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Sheridan Avenue, the main street in Cody, Wyoming

Economic diversity, or lack thereof, has been the spark of many discussions regarding the Wyoming economy. This resulted in the creation of the Economically Needed Diversity Options for Wyoming (ENDOW) project initiated by former Governor Mead. The project focused on developing a 20-year diversification strategy for Wyoming. However, there has not been much discussion about how economic diversity is measured. One commonly used measure of economic diversity is the Hachman Index. Using an indicator such as employment, the index measures the mix of industries present in a particular region relative to a more diversified reference region. A Hachman Index score ranges from 0.000 to 1.000. A higher score indicates more economic diversity, while a lower score indicates less economic diversity. More economic diversity, though not always possible or desirable, may reduce economic volatility in the same way a diversified portfolio can mitigate investment risk. Of course, diversifying an economy is more complicated than diversifying an individual's portfolio. The reference region for the Hachman Index is often the national economy, in order to allow comparison between individual states. The index may also be used to measure industry distributions for individual counties as well. This publication examines the results of a Hachman Index analysis for the state of Wyoming and its individual counties based on how they compare to the national economy. The results for Wyoming are compared to other states. The Federal Reserve Bank of Kansas City, Regional Financial Associates and Moody's Analytics use similar methodology to measure economic diversity (Benway, 2019).

WYOMING DIVERSITY COMPARED TO OTHER STATES

Table 1 shows Wyoming has one of the lowest Hachman Indices in the nation (0.608), second only to the District of Columbia (0.230). Wyoming is one of only six states in the nation with a Hachman index below 0.80 (see Figure 1). The other five states include Nevada (.794), North Dakota (0.744), Oklahoma (0.707), Hawaii (0.649) and Alaska (0.647). Wyoming, North Dakota and Oklahoma all have low diversity indices due to their dependence on mining, including oil and gas production. Hawaii has a low diversity index due to it dependency on accommodations/food services, military and state government. Nevada has a low diversity index due to it dependency on accommodations/food services including many

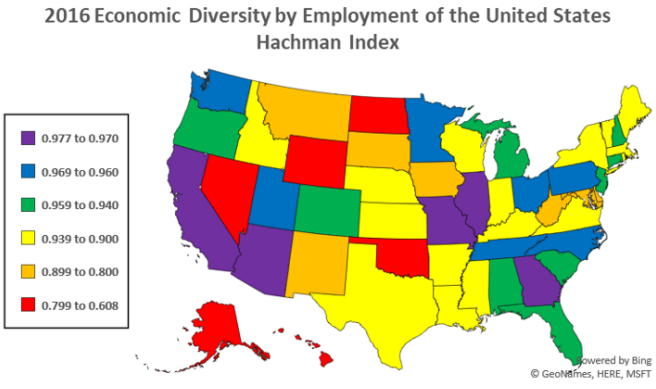

Fig. 1. Hachman Index by state

Table 1. Hachman Index scores for the states, 2016

State	Hachman Index	State	Hachman Index
MO	0.977	VA	0.927
AZ	0.977	KY	0.925
GA	0.976	TX	0.924
CA	0.974	ID	0.918
IL	0.973	MA	0.918
UT	0.969	MS	0.916
TN	0.967	NE	0.916
NC	0.966	WI	0.910
PA	0.966	IN	0.906
OH	0.963	KS	0.905
MN	0.962	AR	0.902
WA	0.960	DE	0.889
NH	0.959	MD	0.885
CO	0.957	IA	0.883
OR	0.955	MT	0.854
NJ	0.955	SD	0.854
MI	0.953	NM	0.853
FL	0.953	WV	0.811
SC	0.948	NV	0.794
AL	0.946	ND	0.744
CT	0.942	OK	0.707
RI	0.933	HI	0.649
LA	0.931	AK	0.647
NY	0.930	WY	0.608
ME	0.930	DC	0.230
VT	0.927		

Table 2. Hachman Index scores for Wyoming and Wyoming counties, 2016

County	Hachman Index	County	Hachman Index
WY	***0.608***	Platte	0.482
Sheridan	0.756	Lincoln	0.466
Washakie	0.738	Goshen	0.464
Laramie	0.722	Big Horn	0.358
Park	0.700	Weston	0.336
Carbon	0.688	Albany	0.334
Uinta	0.687	Crook	0.289
Fremont	0.626	Niobrara	0.283
Teton	0.612	Sublette	0.222
Natrona	0.575	Sweetwater	0.201
Hot Springs	0.525	Converse	0.195
Johnson	0.515	Campbell	0.144

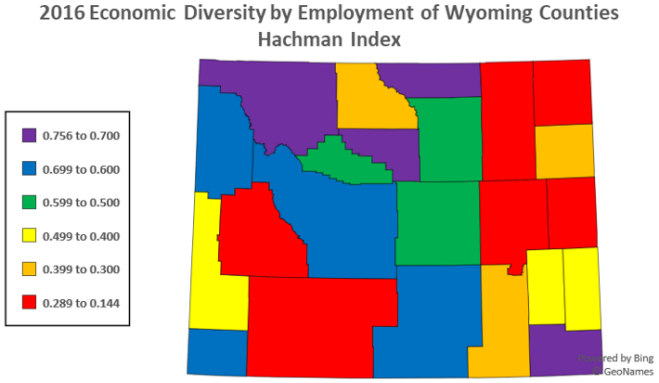

Fig. 2. Hachman Index by county

casino hotels. The District of Columbia has a low diversity index due to it dependency on federal government employment.

