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A Playbook for Economic Development

A strategic methodology, built from empirical analysis

A thesis submitted in partial fulfillment of the
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by

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Abstract

Current strategies for economic development policy use shift-share analysis, location quotient calculations and forward and backward linkage information to identify industry clusters to pursue for economic development. But at different levels of unemployment, different strategies are needed. By using wage data and a systematic approach to analysis, a more measurable approach to economic development can be built. Applying regression analysis to wage data isolates the factors that most contribute to high wages, such as industry, occupation and type of education. Assessing these factors, then applying additional criteria to top identified industries, leads to a more robust economic development strategy. By creating a method for identifying factors that lead to desired economic outcomes, such as increased wages, economic development policy can be more efficient.

Contents

List of Tables

List of Figures

Introduction

Large, established cities, with established growth patterns face different challenges than mid-sized cities. Large cities must focus on managing the growth of their population and infrastructure, and also work to prevent over-specialization in a particular industry. Mid-sized cities, however, must work to understand their unique qualities and make informed policy decisions to diversify their economy and invest in areas of specialization and growth (or growth potential).

For mid-sized cities, economic growth is a key element of policy discussion and programming. While many government agencies, non-governmental organizations (NGOs), public-private partnerships and business organizations exist to work on regional economic development, there is no consistent metric for measuring growth in economic development. Job creation and unemployment rate are typically used as measures of economic health or growth in a region. Assessing progress in these areas can be done with a straight forward number or percent change calculation. However, a more complex measure of economic health might be more informative to strategic policy development. Average wages, while seemingly straight-forward, lends itself to more complex analysis that can yield insights about economic growth. On its face, average wage data is easily understood; however, a deeper look at wage data offers many interesting insights into a region's economic health and growth opportunities.

By focusing on wage data as a metric and incorporating contextual information about industries, occupations and consumer habits, we introduce a new approach to creating economic development policy. This approach addresses an important policy question of "how

do we create economic development programs that create a measurable impact on communities"? This question is crucial because economic development policy can directly impact consumers' lives by giving them job opportunities, business creation opportunities and more options in their consumption choices. Because these policies can directly impact peoples' lives and livelihoods, the research questions behind the policy are critical to address. The main research question this paper will address is "what is the proper intersection of data and analysis for assessing economic health"?

This paper will provide data and analysis to inform policy development in mid-sized cities, through the creation and verification of a methodology to assess regional economic health and develop strategies for managing the region's economic future. Uncovering the factors that contribute to high income, this paper will use Washoe County, Nevada as a "case study" to illustrate an approach to data and analysis that leads to economic development insights. This approach includes evaluating:

- The role of education on wages, including formal education as well as job-specific training, such as skill-based certifications. The role of education will be assessed for its impact on wages as well as the impact of education on minimum and medium wage jobs.
- The role of industry vs. occupation in driving wage growth.
- Consideration for inequality, including assessment of range of wages, as well as average wages, to avoid increasing average wages as a result of expanding the range of wages on the high end and not lifting wages for many residents. Also, the poverty status of individuals over the observed timeframe will be evaluated to understand changes in the poverty levels in the region in question.

- Consideration for gender inequality, evaluating female:male wage ratios in key industries.

By examining the earned income of residents of Washoe County, Nevada we can isolate the factors that contribute to high wage levels and apply additional analysis to illustrate how wages can be an important, multi-faceted metric for economic development policy.

Literature Review

For many years, most regional economic analysis has centered on the evaluation of industries: comparative strengths and weaknesses, specialization, growth, employment, output and other elements of key industries. Various analysis tools, such as shift-share analysis, input-output models and location quotients are used to quantify the strength or competitiveness of industries, with the "top" industries used to create clusters of opportunity for regional economic growth.

Though this approach has many strengths, it is limited in its ability to describe a region and highlight areas of opportunity for growth. The limitations of industry as a primary unity of regional analysis were first brought forward in the late 1980s by Thompson and Thompson [1987] and have been further examined and refined in the years since. In addition to revealing the the limitations of industry-centric approaches to analysis, new approaches to quantifying regional economic health have emerged.

The idea of examining regional economies by looking at occupation groups, rather than industry, created a shift in regional economic development strategy [Koo, 2005]. By looking at occupations, rather than simply looking at industries, we are able to look at specific roles within an industry. This means that similar occupations within different industries - which require similar education and training and offer highly transferable skills - are evaluated separately from the industries in which the occupations are located. For example, accountants in the manufacturing industry and accountants in the agriculture industry are supporting very different industries that generate very different outputs, but actually have similar job responsibilities. The education, experience and training of these roles is likely

very similar, despite the different industries.

Focusing on occupations as a key unit of analysis has been shown to have many positive effects. Looking specifically at occupations shifts the focus onto human capital, rather than simply on industrial output and allows us to incorporate the role of human capital into regional economic analysis. For instance, the accumulation of human capital has been shown to generate positive externalities within a region due to spillover effects [Lucas Jr, 1988]. Lucas showed that when new skills are acquired by workers, those skills can be shared or can spill over to others in the same location, eventually making the entire labor force more productive. Additionally, it has been argued by Black and Henderson [1999] that the accumulation of human capital promotes endogenous economic growth.

Human capital is proven to be an important consideration in economic health at both the regional and firm level. Firms are shown to focus on the quality of the labor force when making corporate location or relocation decisions [Calzonetti and Walker, 1991], further indicating that occupation, as a representation of human capital, is a key unit for economic development analysis.

Once the role of occupation was shown to be significant in regional economic analysis, additional studies were conducted to refine occupation-based analysis and how it is deployed for community and economic development strategies. While some work has been done, there is still room for further examination on the role of occupation in economic analysis.

Most notably, there is limited work in the direction of quantifying the human capital

as represented by occupations. Wage levels and wage growth has emerged as a potential measure of human capital that includes education, skills, experience and also the effects of industry and occupation. Additionally, wage levels in a region represent the market forces of labor availability and demand for labor types within a region. For these reasons, using wage level and wage growth as a primary unit for analysis of regional economic health can be useful.

My contribution will be to assess indicators of economic growth in conjunction with one another, rather than in isolation. By assessing these indicators together, a more precise and strategic approach to economic development can be created. This approach to data-driven regional economic assessment and policy development yields a more strategic methodology that is especially useful during times of low unemployment in a region.

Data

The following data sources will be used in analysis:

- US Bureau of Labor Statistics: Current Population Survey (CPS), which gives minimum wage data, by industry, hours worked per week, state and personal demographics.
- US Bureau of Labor Statistics (BLS): Occupational Employment Survey(OES), which gives average wage data for occupations, as well as number of employees and the location quotient for each occupation. The OES database is published annually and has employment and wage information for almost 700 occupation categories at different geographical levels (e.g., metropolitan area, state and nation).
- US Bureau of Labor Statistics: Quarterly Census of Employment and Wages (QCEW), which gives the number of employees, total and average wages and location quotient for each industry.
- US Bureau of Labor Statistics: unemployment data
- US Census Bureau: American Communities Survey (ACS), which gives earnings data by industry, occupation and geographical area. Ruggles et al. [2019]
- Ask Your Target Market (AYTM): buy local survey; https://aytm.com/surveys/439354/stat/2df1a6b1a2c21bf2dd0da54d1bac4326#charts The survey was completed by 1000 respondents, over the age of 18, in the US.

Methodology

4.1 Wage Analysis

This paper will look at earnings in various occupations and industry sectors to identify factors that are likely to have the most impact on raising the region's average earnings. To assess this, the paper will look at a few key elements:

- Evaluate the role of education on earnings, by amount and type of education
- Evaluate earnings by industry and occupation since the Great Recession: use regression analysis to quantify the impact of industry sector and occupation on earnings
- Use comparative analysis to understand earnings in Washoe County, by comparing Washoe County results to state-level and national-level analysis results
- Evaluate the impacts for inequality consideration, including gender inequality, income inequality and the low end of the wage range, such as minimum wage

A basic regression model will be used in a few different ways to compare factors that contribute to wages. The basic model is:

$$W_i = \beta_0 + \beta_1 x_i + \epsilon_i$$

where

- W_i is the log earnings of each observed person
- x_i is the factor of interest, e.g. amount of education or industry

We expand this model slightly to include terms that account for job type, as defined by industry and occupation combinations, as well as education and gender:

$$W_i = \beta_0 + \beta_1 IND_i + \beta_2 OCC_i + \beta_3 IND_i * OCC_i + \beta_4 yearseduc_i + \beta_5 sex_i + \epsilon_i$$

where:

- W_i is the log earnings of person i
- IND_i and OCC_i are individual factors of interest (industry and occupation)
- $IND_i * OCC_i$ is the interaction of multiple factors of interest (industry*occupation)
- $yearseduc_i$ controls for the amount of education
- sex_i controls for gender

To successfully analyze the data, the ACS data must be manipulated for use in this context. Applying the data manipulation strategy from Jaeger [1997] that groups ACS educational categories and assigns numeric values to the categories, this paper assigns years of education to each individual. Taking the Jaeger [1997] approach one step further, this paper creates unique years of education values for those with "some college" education and those with "associate's degree".

