (Alliance) *Value of Jobs Economic Check-up* report. The purpose of this analysis was to identify metropolitan areas that are similar to the Portland-metro region across a range of economic indicators. These "peer" metros can then be used to compare Portland's economic health across a group of metropolitan regions that have quantifiably similar characteristics.

U.S. Census Public Use Microdata (PUMS) provided the foundation of our analysis. PUMS provides data on social, economic and demographic characteristics, which allows for accessible and transparent analysis across geographies. ECO used the 2015, 1-year survey estimates to compile the following data by metropolitan statistical area (MSA) for the analysis:

- Metro Population between 1,000,000 and 4,000,000[1]
- Gross Metropolitan Product
- Income per capita
- STEM workers
- Cost-burdened residents[2]

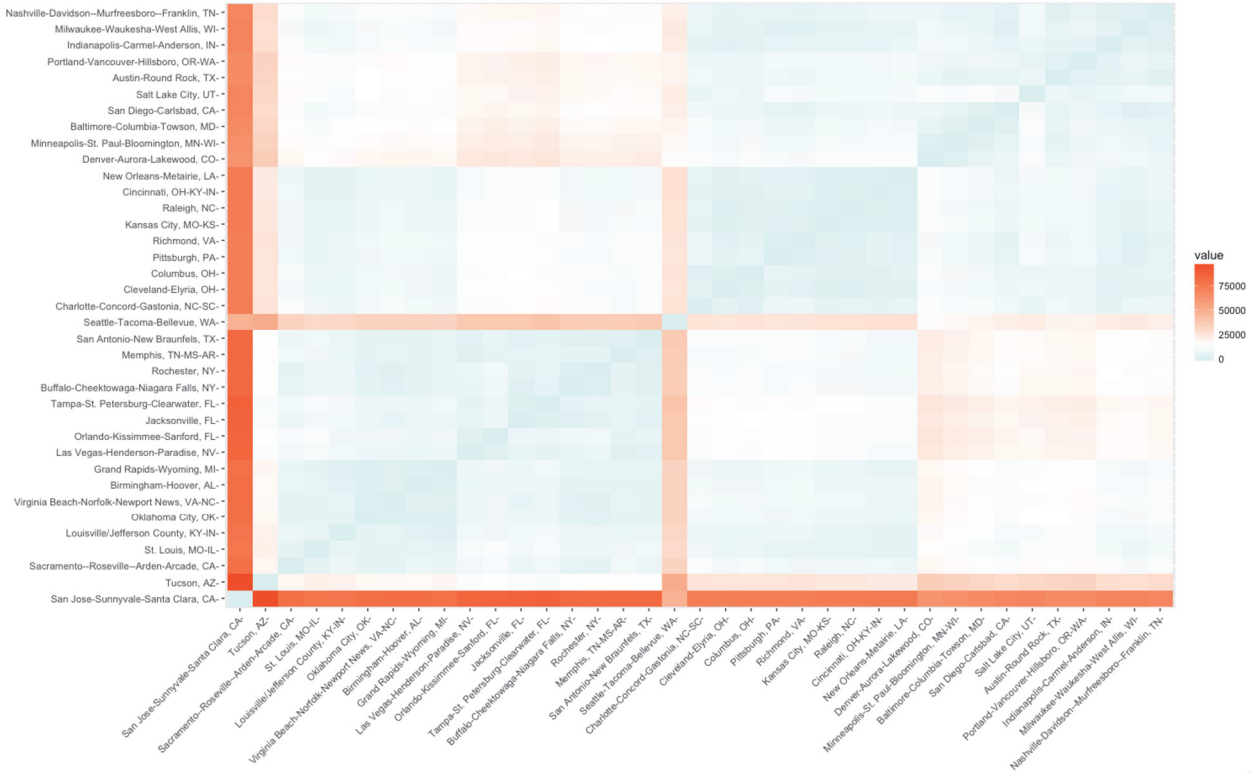
The economic indicators were combined into a single dataset and converted into similar measurements for comparability. The remaining 100 MSAs were then initially compared using a distance matrix. For this analysis, ECO used the Euclidian distance formula to broadly identify how similar metropolitan areas are to each other, based on the economic indicators selected. MSAs with incomplete observations were dropped from the list, resulting in 37 comparison metros.

