Economic Impact Analysis
of
A Minimum Wage Ordinance
in the
City of Las Cruces, New Mexico

Prepared for

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EXECUTIVE SUMMARY

Economic Impact Analysis of a Minimum Wage Ordinance in the City of Las Cruces, New Mexico

Theory and Previous Studies

- Economic and management literature suggests that establishing or increasing a binding minimum wage can have both positive and negative effects. The most notable effects:
    - Positive--higher family incomes for low-skilled workers, and improved worker satisfaction that often results in increased on-the-job efficiency.
    - Negative—the potential for low-skilled jobs to be lost or for work hours to be reduced, or for various benefits to be reduced, as proprietors adjust to an increase in labor costs.

- Most empirical studies of minimum wage effects have found minimal to modest job losses, often ranging from less than -1 percent to -2 percent of low-skilled jobs.

Descriptive Analysis of Output and Employment Data

- The rate of growth of Las Cruces MSA business output (GRP) slowed in 2015 to 1.2 percent, after implementation of the first minimum wage. However, there may be no causal relationship. This type of output data was not available for 2017.

- Since 2013, the State and national unemployment rates have fallen below the Las Cruces unemployment rate. The nation's rate fell to 4.2 percent by the end of 2017, while the state's rate fell to 6 percent. The Las Cruces MSA unemployment rate has remained above 7 percent throughout the period. However, there was no discernible increase at the time of each minimum wage change.

- There were apparent changes (but not scientifically relatable to minimum wage changes) in employment in some of the low-wage occupations examined.
    - *Food Preparation:* employment growth was interrupted, or slowed/stopped, just before and after 2015Q1 and again in 2017, losing 50 to 80 employees each time compared to the number that would have been employed had growth continued unabated.
    - *Sales and Related:* employment growth turned negative for four quarters in 2015 and, after recovering some, fell again for the last three quarters of 2017. Employment in this category was then slightly below its first quarter 2014 level and about 100 workers below its 2015Q2 peak.
    - *Healthcare Support:* employment growth stagnated in 2015 and fell more noticeably by several workers through the last three quarters of 2017. *Nursing, Psychiatric and Home Health Aides*, a subcategory that represents 58 percent of *Healthcare Support*, fell noticeably for four quarters beginning in the fourth quarter of 2014 and again in 2017.

Economic Impact Analysis with REMI-DAC Simulations

- The REMI PI+ V2.1 for Doña Ana County model (hereafter, REMI-DAC) is based on historical values through 2014, is calibrated by inserting actual annual GDP from Federal Reserve Data for 2015 through 2020, and is then used to run simulations estimating output, income, and employment for the Las Cruces MSA with and without the minimum wage increases in 2015, 2017 and (expected in) 2019. The primary results of this approach to the issue for the Las Cruces MSA are the following:
    - Business output or Gross Regional Product (GRP) is less each year than it would have been without the minimum wage increases. The negative annual output impact increases each year, ranging from -$340,000 in 2016 to -$5.97 million in 2020. The total output loss over the five years is $14.09 million. This total lost output is 0.044 percent, or less than one-half of one percent, of the total baseline output of $31,805.23 million over the five years.
    - Personal income increases each year and the increase ranges from $2.24 million in 2016 to $7.08 million in 2020. The total income increase for the five years is $28.57 million.
    - Although employment increases each year due to strong growth in the economy, there are still fewer jobs available each year in the minimum wage scenario than the one without. This is as expected when the cost of a factor of production, in this case, labor, increases.
    - The jobs lost to minimum wages are numerically small in number. The comparative number of jobs lost annually range from -12 in 2016 to -154 in 2020, with a total loss of 385 jobs over the five years. That -154 in 2020 represents 1.46 percent of the 105,780 jobs available in the baseline simulation for that year.
    - The two industries accounting for the largest simulated job losses are the *Accommodation and Food Services* (-137 jobs) and *Health Care and Social Assistance* (-67 jobs) sectors.
    - The two occupations with the greatest simulated job losses are the *Food Preparation and Serving* (-125 jobs) and *Office and Administrative Support* (-38 jobs) occupations.