While both of these types of individuals might have spent 14 years in an educational setting, those who earned an associate's degree have many different qualities than those who attended a college or university for some time, but did not complete a degree. In this paper, those who attempted coursework beyond high school, but did not complete a degree are identified as having 13 years of education. Those who received an associate's degree are identified as having 14 years of education and those who completed a bachelor's degree are identified as having 16 years of education, regardless of the amount of time it took an individual to complete those degrees.

Further refining the approach from Jaeger [1997], this paper assigns different numeric values for years of education to those who have completed a master's degree, those who have a professional degree and those who have a doctorate degree. These individuals are assigned 18 years, 19 years and 21 years of education, respectively. While there is some variation in the length of time of different higher education programs, the most common time frames for higher education degrees was used.

4.2 Buy Local

An additional benefit to increasing the average wage in the region and pursuing economic development policy that seeks to increase wages is that it leads to increased consumption in the region, which has many positive benefits. Higher wages lead to higher consumption in general, but (perhaps more interestingly), higher wages also lead to more local spending. One key area of impact is the circulation of income within the region. To assess this, we will analyze consumers' propensity to "buy local", based on wage level. Using regression analysis, we will:

- Evaluate likelihood to buy local, based on wage level.
- Calculate willingness to pay more for local products, compared by wage level.

The specific regression is:
$W_i = \beta_0 + \beta_1 x_i + \epsilon_i$
where

- W_i is the log earnings of a person surveyed
- x_i is a habit of interest, e.g. willingness to pay more for local products, likelihood to buy local (general) or likelihood to buy local (category)

To successfully analyze the "buy local" phenomenon, we use survey data from AYTM. The survey was conducted to assess and understand consumer shopping habits, but this

data can also be used to assess the buy local habits and implications for economic development. However, because the survey was created for consumer behavior and marketing analysis, the survey data must be manipulated for use in this context.

Applying the data manipulation strategy from Jaeger [1997] to this data set as well allows for easier analysis and comparison with the ACS data. Therefore a similar approach is applied to this data, assigning numerical values for years of education to each individual.

However, because the buy local survey data was collected differently, the data is organized differently and additional considerations must be included to assign numerical values to educational attainment. The survey has a designation for those who achieved "some college" as well as those who received a 2-year degree. These designations are considered analogous to those who attempted coursework beyond high school, but did not complete a degree and those who received an associate's degree, respectively. Therefore these designations are identified as having 13 and 14 years of education, respectively. This corresponds with the structure of the ACS data, which is useful for comparing analysis results.

The buy local survey only allows for two categories of education beyond a 4-year degree: professional degree and graduate school degree. For purposes of this paper, these individuals are assigned 18 years and 19 years of education, respectively.

Additional adjustments to the data set include:

- Defining income range as one numerical value to represent each range. The value used for each range listed in the survey was found by taking the mean of that income range from ACS data.
- Defining the Likert scale questions that were conducted with verbal answers as a numeric scale. The seven-point range from "Strongly Disagree" to "Strongly Agree" was defined as a discrete variable, range -3 to 3.

- Likelihood questions that were posed as a verbal range from "Never" to "Always" was converted to a continuous variable, range 0 to 1, where levels indicate a percent likelihood of exhibiting that behavior.

4.3 Specialization

In addition to assessing the industry and occupation groups that lead to higher wages, it is important to understand whether a region can successfully pursue/attract those types of jobs. In many cases, the region's current specialization in an industry or occupation can be indicative of the region's ability to attract and/or retain jobs in that sector. Assessing a region's competitiveness for a certain type of job is key to policy creation and an important step in the job type methodology being developed here. Understanding a region's competitiveness requires a mix of data analysis and observational understanding to land on a definitive assessment of the situation, but a good first step is to create comparisons in terms of wage between job types across industries and/or geographies. This comparison is done by direct wage comparisons, evaluated as relative percentages as well as by location quotient calculation.

Motivation

Historically, economic development authorities have prioritized job creation as a key metric of their programs and policies. When the local unemployment rate is above 6.0 percent (or decidedly above the natural rate the economy can sustain) this strategy is advantageous. New firms bring new jobs to the region and people who are looking for work are given new opportunities. When looking at the factors that lead to a high unemployment rate, such as stagnant productivity in key industries and/or closing businesses due to recessionary dynamics, increasing employment by creating jobs (through nearly any viable means) is a valid strategy. Identifying and pursuing high wage jobs at higher levels of unemployment is valid, but must be considered alongside policies to decrease the unemployment rate. Otherwise, the increased wages and high unemployment rate conflict and battle against each other for overall regional economic health.

However, once the unemployment rate drops below 6.0 percent, creating or attracting new jobs does not directly create new opportunities, it merely poaches talent from existing employers. To avoid this and create a net positive increase in the local economy, policies need to support business dynamics that lead to an increase in the labor force. Once the unemployment rate drops, the economic development strategy needs to shift from focusing on number of jobs and prioritize the type of jobs [Hicks, 2018]. Jobs that offer higher wages can attract people back into the workforce, leading to higher productivity and positive outcomes for the region. When the average wage of a region increases, there are many positive effects that can occur:

- Labor force increases, as people who had given up on job searching are enticed to apply for jobs again. People who had exited the labor force for other reasons may also return to work. For example, parents who left the labor force to be home with their children rather than pay for childcare, may find opportunities with incomes that outweigh the cost of childcare. Additionally, people who would otherwise choose to leave the labor force may continue to work, due to the higher wages offered and potential job stability

that is available. For example, older workers may delay retirement and choose to say in the labor force longer than they would in other conditions.

- Higher wages are an indication of overall economic health of businesses. Shambaugh et al. [2017] indicates that wage growth leads to higher economic health in a region, across many measures of economic health including new business starts and successes.

- When average wages of a region increase, without a change in the regional tax structure, that leads to an increase in tax revenue for the region. Higher wages yield higher revenue from income tax (where applicable) and higher wages lead to higher consumption, which yields higher revenue from sales tax (where applicable). An increase in tax revenue for the region means there is more money for providing services to the community, such as infrastructure investment or school system improvements.

In September 2015, unemployment dipped below 6.0 percent, to 5.8 percent in the Reno metropolitan statistical area (MSA) (BLS data, not seasonally adjusted). This is a year after the overall US unemployment rate dropped below 6.0 percent,to 5.7 percent which happened in September 2014 (BLS, not seasonally adjusted). (See Figure 1). Given the slow economic recovery in Nevada, it is not surprising that unemployment would trail the US unemployment rate in terms of time to drop below 6.0 percent.

At low unemployment rates, it is important that policy makers shift from a focus on numbers of jobs to types of jobs. Prioritizing high wage jobs (which will lead to the overall average wage increase in the region) is a more advantageous policy choice when unemployment drops below 6.0 percent. When there is less slack in the labor market, generally, employers must pay higher wages to attract workers [Krueger, 2015], increasing wages for all workers, across industries and occupations. Additionally, since wage growth for less-educated workers is particularly sensitive to changes in labor demand [Katz et al., 1999], lower unemployment rates should lead to significant increases in wages for less-educated workers. However, in the recovery climb out of the Great Recession, the resulting reduction in slack has not been accompanied by dramatically higher nominal wage growth. Therefore,