Wyoming also has the lowest Hachman Index among its neighboring states including Utah (.969), Colorado (0.957), Idaho (0.918), Nebraska (0.916), Montana (0.854), South Dakota (0.854) and North Dakota (0.744). States with larger employment bases tend to have more diverse economies due to a larger variety of economic opportunities and the presence of a wider range of industry sectors.

ECONOMIC DIVERSITY OF WYOMING COUNTIES

Table 2 summarizes the Hachman Indices for Wyoming counties. The indices for eight of the counties are higher than the state index (see Figure 2). Sheridan County has the highest diversity index at 0.756, followed by Washakie (0.738), Laramie (0.722), Park (0.700), Carbon (0.688), Uinta (0.687), Fremont (0.626) and Teton (0.612). The relatively high Hachman Indices for these counties indicate that their employment is spread across a number of sectors with no one dominate sector. Between the two metropolitan counties in Wyoming, there is substantial difference in economic diversity with the Laramie County index at 0.722 and the Natrona County index at 0.575. Natrona County has a lower diversity index due to dependency on mining, including oil and gas production.

Among the six Wyoming Counties with the lowest level of economic diversity, four including Campbell (0.144), Converse (0.195), Sweetwater (0.201) and Sublette (0.222) are all dependent on mining, including oil and gas production. Both Crook (0.289) and Niobrara (0.283) have lower diversity indices due to their dependence on both mining and agriculture.

ABOUT THE HACHMAN INDEX

The Hachman index is the reciprocal sum, or mean location quotient, of the study area across all industries where the mean is generated by weighting the respective sector's location quotient by the sector's share of employment in the region (Benway, 2019). A location quotient is calculated by dividing a sector's share of total employment in the study area by its share in the reference region. The Hachman Index for a given region is calculated as follows:

$$HI = \frac{1}{\left(\sum_i \left(\frac{E_{Si}}{E_{Ri}}\right) x \left(E_{Si}\right)\right)}$$

E_{Si} is the share of the subject area employment in industry *i*.
E_{Ri} is the share of the reference region employment in industry *i*.

A Hachman Index score ranges from 0.000 to 1.000. A higher score indicates that the region of interest's industrial distribution more closely resembles that of the reference region and is therefore more diverse. A lower score indicates that the region of interest's industrial distribution less closely resembles that of the reference region and is therefore less diverse. Diversity in economic structure, as represented by a diverse set of industries, is generally considered a positive contribution to a region's economic stability. For example, Park County, which had a relatively high Hachman Index (0.700), experienced average variability in employment of only 1.2 percent between 2001 and 2017. On the other hand, Sublette County, which had a relatively low Hachman Index (0.222), experience average variability in employment of 7.9 percent between 2001 and 2017. Due to its diversity, Park County's employment grew steadily increasing to 21 percent above the 2001 level by 2017. Meanwhile, Sublette County, with less diversity, saw its employment increased by 102 percent above the 2001 level in 2012, but then declined to

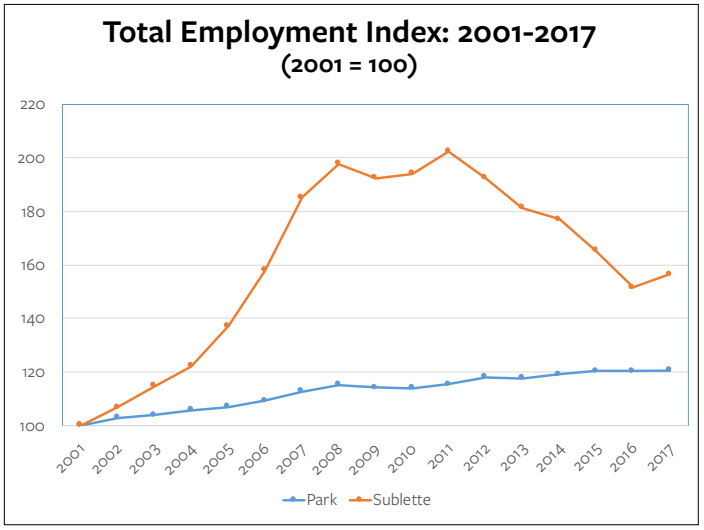

Fig. 3. Employment numbers for Park and Sublette counties

Table 3. Wyoming Total Full-Time and Part-Time Employment by NAICS Industry 2015, 2016 and 2017