Final Thoughts

- Increases in the Las Cruces minimum wage have (in our graphs and simulations) increased personal income for low-wage families, while depressing business output somewhat and reducing employment marginally—even through 2020.
- Given that this is an issue about which different groups feel very passionately, ***Hibbs Institute*** researchers believe this report contains statistics and arguments for all sides. We have been as carefully and deliberately independent and unbiased as possible.
- ***Hibbs Institute*** researchers can lay out the facts as we determine them, but policymakers must weigh these facts and make their own decisions about whether to go ahead with future minimum wage increases as planned or not.
- We add lastly that it is important to consider long-run alternatives to redistribution, which has its place, alternatives such as an even more fierce promotion of education that brings positive social change, attracts higher-paying industries and strongly encourages free people to work in friendly competition with firms large and small across the world. As Bill Gates recently said, it is not true that the rich are getting richer and the poor are getting poorer. He notes that in just 25 years, astonishingly, China's poverty rate has fallen from 60 percent of its citizens to 10 percent. He points to a similar transformation taking place in Brazil and even more countries. He notes that central in these transformations is reliance on markets, belief in education and the desire to compete.

Economic Impact Analysis of a Minimum Wage Ordinance in The City of Las Cruces, New Mexico

Introduction

The City of Las Cruces, New Mexico, contracted with The University of Texas at Tyler ***Hibbs Institute for Business and Economic Research*** to conduct an independent analysis of the economic impact of changes in the City's legal minimum wage. The ***Hibbs Institute*** is a research unit of the University's Soules College of Business.

Specifically, the ***Hibbs Institute*** was asked—in addition to providing a general economic perspective—to use descriptive statistics and sophisticated economic impact modeling and econometrics to determine the likely economic effects of past and proposed future increases in the City's minimum wage on important economic variables such as employment and output.[1] Employment effects on low-wage workers citywide and in selected vulnerable occupations, as well as output effects on businesses in the City resulting from minimum wage increases, are of considerable interest to the citizens and policymakers of Las Cruces.

The ***Hibbs Institute*** recognizes that the topic of minimum wages can be a sensitive one, and takes its role as an independent, professional research organization seriously. The research team entered this work with no preconceived notions of whether the specific past increases in the minimum wage in Las Cruces were beneficial overall or had negative consequences overall. Given available data and instructions included in the scope of work, the research team worked diligently to discover whatever effects may have resulted from the City's changes in their minimum wage requirements, positive or negative. Researchers were careful to remain neutral and let the numbers speak for themselves.[2]

Further, while the economics and business development division of the City of Las Cruces was very helpful in providing necessary information as needed, the data collected and reported here, the statistical methodology used and the conclusions are entirely those of the ***Hibbs Institute***.

The research team presents data in charts and tables, along with more than one type of economic analysis to determine how increases in the City's minimum wage at the beginning of 2015 and 2017 affected workers and businesses in the City and Doña Ana County. Researchers also make projections regarding potential impacts to be expected from a third minimum wage increase planned by the City in 2019. Researchers

[1] The City of Las Cruces, New Mexico announced a new minimum wage ordinance effective January 1, 2015. Employers covered by the ordinance are required to pay a minimum wage rate of $8.40 per hour in 2015. The Las Cruces minimum wage rate will increase in stages to $10.10 by 2019. The initial rate of $8.40 per hour remains in effect until 2017 when the rate increases to $9.20 per hour before achieving the $10.10 per hour rate in 2019.

[2] ***Hibbs Institute*** researchers sought to determine the economic effects of the City's minimum wage decisions, leaving normative interpretations of the importance, or value, of those discovered effects to others. The same is true for the researchers' estimates of the likely impacts for the planned 2019 minimum wage increase—we do not say whether it will be god or bad, but concentrate on expected effects. We do, however, laud the City's desire to learn more about the economic effects of their decisions by commissioning this independent study.

examine economic data that focuses primarily on employment and unemployment statistics, labor income, and overall business output by industry and for the City or County.

This report is organized into six parts:

- Economic theory and minimum wages
- Literature review
- Descriptive statistical analysis of regional employment effects
- Economic impact simulations using a REMI PI+ model
- Econometric analysis
- Conclusions

Economic Theory and Minimum Wages

A minimum wage serves as a wage floor, which is intended to benefit workers at the lowest end of the income spectrum by raising the hourly wage rate and the annual incomes of those who receive the higher wage.