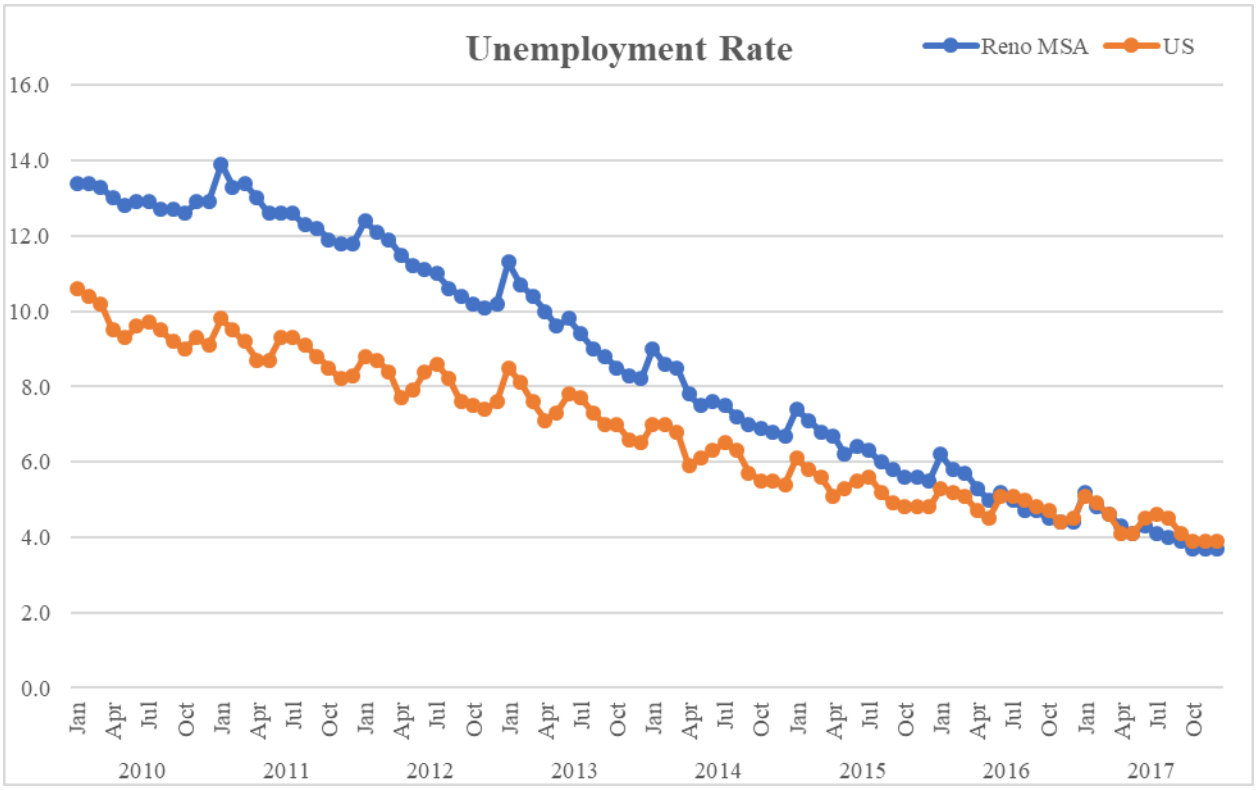

Figure 1: Unemployment Rates

communities cannot simply rely on the forces of a tight labor market to drive up wages for its population. At low unemployment rates, it is advantageous to assess the jobs that have higher wages and can contribute to increasing the average wages in a region.

Using wage data for analysis and assessing average wage change as a measure of economic activity is important because high wage levels allow for increased purchasing power for residents and increased circulation of money within the region.

At higher wage levels, not only are local citizens spending more money, they are more likely to spend money with local retailers. An analysis of survey data from Ask Your Target Market (AYTM), a private market research firm, suggests that for every $10,000 increase in income levels, a consumer is 1 percent more likely to buy local and they are 3 percent more willing to pay more for local products. Additionally, they buy local food and local

wine/beer approximately .5 percent more often.

At the individual level, this is a small shift, but at the regional level, the aggregate impact of these behavior changes can be meaningful. There is a multiplier effect that comes from increased local spending, such that any increase in local spending ends up having a larger effect than the initial dollar amount. If an increase in wages leads to more local spending, which in turn leads to more local recirculation of revenue, this has both direct and indirect positive effects on the regional economy, giving additional motivation to use wage growth as a key metric for economic development analysis.

Results

6.1 Wage Comparisons Over Time

By isolating the industry sectors with high earnings, policy makers can understand the occupations and industry sectors that would be most advantageous to support for increasing the region's average earnings.

The first step in understanding earnings within a region is to look at the average earnings over time, compared to national earnings. The time period of interest is 2010-2017 and annual earnings for each year in Washoe County are compared to annual earnings for each year in Nevada as well as the United States. (See Figure 2)

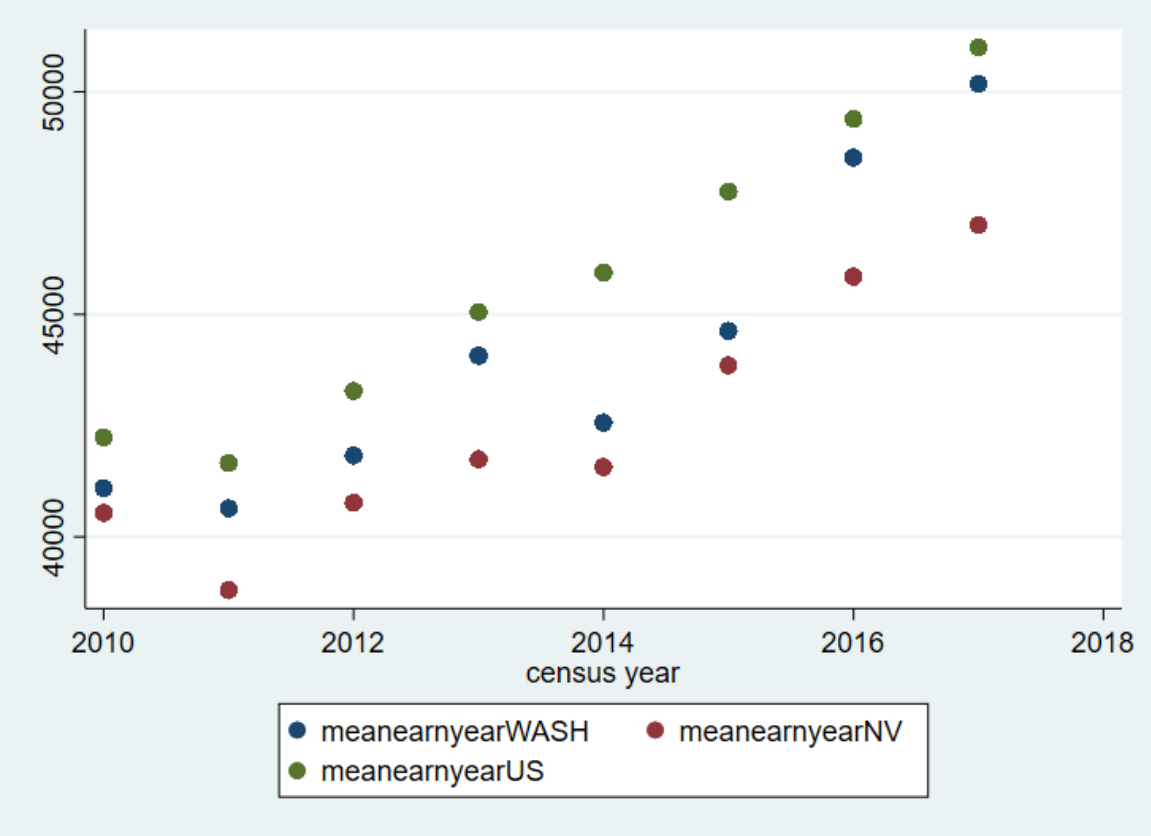

Figure 2: Average Earnings: US, NV, Washoe County

This comparison shows that wages in Washoe County follow a similar upward trend as the state of Nevada and the United States. This sets the stage for using Washoe County

data as a case study for this empirical approach to regional economic analysis.

6.2 Education as Wage Predictor

The role of education on wages, including formal education as well as job-specific training (such as skill-based certifications) is crucial to understanding the job types that offer higher wages. The role of education is assessed for its impact on wages and also its impact on wages over time. Understanding changes in the role of education in predicting high wages can be informative for policy makers, as they assess how to support educational programs, including K-12, university and skill-based certificate education.

Returns to Education To assess the impact of additional education, we conduct a regression analysis on the returns to education for workers. The results in Table 1 indicate that nationally, there is a positive return to education and for every additional year of education, a worker can expect to see a 15.1 percent increase in earnings.

Looking specifically at Washoe County, Nevada, we see returns to education of .120. This means that for every additional year of education, employees can expect to earn 12.0 percent more in annual earnings. Compared to the rest of the state of Nevada (10.3 percent) and the US (15.1 percent), this is higher than the state of Nevada, but lower than the US. Comparing the average returns to education over the time period 2010-2017 with the returns to education in 2017 gives very similar results at all three levels (See Table 2).