	Percent Change		Percent of Total			Location Quotient		
Description	**2015-16**	**2016-17**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**
Total employment (number of jobs)	-1.93%	0.07%	100.00%	100.00%	100.00%			
Farm employment	0.27%	3.01%	3.50%	3.58%	3.69%	2.516	2.620	2.748
Forestry, fishing, and related activities	7.09%	-1.03%	0.72%	0.78%	0.77%	1.488	1.617	1.638
Mining, quarrying, and oil and gas extraction	-15.44%	4.95%	7.77%	6.70%	7.03%	9.521	8.922	9.121
Utilities	3.79%	2.68%	0.66%	0.69%	0.71%	2.090	2.159	2.106
Construction	-5.21%	-4.75%	7.61%	7.36%	7.00%	1.472	1.378	1.292
Manufacturing	-3.14%	2.39%	2.94%	2.90%	2.97%	0.427	0.427	0.437
Wholesale trade	-14.88%	-4.43%	2.77%	2.40%	2.29%	0.772	0.718	0.694
Retail trade	-0.77%	-2.51%	9.80%	9.92%	9.66%	0.977	0.999	0.986
Transportation and warehousing	-10.93%	-0.55%	3.90%	3.55%	3.52%	1.072	0.925	0.902
Information	2.02%	-1.43%	1.15%	1.20%	1.18%	0.659	0.683	0.682
Finance and insurance	6.13%	3.51%	4.06%	4.39%	4.54%	0.785	0.834	0.848
Real estate and rental and leasing	0.79%	2.81%	5.49%	5.64%	5.80%	1.205	1.230	1.248
Professional, scientific, and technical services	-2.47%	1.12%	4.32%	4.30%	4.34%	0.617	0.616	0.621
Management of companies and enterprises	19.80%	0.41%	0.40%	0.49%	0.49%	0.312	0.361	0.359
Administrative and support and waste management and remediation services	2.76%	1.06%	3.05%	3.19%	3.22%	0.493	0.513	0.523
Educational services	4.66%	-0.20%	0.96%	1.03%	1.02%	0.397	0.428	0.428
Health care and social assistance	2.15%	-0.34%	7.20%	7.50%	7.47%	0.642	0.665	0.660
Arts, entertainment, and recreation	6.09%	5.11%	1.75%	1.89%	1.99%	0.790	0.840	0.876
Accommodation and food services	-1.12%	0.49%	8.78%	8.85%	8.89%	1.195	1.188	1.186
Other services (except government and government enterprises)	-2.04%	0.27%	4.48%	4.48%	4.49%	0.764	0.781	0.788
Federal civilian	2.19%	0.27%	1.82%	1.89%	1.90%	1.230	1.285	1.301
Military	-0.05%	1.17%	1.48%	1.51%	1.53%	1.440	1.514	1.551
State and local	0.36%	-1.59%	15.39%	15.76%	15.49%	1.512	1.560	1.549
Hachman Index:						**0.567**	**0.608**	**0.595**

Data source: Bureau of Economic Analysis, with estimates for missing data from Woods & Poole Economics Inc.

57 percent above the 2001 level by 2017 in a classic "boom and bust" scenario (see Figure 3, previous page).

The Hachman Index does have some shortcomings. For one, the index does not account for the potential competitive advantages of a region. A region may have an advantage specializing in a specific industry, making a concentration in that industry economically advantageous over having a more diversified economy. For example, Albany County has a relatively low diversity index (.334) yet its economy has tended to be relatively stable due to its dependency on State Government employment through the University of Wyoming, which has been relatively stable over time. Insight into a region's competitive advantage can be gained from other techniques such as shift-share analysis. However, such specializations can reduce the region's economic stability, particularly if employment in the dominate industry is variable.

Although diversification is usually considered a positive attribute for an economy, an increase in diversification may not necessarily be good for the region's economy. For example, a decline in Wyoming's mining industry could increase its Hachman Index but would not necessarily be good for the Wyoming economy in general if there were not expansions in other industries. In essence, an increase in industrial diversity may not directly result in improvements for residents or imply economic growth. For example, as shown in Table 3, a 15 percent decrease in mining employment in Wyoming between 2015 and 2016 increased the state's Hachman Index by seven percent from 0.567 to 0.608. However, total employment for the state declined by two percent between 2015 and 2016 indicating that the increase in diversity did not have an overall positive effect on the state's economy. Similarly, a five percent increase in mining employment in Wyoming between 2016 and 2017 decreased the state's Hachman Index by two percent from 0.608 to 0.595. However, total employment for the state increased by nearly one percent indicating that the decrease in diversity did not have an overall negative effect on the state's economy.

Finally, the type of measure used can affect the Hachman Index. For example, an index calculated from employment by industry may be different than one calculated from another measure such as GDP. In addition, an index based on a broader measure, such as more detailed employment by industry, may be different from an index based on a less detailed measure of employment by industry. For this analysis, 2016 Bureau of Economic Analysis Local Area Personal Income and Employment data for 23 sectors were used to estimate the Hachman Indices: (http://bit.ly/beaRegionalData).

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