The results of this analysis are shown in Figure 1 below. Blue squares represent metro pairs that are most similar to each other. In contrast, red squares represent metro pairs that are dissimilar. The Portland-metro region, for example, appears to be similar to Austin based on a simple pairwise analysis.

[1] The initial list of 382 metropolitan areas yielded results that were both unwieldly and irrelevant for developing a list of peer metros. After an initial examination of the data, ECO chose to limit the analysis to "mid-tier" metropolitan areas, ranging from 1 million to 4 million residents. This reduced the potential number of comparison regions to 100 metros.

[2] Cost-burdened residents for this analysis are defined as owner and renter occupied persons that spend 30 percent or more of their income on housing.

Figure 1. Distance matrix across MSAs



Source: ECONorthwest analysis using PUMS

Next, ECO formally divided the MSAs into groups using a K-means clustering algorithm. The K-means algorithm is simply a tool used to assign each MSA to a group based on similarity and the number of clusters chosen. The K-means method assigns the data to their closest cluster centroid using the Euclidian distance formula. It then calculates the mean (centroid) of all data within the cluster and reassigns data to other clusters as necessary. The algorithm iterates over these step until no data are reassigned.

ECO chose four clusters for the K-means analysis. Determining the optimal number of clusters remains somewhat subjective. However, data visualization tools[3] showed that there was minimal advantage to analyzing the data with more than four clusters. The results broadly confirm the results from the distance matrix, with Portland aligning with other mid-size MSAs that have strong STEM sectors. Seattle MSA and San Jose MSA are more unique in their clustering due to high GMP per capita.

[3] This was done by visualizing the within-cluster sum of squares a measure of cluster cohesion, to determine how closely related data are within a cluster. Using the "elbow method" ECO observed that four clusters appeared to minimize the within-cluster sum of squares.

Figure 2. Cluster analysis of MSAs

Source: ECONorthwest analysis using PUMS

The K-means clustering method identified 18 MSAs that clustered into the same group as the Portland-metro region. Rapid population growth can be seen as a measure of desirability for an MSA. Access to jobs, cost of living and environmental amenities are all drivers of desirability for a metropolitan region. To indirectly account for some of this desirability, ECO calculated the average annual population growth by MSA since 2010.

ECO then selected the top four MSAs within Portland's MSA cluster that were similar based on a composite score, which accounted for similarities across the economic indicators and population growth. Table 1 displays the results of the combined analyses. Austin had the highest distance value, but has seen higher population growth since 2010. Indianapolis is the next closest MSA, with lower growth but economic characteristics that are uniquely similar to Portland, such as a strong manufacturing sector. Salt Lake City has is the near distance metro with the most similar population growth, and will serve as an effective West Coast comparison city. Nashville is the last near distance city selected as a comparison to Portland.

Table 1. Final list of MSAs

MSA	Distance (ranked)	Avg Annual Pop Growth 2010 to 2016
Portland-Vancouver-Hillsboro, OR-WA	*0*	*1.4%*
Austin-Round Rock, TX	1	3.1%
Indianapolis-Carmel-Anderson, IN	2	1.0%
Salt Lake City, UT	3	1.5%
Nashville-Davidson--Murfreesboro--Franklin, TN	4	1.9%

Source: ECONorthwest analysis using PUMS

The next closest rank metros were Milwaukie and Charlotte. Milwaukie has a much different economic trajectory than Portland, with an average annual population growth rate since 2010 of 0.2 percent. Charlotte does not look distinctly different than the four selected metros, but does not has as close of a distance value in the cluster analysis.

Additionally, the Seattle MSA was added back in given the importance of Seattle to the Northwest economy and similar values that aren't easily quantifiable using PUMS data. This results in a final list of:

- Austin, Texas MSA
- Indianapolis, Indiana MSA
- Salt Lake City, Utah MSA
- Nashville, Tennessee MSA
- Seattle, Washington MSA