This suggests that even though the US economy was experiencing growth and change in the post-recession recovery years, the returns to education was stable. Because the returns to education are lower in Washoe County than in the rest of the US, but the average salary is similar, this suggests that there are many high wage job opportunities in Washoe County that do not require higher levels of education. Unpacking the returns to education will expose the jobs that offer high wages, the education levels that are required for those jobs and provide indication on how to prioritize for growth.

Table 1: Comparison: Returns to Education, 2010-2017

	(1)	(2)	(3)
	US	Nevada	WashoeCounty
yearseduc	0.151***	0.103***	0.120***
	(0.000123)	(0.00123)	(0.00311)
_cons	8.044***	8.772***	8.503***
	(0.00173)	(0.0167)	(0.0433)
N	11960227	102584	17009
r2	0.112	0.0642	0.0803
F	1504740.8	7033.1	1485.9

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Comparison: Returns to Education, 2017

	(1)	(2)	(3)
	US	Nevada	WashoeCounty
yearseduc	0.149***	0.102***	0.120***
	(0.000336)	(0.00336)	(0.00847)
_cons	8.151***	8.870***	8.612***
	(0.00477)	(0.0458)	(0.119)
N	1554945	13774	2331
r2	0.113	0.0633	0.0788
F	197894.8	931.3	199.3

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Tables 3,4 and 5 show average earnings by education level for the US, the state of Nevada and Washoe County. Several features are notable:

- US: the national average annual income of those with a high school diploma is $48,128, which is nearly $20,000 lower than the national average annual income of those with an associate's degree of $67,333 and more than $25,000 less than the $74.205 average annual income for those with a 4-year degree

- Nevada: the average annual income of those in Nevada with a high school diploma is $44.729, which is nearly $20,000 lower than the average annual income of those with an associate's degree of $61,923 and nearly $25,000 less than the $68,064 average annual income for those with a 4-year degree

- Washoe County: the average annual income of those in Washoe County with a high school diploma is $46,380, which is nearly $20,000 lower than the average annual income of those with an associate's degree of $63,582 and nearly $25,000 less than the $69,669 annual income for those with a 4-year degree

Table 3: US Avg Earnings by Educ Level

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	48128.1***	67332.6***	74205.3***	77997.9***	139895.7***	104518.0***
	(17.86)	(33.21)	(40.34)	(74.57)	(263.4)	(227.9)
N	11016457	5024833	3956517	1059911	264629	177138

Table 4: NV Avg Earnings by Educ Level

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	44729.3***	61922.9***	68064.0***	69909.3***	136946.6***	100488.9***
	(168.6)	(359.4)	(449.1)	(816.3)	(2953.0)	(2894.1)
N	92527	34283	25890	6382	1850	932

Table 5: WASH Avg Earnings by Educ Level

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	46379.7***	63582.3***	69669.2***	68160.5***	146669.9***	101927.0***
	(442.9)	(846.8)	(1024.1)	(1813.3)	(6777.4)	(5330.7)
N	15589	6635	5220	1239	378	274

Conducting the same analysis for the year 2017 only (the most recent year for which we have data), yields similar conclusions (See Tables 6,7,8). This suggests that the role of education is not changing - or not changing quickly - in Washoe County.

Table 6: US Avg Earnings by Educ Level 2017

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	53301.0***	73192.9***	80674.1***	84448.4***	150898.6***	112332.8***
	(55.43)	(98.96)	(119.6)	(219.2)	(782.0)	(666.2)
N	1442418	691861	548201	149018	36597	24949

Table 7: NV Avg Earnings by Educ Level 2017

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	49207.4***	67205.5***	74229.2***	76339.1***	152009.7***	116969.1***
	(529.0)	(1091.0)	(1383.1)	(2505.8)	(9869.2)	(9247.1)
N	12513	4846	3667	886	247	136

Table 8: WASH Avg Earnings by Educ Level 2017

	(1)	(2)	(3)	(4)	(5)	(6)
	HS	AA	BA	MA	PR	DR
incearn	52033.8***	70960.9***	78299.2***	72480.1***	160743.5***	131360***
	(1389.3)	(2601.3)	(3164.6)	(4957.5)	(22374.8)	(18416.4)
N	2167	958	763	180	46	45

Understanding the overall estimated returns to education for Washoe County is important context for analyzing the different factors that lead to high wages. If returns to education are lower in Washoe County than in the rest of the US, there may be industries or occupations present in Washoe County that yield high wages without high education levels. Identifying those areas will be important for answering the related policy questions around wage growth.

Education at Minimum Wage and Medium Wage Levels Another important consideration for wage growth policy is the role of education in minimum wage roles compared to education in medium or higher wage roles. The average earnings by education level shown in Tables 3-8 indicate a large gap in earnings between those with a high school diploma and those with an associate's degree. Examining the difference between minimum wage jobs and medium wage jobs offers a way to look at the earnings gap between those with a high school diploma and those with an associate's degree. Understanding the amount of education required to move someone from a minimum wage position to a position that pays something meaningfully better can focus efforts on education and training that will raise wages for minimum wage workers.

According to the US Census Bureau, in 2017, the population of Nevada was approximately 3,000,000; 77.1 percent of that population is 18 years old or older. In Nevada, only 1.4 percent of hourly wage workers made at or below minimum wage in 2017 (12,000 minimum wage workers out of 8,883,000 hourly wage workers, according to 2017 BLS report based on CPS data); and only an estimated 0.52 percent of the state's population is working minimum wage jobs. Though only a sliver of the population is making minimum wage, it is useful to use minimum wage jobs as a benchmark for comparison.

Based on 2017 BLS data on the number of US workers making at or below the national minimum wage, the national average annual earnings for someone making at or below minimum wage in 2017 is $10606 (mean) and $10179 (median). This includes all minimum

wage workers, including part-time workers who may work as few as 1 hour per week. This means that students who are working part-time while in school are included in the data set. To give a more realistic representation of adults who are working minimum wage jobs in a full-time equivalency capacity, we look at the average annual wage of those working 30 or more hours per week. The national average annual earnings for this group is $14210 (mean) and $15080 (median).

Using these parameters, the US mean level of education for those who make less than $10179 per year is 12.705 years of education. To get a better representation of the worker who is actually in a full-time capacity, we look at those who are making more than $10179 and less than $15080. This group has a mean education level of 12.704 years of education. This suggests that the level of education among those working minimum wage jobs is 12.7 years of education, or just over a high school diploma, regardless of hours per week worked.

To find the average minimum wage data for Nevada, we use the breakdown of percent of minimum wage workers that are in Nevada, assume that the distribution of hours worked is similar for the state of Nevada and get estimates for the number of workers in each "hours per week" category in Nevada. This gives us estimates for average annual earnings for full-time equivalent(FTE) minimum wage workers in Nevada.

In Nevada, the average annual earnings for all workers earning at or below minimum wage is $12069 (mean) and $11583 (median). Those working 30+ hours per week in a minimum wage job have average annual earnings of $16170 (mean) and $17160 (median). Using these parameters, the average level of education for those who make less than $11583 per year is 12.588 years of education. To get a better representation of the type of worker who is actually in a full-time capacity, we look at that who are making more than $11583 and less than $17160. This group has an average education level of 12.441 years of education. This suggests that the level of education among those working minimum wage jobs is 12.5 years of education, or just over a high school diploma, regardless of hours per week worked.

This suggests that those who are working minimum wage jobs in a full-time capacity may have a high school diploma, but limited post-secondary education. The consistency in average education level across hours per week categories - and the slightly higher education level of those working in the lower hours per week categories - may indicate that the majority of people working minimum wage jobs are students who are working jobs that require limited commitment and expect limited prior work experience. Recognizing that many service industry jobs (such as food preparation, food service and bartending) are often minimum wage jobs, this could explain the consistency in education levels across hours per week categories and support the idea that many people in minimum wage positions are students.

Regardless, to move these workers to a higher wage category could be accomplished with additional education or training.

- At $20 per hour, for 30+ hours per week, the estimated annual earnings is $41,600
- At $25 per hour, for 30+ hours per week, the estimated annual earnings is $52,000
- At $30 per hour, for 30+ hours per week, the estimated annual earnings is $62,400

In Nevada, the average education level for these median annual wage levels would be

- at $20 per hour is 12.874 years of education
- at $25 per hour it is 13.465 years of education
- at $30 per hour it is 13.848 years of education

Compared to the average education level at minimum wage, this suggests that employees would require (approximately) an additional .5, 1 and 1.5 years of education to achieve $20, $25 and $30 per hour, respectively. This suggests that certificates and training programs other than 4-year degrees can have a meaningful impact on increasing wages.

6.3 Job Type as Factors of High Earnings

To support high earnings in a region, we must first understand what are the indicators that drive increased wages in a region other than the unemployment rate and labor market dynamics. Looking at type of industry, type of occupation and type of job (defined as industry/occupation combinations) may provide indicators of high wages.

We will compare wage indicators in 2017 to wage indicators in the range of time from 2010-2017 (rather than year by year) to mitigate the impact of any spikes or dips in wages that are caused by unobserved factors. For example, in 2014, the average wage in Washoe County dipped, while US and NV Wages did not. This dip was likely caused by a dip in the mining industry, because mining has been identified as a top earning industry in Washoe County. Using the range of data from 2010 to 2017 includes, but does not overstate the impact of, this dip in wages in analyzing the growth and opportunity of certain job types.

Ranking Industry, Occupation and Job Types for Wages

- 2010-2017: Using ACS data from 2010-2017 and looking only at Washoe County, we look at the factors that impact earnings.

  This analysis suggests that the industries that yield the highest income are:

  - Mining (IND300) including metal ore mining and requisite support activities.
  - Utilities(IND500) including power generation and distribution, and sewage treatment facilities.
  - Manufacturing (IND800) including advanced manufacturing, commodities manufacturing and agriculture manufacturing.
  - Public Administration (IND9300) including executive offices and legislative bodies, public finance activities and other general government agencies.
  - Finance, Insurance (IND6800) including banking and related activities, insurance carriers and non-depository credit activities.

  - See Appendix, Table 9 for full regression results.

- The occupations that yield the highest income are:
  - Legal field (OCC2100) including lawyers, judges and legal support staff.
  - Management occupations (OCC0) including chief executives, marketing managers and gaming managers.
  - Financial specialists (OCC750) including accountants, budget analysts, personal financial advisors and insurance underwriters.
  - Healthcare practitioners and technical occupations (OCC3000) including chiropractors, dentists, physicians, surgeons and pharmacists.
  - Computer and Mathematical Occupations (OCC950) including computer scientists and system analysts, computer network architects, web developers, support specialists, actuaries, mathematicians and statisticians.
  - See Appendix, Table 10 for full regression results.
- The industry and occupation combinations that yield the highest income are:
  - Legal occupations (OCC2100) including lawyers and legal support workers in Arts, Entertainment, Recreation, Accommodations, and Food Services industry (IND8500) including performing arts, gaming and other recreation.
  - Legal occupations (OCC2100) including lawyers and legal support workers in Utilities industry (IND500) including power generation and distribution, and sewage treatment facilities.
  - Healthcare practitioners and technical occupations (OCC3000) including chiropractors, dentists, physicians, surgeons and pharmacists in Utilities industry (IND500) including power generation and distribution, and sewage treatment facilities.
  - Arts, Design, Entertainment, Sports, and Media Occupations (OCC2600) including artists, actors, designers and entertainers in Finance/Insurance industry

(IND6800) including banking and related activities, insurance carriers and non-depository credit activities.

  - Transportation and Material Moving Occupations (OCC9000) including flight attendants, bus drivers and large equipment drivers in Mining industry (IND300) including metal ore mining and requisite support activities.
  - See Appendix, Table 11 for a sample of full regression results.

Identifying the top industries, occupations and industry/occupation combinations for wages is a key step to creating policy to drive higher wages. Understanding any changes over time in the top industries, occupations and industry/occupation combinations for wages will illuminate trends in growth or decline in wages and provide an additional consideration for identifying top job types to support through economic development policy.

Applying the same regression analysis to 2017 (the most recent year for which we have data) and comparing results to the results from the entire time period 2010-2017 gives a basis for identifying trends in wage growth or decline.

- The highest earning industry groups are:
  - Mining (IND300) including metal ore mining and requisite support activities.
  - Utilities (IND500) including power generation and distribution, and sewage treatment facilities.
  - Finance/Insurance (IND6800) including banking and related activities, insurance carriers and non-depository credit activities.
  - Military/Defense (IND9600).
  - Construction (IND700).
  - See Appendix, Table 12 for full regression results.
- Occupations:
  - Legal Occupations (OCC2100) including lawyers and legal support workers.

  - Management Occupations (OCC0) including chief executives, marketing managers and gaming managers.
  - Computer and Mathematical Occupations (OCC950) including computer scientists and system analysts, computer network architects, web developers, support specialists, actuaries, mathematicians and statisticians.
  - Financial specialists (OCC750) including accountants, budget analysts, personal financial advisors and insurance underwriters.
  - Healthcare practitioners and technical occupations (OCC3000) including chiropractors, dentists, physicians, surgeons and pharmacists.
  - See Appendix, Table 13 for full regression results.

- The industry and occupation combinations that yield the highest income in 2017 are:
  - Transportation and Material Moving Occupations (OCC9000) in Finance/Insurance Industry (IND6800).
  - Transportation and Material Moving Occupations (OCC9000) in Manufacturing industry (IND800).
  - Legal occupations (OCC2100) in Finance/Insurance (IND6800).
  - Business Operations Specialists (OCC450) in Arts, Entertainment, Recreation, Accommodations, and Food Services Industry (IND8500).
  - Legal occupations (OCC2100) in Real Estate, Rental and Leasing Industry (IND7000).
  - See Appendix, Table 14 for a sample of full regression results.

Comparing the results in 2017 to the average results over the 2010-2017 timeframe allows us to see areas of growth, such as the rise of the construction industry after the housing crash of 2008 and the increase in the finance/insurance industry. Additionally, we see the persistence of occupations like computer/mathematical occupations and legal occupations as top occupations for wages in Washoe County. As these occupations are present across multiple industries, isolating these roles is important.

An important step in the analysis is to apply logic to the results in order to evaluate them for policy implications. Because slicing the data at the year-county level leaves a small sample size, one individual may cause a particular degree/occupation combination to appear as a top earning combination. Applying logic to the data analysis would lead policy makers to properly prioritize occupations for pursuing for economic development strategy.

6.4 Additional Analysis for Top Ranked Industries

Comparisons To refine the list of industries and occupations to focus on for economic development, a bi-directional comparative analysis is conducted. Once a list of industries of interest and occupations is created, wages in each industry are compared in two directions, to understand impact and opportunities.

The first direction for comparison is comparing regional wages in that industry to national wages in that job type. Compare local wages in an industry to national wages in that job type over the selected time period (2010-2017).

To illustrate this approach, we will look at three of the top industries identified by the wage analysis:

- Finance/Insurance: Those working in the Finance industry in Washoe County make 92.13 percent of those in the same industry across the US ($93071.09 to $101020.80)
- Military/Defense: Those working in the Defense industry in Washoe County make 120 percent of those in the same industry across the US ($50806.67 to $42335.35)
- Manufacturing: Those working in the Manufacturing industry in Washoe County make 100.7 percent of those in the same industry across the US ($57574.78 to $57175.77)

Following that, conduct the same comparison using only data from the most recent year, in this case, 2017. Comparing the 2017 ratios to the 2010-2017 ratios will indicate areas of wage growth or increased specialization.

Industry: Washoe to US	2010-2017	2017	Interpretation
Finance/Insurance	92.13%	116.26%	Wages growing faster in Washoe
Military/Defense	120%	168.88%	Wages growing faster in Washoe
Manufacturing	100.7%	100.8%	Wages growing same in Washoe

Figure 3: Earnings Comparison, Top Industries Local vs. National

- Finance/Insurance: Those working in the Finance industry in Washoe County make 116.26 percent of those in the same industry across the US ($132213.90 to $113720.20)
- Military/Defense: Those working in the Defense industry in Washoe County make 168.88 percent of those in the same industry across the US ($78571.43 to $46525.55)
- Manufacturing: Those working in the Manufacturing industry in Washoe County make 100.8 percent of those in the same industry across the US ($61388.67 to $60929.51)

The 2010-2017 vs. 2017 comparison (see Figure 3) suggests that the Finance/Insurance and Military/Defense industries in Washoe County experience faster wage growth than the US average. Conversely, the wages in Manufacturing are growing at roughly the same rate as wages in that industry nationwide. Looking at these wage growth comparisons may lead to further prioritization for industries to pursue for economic growth. This analysis can also be conducted for top occupations and top industry/occupation combinations.

The second direction for comparison is comparing wages in identified industries to wages in job types that are legacy job types in the region. Legacy jobs are industries, occupations or roles that have historically yielded high output for the region or that represent a large percentage of employment in the region.

To illustrate this for Washoe County, we identify tourism, mining and logistics as legacy industries for comparison:

- Finance: Those working in the Finance industry in Washoe County make more than those working in Tourism in Washoe County ($93071.09 to $26157.64); more than those working in mining in Washoe County ($93071.09 to $88652.27); and more than those working in Logistics in Washoe County ($93071.09 to $42462.52)

- Defense: Those working in the Defense industry in Washoe County make more than those working in Tourism in Washoe County ($50806.67 to $26157.64); less than those working in mining in Washoe County ($50806.67 to $88652.27); and more than those working in Logistics in Washoe County ($50806.67 to $42462.52)

- Advanced Manufacturing: Those working in the Advanced Manufacturing industry in Washoe County make more than those working in Tourism in Washoe County ($57574.78 to $26157.64); less than those working in mining in Washoe County ($57574.78 to $88652.27); and more than those working in Logistics in Washoe County ($57574.78 to $42462.52)

Similar to the national comparisons, we compare wages in top industries with wages in legacy industries in the year 2017 only and them relate those with the comparisons from the 2010-2017 time frame. This will indicate the dynamics of the relationship between newly identified top industries and the legacy industries.

- Finance: Those working in the Finance industry in Washoe County make more than those working in Tourism in Washoe County ($132213.90 to $29855.86); more than those working in mining in Washoe County ($132213.90 to $91440.63); and more than those working in Logistics in Washoe County ($132213.90 to $38450.44)

- Defense: Those working in the Defense industry in Washoe County make more than those working in Tourism in Washoe County ($78571.43 to $29855.86); less than those working in mining in Washoe County ($78571.43 to $91440.63); and more than those working in Logistics in Washoe County ($78571.43 to $38450.44)

- Advanced Manufacturing: Those working in the Advanced Manufacturing industry in Washoe County make more than those working in Tourism in Washoe County

Industry to Industry: Washoe	2010-2017	2017	Interpretation
Finance/Insurance vs. Tourism	355.8%	442.8%	Higher wage AND growth
Finance/Insurance vs. Mining	105.0%	144.6%	Higher wage AND growth
Finance/Insurance vs. Logistics	219.2%	343.9%	Higher wage AND growth
Finance/Insurance vs. Average	210.6%	263.5%	Higher wage AND growth
Military/Defense vs. Tourism	194.2%	263.2%	Higher wage AND growth
Military/Defense vs. Mining	57.3%	85.9%	Lower wage BUT higher growth
Military/Defense vs. Logistics	119.7%	204.3%	Higher wage AND growth
Military/Defense vs. Average	115.0%	156.6%	Higher wage AND growth
Manufacturing vs. Tourism	220.1%	205.6%	Higher wage BUT lower growth
Manufacturing vs. Mining	64.9%	67.1%	Lower wage, similar growth
Manufacturing vs. Logistics	135.6%	159.7%	Higher wage AND growth
Manufacturing vs. Average	130.3%	122.3%	Higher wage BUT lower growth

Figure 4: Earnings Comparison, Top Industries vs. Legacy Industries

($61388.67 to $29855.86); less than those working in mining in Washoe County ($61388.67 to $91440.63); and more than those working in Logistics in Washoe County ($61388.67 to $38450.44)

In 2017, the industries of interest pay significantly more than the legacy industries of tourism mining and logistics (see Figure 4). This suggests that the legacy industries may become less important to the Washoe County economy than other industries, due to low (and decreasing) relative wages. In particular, the wages of the Finance, Defense and Manufacturing industries increased significantly over time, while the legacy industries increased only marginally. The difference in the wage growth rates between newly identified top industries and legacy industries is a key piece of analysis for creating policy and programs.

To illustrate the point, this paper includes bidirectional comparisons on a selection of industries. For practical application, this same analysis could be applied to a broader list of industries, to top occupations or industry/occupation combinations, depending on the region of interest.

Clustering Industry clustering is an established practice in economic development strategy and can be useful for identifying additional opportunities to grow and diversify a regional economy. Identifying forward and backward linkages from existing industries of strength can illustrate new areas for potential growth. After conducting wage analysis to identify top industries and occupations, a traditional cluster analysis can be performed to identify additional opportunities.

To see the impact of using wage-centric analysis, we compare the use of this analysis to the use of output as a metric. If we looked only at industry output for Washoe County in 2016, it would suggest that the top industries in the county would be:

1. Wholesale trade
2. Real estate
3. Hotels and motels, including casino hotels
4. Hospitals
5. Management of companies and enterprises
6. Warehousing and storage
7. Finance/Insurance
8. Truck transportation

However, using wage as a metric to identify top industries, with consideration for wages and occupations, the top industries in 2017 would be:

1. Finance/Insurance (IND6800)
2. Manufacturing (IND800)
3. Arts, Entertainment, Recreation, Accommodations, and Food Services (IND8500)
4. Real Estate, and Rental and Leasing industry (IND7000)
5. Mining (IND300)
6. Utilities (IND500)
7. Military (IND9600)
8. Construction (IND700)

While some industries appear on both lists, there is not complete alignment. For building clusters, industries of interest can be identified through various techniques. Applying a wage-centric analysis first yields a different list of industries for focusing cluster analysis and offers a metric for measuring and prioritizing clustering strategy.

6.5 Consideration for Inequality

An important consideration to the use of wages as a key metric for economic health is the distribution of wages. Policies that increase a region's average wages by only increasing wages at the highest end of the wage range will change the distribution of wages and lead to potential negative effects.

Increasing income inequality has been linked to undesirable outcomes, such as reduced productivity and output; an OECD report from 2014 found that rising inequality in the United States from 1990 to 2010 knocked about five percentage points off cumulative GDP per capita over that period (MCingano).

Additionally, OECD finds that "The main mechanism through which inequality affects growth is by undermining education opportunities for children from poor socio-economic backgrounds, lowering social mobility and hampering skills development". Children from the bottom 40 percent of households (a huge chunk of the population) are missing out on pricey educational opportunities. That makes them less productive employees, which means lower wages, which means lower overall participation in the economy.

Also, inequality leads to crime. Specifically, larger income gaps between neighboring US neighborhoods are associated with higher levels of property crime in the neighborhoods with higher income levels (Metz and Burdina [2018]). With growing inequality in areas in close proximity, income differences create an incentive for those at the lower end of the income scale to steal from richer households.

In addition to the potential theft that increases with increased income inequality, other negative effects are shown to coincide with high income inequality, such as violent crime. Additionally, inequality is not only linked to negative health outcomes but has been shown to have causal impact on negative health outcomes (Pickett and Wilkinson [2015]). Because of the multiple negative effects of large (or increasing) income inequality, consideration for inequality in economic development policy must be included.

One way to give consideration to income inequality is by looking at the poverty status of individuals over the observed timeframe. To examine poverty status impacts, we use ACS data and its poverty score index. The ACS calculates a poverty level wage each year:

"The income cutoffs used to determine the poverty status of families and unrelated individuals include a set of 48 thresholds arranged in a two-dimensional matrix consisting of family size (from one person to nine or more persons) cross-classified by presence and number of family members under 18 years old (from no children present to eight or more children present). Unrelated individuals and two-person families were further differentiated

by age of the householder (under 65 years old and 65 years old and over). The total income of each family or unrelated individual in the sample was tested against the appropriate poverty threshold to determine the poverty status of that family or unrelated individual. The federally established poverty thresholds are revised annually to allow for changes in the cost of living as reflected in the Consumer Price Index (CPI-U). The poverty thresholds are the same for all parts of the country; they are not adjusted for regional, state, or local variations in the cost of living."

The ACS assigns each person in the survey a score based on their annual wage, as a percentage of the poverty wage level. For example, in 2010 if the poverty wage level was $20,000, someone making $10,000 would be assigned a score of 50 and someone making $100,000 would be assigned a score of 500.

Over the timeframe examined, the percentage of Washoe County that is at or below the poverty wage level has decreased slightly (from 10.19 percent to 9.41 percent), with fluctuations over time. Over that same time period, the percentage of Washoe County at the high end of the index, those making more than 500x the poverty level wage, has decreased slightly (from 33.67 percent to 33.44 percent).

If the opposite were true (an increase in both the high level and the low level), that would indicate an increase in income inequality in the region.

For the state of NV, both the high end and the low end have small percentages. This suggests that Washoe County has more income inequality than Nevada as a whole.

The poverty wage level for a single individual in 2017 is approximately $12,500. For a two-person household, it is approximately $15,900 per person; and for households with additional members, the poverty level increases roughly $4,300 per person for each additional person. This is less than the average annual income for a person earning minimum wage in

a FTE capacity.

If roughly 8 percent of the state of NV is at or below the poverty wage level and only 1.4 percent of hourly workers in NV are making minimum wage, the rest of the poverty level workers could be making more than minimum wage (either marginally more or significantly more), but not working in an FTE capacity. For example, someone working 20 hours per week at $15 per hour would earn approximately $15,600 in a year. Though their position pays more than minimum wage, the limited number of hours worked places them below the poverty threshold.

From a policy standpoint, it is important to consider not only the wage level of positions, but also the proportion of jobs in an industry (or within a company) that are FTE roles, as opposed to part-time roles.

Consideration for Gender Inequality In addition to considering income inequality, we look at the potential impact of gender inequality.

Over 2010-2017, average annual earnings for women in the US was $36,112 while average annual earnings for men was $55,052. On average, women were paid 65.6 percent of what men were paid. Over this same timeframe, the average education level for women in the US was 13.93 years of education, which is nearly half a year more than the average education level of men in the US (13.59 years of education). Though women had more education on average, they were receiving lower wages, suggesting that women were experiencing lower returns to education. In fact, women can expect to receive nearly $3000 per year less than men for every additional year of education they attain.

There are many explanations for this, several of which have been previously studied. One major explanation for this gap is the evidence that "women's jobs" are paid less than

"men's jobs" (Macpherson and Hirsch [1995]). And while there has been some change to this over time, the pay in occupations that are traditionally female is not on par with that of traditionally male jobs. So the lower average wage for women workers may be due to the underlying presence of women in traditionally female jobs that historically pay less.

In 2017, average annual earnings for women in the US was $40,401 while average annual earnings for men was $60,912. On average, women were paid 66.3 percent of what men were paid. While average wages for both men and women were higher in 2017 than the average over 2010-2017, women's wages as a percent of men's wages increased less than one percentage point.

In 2017, the average education level for women in the US was 14.07 years of education, which is more than the average education level of men in the US (13.71 years of education). Though women had more education on average, they were receiving lower wages, suggesting that women were experiencing lower returns to education. In fact, women can expect to receive more than $3000 per year less than men for every additional year of education they attain.

Looking specifically at the state of Nevada and Washoe County in 2017, there is a smaller gap between women's wages and men's wages: women earn 71.3 percent and 68.5 percent of men's wages, respectively. Comparing to the average wage ratio over 2010-2017, this represents a slight decrease in the pay gap at the state level (as women's pay increased from 71.1 percent of men's wages to 71.3 percent)and an increase in the pay gap at the county level (as women's pay decreased from 70.5 percent of men's pay to only 68.5 percent of men's pay).

If women's pay remains significantly lower than men's, it may encourage women to leave or not join the labor force. Additionally, if returns to education are lower for women than for men, it may discourage women from pursuing higher education. Neither of these outcomes is good for the overall economic health of a region, so consideration for gender

equality must be given when conducting regional economic development analysis.

For example, when looking at the top earning industries for Washoe County the ratio of women's pay to men's is not the same in each industry. In mining, military and utilities industries, women's pay is at least 79 percent of men's pay. However, in the finance industry, a top earning industry, women's pay is only 48 percent of men's pay. When looking only at those who earned more than $30,000 per year, the ratio of women's pay to men's is still only 56.4 percent.

When pursuing industries that offer high wages, consideration for industries that contribute to or mitigate gender wage gaps is important. Pursuing industries that offer high wages, but have large gender pay inequality could contribute to longer-term negative effects in the region. Therefore, evaluating the balance of gender in targeted industries, as well as the balance of wage across gender, and relating that to the population of the region of interest is important for refining economic development policy that will have positive effects on the community and a large swath of its population.

Conclusions

Based on the regression analysis and the contextualization of wage/industry analysis, it is recommended that policy and programming efforts focus on TYPE of jobs rather than NUMBER of jobs when the regional unemployment rate dips below 6.0 percent. When this happens, policies aimed at increasing income as an indicator of economic health should focus on evaluating several economic indicators at once, in a prescribed method. By evaluating the factors that lead to higher wages and pursuing the sectors that offer higher wages, a region can work to raise the average wage of the region, which has several positive benefits.

The prescribed methodology proposes the following to focus on type of job: examine returns to education for the region, isolate the industries, occupations and industry/occupation combinations that lead to highest wages; evaluate for income and gender inequality in top wage-earning roles.

- Understanding the overall estimated returns to education for Washoe County is important context for analyzing the different factors that lead to high wages. If returns to education are lower in Washoe County than in the rest of the US, there may be industries or occupations present in Washoe County that yield high wages without high education levels. Identifying those areas will be important for answering the related policy questions around wage growth.

- Compared to the average education level at minimum wage, an additional .5, 1 and 1.5 years of education could help workers achieve $20, $25 and $30 per hour, respectively. This suggests that certificates and training programs other than 4-year degrees can have a meaningful impact on increasing wages.

- To further refine the list of industries to focus on for economic development, a comparative analysis is used. Once a list of industries of interest is created, wages in each industry are compared in two directions, to understand impact and opportunities.

Using this analysis, create a list of industries and occupations that are to be prioritized,

then conduct traditional cluster analysis with these industries. Based on the "case study" done on Washoe County, using wage analysis rather than output analysis to identify top sectors for potential growth leads to a more advantageous economic development strategy.

Additional work in this area could take on an analysis of a region's skills and incorporate skills-matching as a further consideration for economic policy analysis. Identifying the existing skills within a region and hypothesizing about the transfer value of those skills into other industries or occupations could offer further insight for prioritizing job types to pursue via economic development policy.

Beyond that, additional work could also look at the potential interregional factors that could affect a region's economic health. Evaluating commute patterns and industry/occupation relationships between the region of interest and neighboring regions would offer another dimension for comparative analysis. This type of analysis could be particularly useful for growing areas where distance between metropolitan areas is shrinking and neighboring cities or counties are becoming more economically linked. Additionally, deeper analysis on the effects of urban areas, such as agglomeration of type of work or the effects of cost of living on wage comparisons, could refine this methodology and economic development strategy.

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Appendix

This appendix includes sample regression results to support the results highlighted in this paper. Additional regression analysis was conducted, including state-level analysis. Those results can be made available upon request.

Table 9: Industry, Washoe County

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
8500.indgroup	-.5475417	.1285097	-4.260704	.0000205
8700.indgroup	-.393381	.1351201	-2.911343	.0036035
4600.indgroup	-.3822335	.1291516	-2.959572	.0030849
7000.indgroup	-.0040786	.1398635	-.0291611	.9767365
0b.indgroup	0	0		
7200.indgroup	.0435862	.1294147	.3367948	.7362757
7800.indgroup	.0676012	.1280398	.52797	.597527
700.indgroup	.0704574	.1319407	.5340077	.5933432
6000.indgroup	.0981659	.1329051	.7386165	.4601501
4000.indgroup	.2056777	.1357233	1.51542	.1296847
6400.indgroup	.2216877	.1429642	1.550653	.1210036
800.indgroup	.2823326	.1310868	2.153784	.0312712
6800.indgroup	.3703228	.1363993	2.71499	.0066345
9600.indgroup	.4091179	.1986481	2.05951	.0394606
9300.indgroup	.502867	.1324889	3.79554	.0001478
500.indgroup	.8133103	.1599206	5.085712	3.70e-07
300.indgroup	.8376586	.1696936	4.9363	8.04e-07
_cons	10.17412	.1264822	80.43917	0

Table 10: Occupation, Washoe County

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
6000.occgroup	-1.573652	.2235927	-7.03803	2.02e-12
4000.occgroup	-1.558356	.042927	-36.30249	0
9500.occgroup	-1.543484	.0532943	-28.96152	0
4300.occgroup	-1.448236	.048798	-29.67815	0
4200.occgroup	-1.327597	.052437	-25.31794	0
5000.occgroup	-1.058171	.0353212	-29.95857	0
2600.occgroup	-1.018968	.0675918	-15.07533	0
4700.occgroup	-.9781325	.0378396	-25.84941	0
7700.occgroup	-.9187594	.0501476	-18.3211	0
6200.occgroup	-.8151501	.0502199	-16.23161	0
2200.occgroup	-.7997826	.0449859	-17.7785	0
2000.occgroup	-.6554512	.0792244	-8.273347	1.40e-16
9000.occgroup	-.6441582	.0544251	-11.83569	3.42e-32
3700.occgroup	-.5897031	.0615229	-9.585103	1.05e-21
9800.occgroup	-.5376688	.2235927	-2.40468	.0161973
7000.occgroup	-.5231393	.058577	-8.930798	4.65e-19
450.occgroup	-.3858248	.0632423	-6.100743	1.08e-09
1600.occgroup	-.3017758	.0863767	-3.493717	.0004776
3000.occgroup	-.279173	.0427058	-6.537117	6.45e-11
950.occgroup	-.2071742	.065095	-3.182644	.001462
750.occgroup	-.1655462	.0653879	-2.531754	.0113583
1300.occgroup	-.1582964	.0712986	-2.220189	.0264191
0b.occgroup	0	0		
2100.occgroup	.2914019	.0872026	3.341664	.0008346
_cons	10.93559	.0275464	396.9874	0

Table 11: Industry*Occupation, Washoe County

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
4000.occgroup#6400.indgroup	-3.979265	.9361178	-4.250817	.0000214
2000.occgroup#8500.indgroup	-3.302419	1.403197	-2.353497	.0186093
4300.occgroup#6400.indgroup	-3.296841	1.037721	-3.177	.0014908
9000.occgroup#500.indgroup	-2.659789	1.319026	-2.016479	.0437659
3700.occgroup#500.indgroup	-2.588308	1.229707	-2.104818	.0353221
4000.occgroup#800.indgroup	-2.49889	.8111624	-3.080629	.002069
4000.occgroup#6000.indgroup	-2.308136	1.211042	-1.90591	.056679
4300.occgroup#7000.indgroup	-2.208519	1.288129	-1.714517	.0864524
4300.occgroup#4000.indgroup	-2.068566	1.29474	-1.597669	.1101355
9000.occgroup#6400.indgroup	-1.988277	1.037721	-1.916002	.0553819
3700.occgroup#800.indgroup	-1.883712	.7288917	-2.584352	.0097646
3000.occgroup#300.indgroup	-1.662024	1.421414	-1.169276	.2423093
6200.occgroup#4600.indgroup	-1.646518	.7989976	-2.06073	.0393443
. . .				
7000.occgroup#7200.indgroup	1.100179	.8341344	1.318946	.1872051
7000.occgroup#8500.indgroup	1.131594	.8256894	1.370484	.1705541
2200.occgroup#800.indgroup	1.13616	.7201023	1.577775	.1146362
7000.occgroup#6400.indgroup	1.171445	.8453941	1.385679	.1658635
6000.occgroup#7000.indgroup	1.175003	1.155674	1.016725	.3092991
2600.occgroup#6800.indgroup	1.251855	.6752	1.854051	.0637495
7000.occgroup#4000.indgroup	1.264286	.8571447	1.474997	.1402322
7000.occgroup#7800.indgroup	1.502523	.8522229	1.763063	.0779081
7000.occgroup#6000.indgroup	1.596485	.8517731	1.874308	.0609054
9000.occgroup#9600.indgroup	1.603478	.9070025	1.767887	.0770981
7000.occgroup#9600.indgroup	1.868694	1.105009	1.691111	.0908342
2100.occgroup#8500.indgroup	1.941636	1.114254	1.742544	.0814317
_cons	10.79503	.2330798	46.31474	0

Table 12: Industry, Washoe County (2017)

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
8500.indgroup	-.6985382	.3540501	-1.972992	.0486153
4600.indgroup	-.4641774	.3566823	-1.301375	.1932596
8700.indgroup	-.388515	.3741133	-1.038496	.2991479
6000.indgroup	-.2400025	.3664619	-.6549181	.5125856
7800.indgroup	-.151418	.3526678	-.4293503	.6677083
7200.indgroup	-.101147	.3564681	-.2837476	.7766291
7000.indgroup	-.0944152	.3881564	-.2432401	.8078409
4000.indgroup	-.0888216	.3741133	-.237419	.8123528
0b.indgroup	0	0		
6400.indgroup	.0782894	.3952467	.1980773	.843002
800.indgroup	.1112864	.360954	.3083119	.7578728
700.indgroup	.1480545	.3629057	.4079695	.6833338
9300.indgroup	.2565762	.3650519	.7028485	.4822209
6800.indgroup	.3635261	.3772714	.9635666	.335364
500.indgroup	.4818292	.4240595	1.13623	.2559779
9600.indgroup	.720364	.5742801	1.254377	.2098315
300.indgroup	.8288484	.4611211	1.797464	.0723924
_cons	10.44112	.3485748	29.95376	0

Table 13: Occupation, Washoe County (2017)

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
6000.occgroup	-2.49873	.570775	-4.377784	.0000125
4000.occgroup	-1.602878	.1145043	-13.99841	0
4200.occgroup	-1.584488	.1454469	-10.89392	5.53e-27
9500.occgroup	-1.525235	.1454469	-10.48654	3.63e-25
4300.occgroup	-1.5173	.132896	-11.4172	2.08e-29
5000.occgroup	-1.129722	.0979791	-11.53023	6.04e-30
7700.occgroup	-1.042274	.1255596	-8.30103	1.73e-16
4700.occgroup	-.9871337	.1071734	-9.21062	7.07e-20
2200.occgroup	-.8593329	.1175634	-7.30953	3.68e-13
2000.occgroup	-.7883631	.2142567	-3.679526	.000239
7000.occgroup	-.7669948	.1590876	-4.821212	1.52e-06
450.occgroup	-.5839094	.1720951	-3.392945	.0007031
9000.occgroup	-.5807889	.1501316	-3.868532	.0001125
2600.occgroup	-.5371379	.1804949	-2.975917	.0029515
6200.occgroup	-.4743323	.133719	-3.547233	.0003971
1600.occgroup	-.3407882	.2433793	-1.400235	.1615774
3700.occgroup	-.3401727	.1696188	-2.005513	.0450248
1300.occgroup	-.1882018	.1789816	-1.051515	.2931324
3000.occgroup	-.1670596	.1197528	-1.395037	.1631389
750.occgroup	-.1057652	.1804949	-.5859733	.5579508
9800.occgroup	-.0755379	1.13374	-.0666271	.9468843
0b.occgroup	0	0		
950.occgroup	.0043605	.1853521	.0235254	.9812332
2100.occgroup	.1017474	.2308899	.4406751	.6594896
_cons	11.07764	.0769633	143.9341	0

Table 14: Industry*Occupation, Washoe County (2017)

	(1)	(2)	(3)	(4)
	coef	stderr	tstat	pval
4300.occgroup#6400.indgroup	-5.0792	1.274804	-3.984297	.0000698
7700.occgroup#7800.indgroup	-4.667437	.7146705	-6.530893	8.07e-11
6000.occgroup#4600.indgroup	-4.386053	1.274804	-3.440569	.0005911
2200.occgroup#8500.indgroup	-3.16271	.9874593	-3.202876	.0013797
1300.occgroup#7800.indgroup	-3.105119	1.274804	-2.435761	.0149381
4200.occgroup#8700.indgroup	-2.919166	.7648827	-3.816488	.000139
1600.occgroup#800.indgroup	-2.786716	.9874593	-2.822107	.0048131
4200.occgroup#9300.indgroup	-2.518867	.8708572	-2.892399	.00386
9500.occgroup#7200.indgroup	-2.492625	.6851868	-3.637877	.0002811
9500.occgroup#6400.indgroup	-2.373377	.9874593	-2.403519	.016319
4300.occgroup#7800.indgroup	-2.333987	.6069283	-3.845573	.0001236
. . .				
0b.occgroup#4600.indgroup	-.0291361	.6982391	-.0417279	.9667193
450.occgroup#6800.indgroup	-.0114858	.6464438	-.0177676	.9858258
1300.occgroup#700.indgroup	-.0040264	1.274804	-.0031585	.9974802
0b.occgroup#0b.indgroup	0	0		
950.occgroup#6800.indgroup	.0337849	.8708572	.038795	.9690573
1600.occgroup#300.indgroup	.0499519	.8708572	.0573594	.954264
450.occgroup#500.indgroup	.0565987	1.274804	.0443979	.9645912
450.occgroup#300.indgroup	.0974441	.9874593	.0986816	.9214
1300.occgroup#500.indgroup	.1100197	.7648827	.1438386	.8856409
2100.occgroup#7000.indgroup	.1137571	1.274804	.089235	.9289032
0b.occgroup#500.indgroup	.1886587	1.274804	.1479903	.8823637
6200.occgroup#500.indgroup	.2679081	1.274804	.2101562	.8335649
2100.occgroup#9300.indgroup	.3106304	.7648827	.4061151	.6846969
9000.occgroup#800.indgroup	.5837603	1.274804	.4579214	.6470534
9000.occgroup#6800.indgroup	.5906811	1.274804	.4633503	.6431583
2100.occgroup#6800.indgroup	.7051134	.8062571	.8745515	.3819118
0b.occgroup#300.indgroup	.9599199	.9874593	.9721109	.3311004
_cons	11.29381	.5701098	19.80988	0