Basic economic theory with respect to these laws is well-established and most of that theory focuses on the microeconomic hiring responses of individual firms that employ low-wage labor when they face higher production costs resulting from minimum wage increases.

With respect to employment, increasing wage rates for low-skilled workers above the unregulated market rate so that it is effective, or "binding," has several outcomes, both positive and negative when judged relative to the desired purpose of the increase.

Positive Effects of Minimum Wages

The most important positive effect of a minimum wage for most low-wage workers is an increase in their wage rate and a concomitant increase in annual incomes for those workers. Other potentially positive outcomes are often mentioned in the management literature. Many management studies show that there is a positive relationship between higher incomes and increased productivity.[3]

Clearly, though, wage rates and income are major components of job satisfaction. Minimum wage increases should create more job satisfaction among workers who receive the higher rate. Management researchers also note that increases in wage rates, and resulting total worker income, positively affect variables such as organizational commitment and job involvement. With higher pay, workers may feel more important to the organization and may, therefore, become more committed to their jobs, more energetic in the production process and the more positive and enthusiastic in the way they treat customers.

Workers who have a higher commitment to the firm often exhibit reduced absenteeism and lower rates of turnover.[4] There are discussions of better social outcomes among workers receiving a higher wage rate, with better family situations, more students attending school and even less crime.

[3] For many economists, the first problem with such studies is that they often beg the question of which occurred first, i.e., the "chicken-or-egg" question. It is likely that workers in specific instances are paid more as a result of higher productivity—something economic theory predicts rather well in competitive markets—rather than productivity increasing substantially as a result of increased wages. The second problem is that if there is a productivity gain from arbitrarily increased wages, it must be smaller than the value of the wages. It is rather easy to posit that if any observed increase in productivity more than pays for the increased wages, it would already be in proprietors' interest to raise wage rates continuously.

The conclusion has to be that the proprietor has already sought and received all (certainly most) productivity gains available from increasing wage rates. Legally binding minimum wage increases beyond that natural, fully incentivized equilibrium wage rate must be nominal and cannot, in a competitive market, be offset by resulting increases in worker productivity by more satisfied workers.

[4] Robbins, S. & Judge, T. Organizational Behavior, 17th. ed., 2017, pp. 76-92, 258-259.

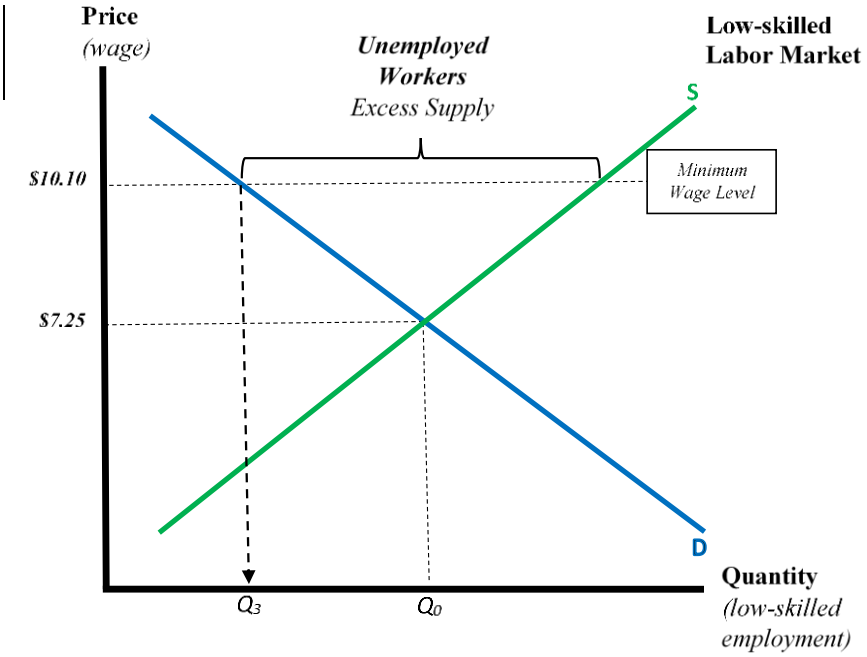
Negative Effects of Minimum Wages

The negative outcomes resulting from increasing minimum wage rates above what the normal, or equilibrium, wage rate would be are both well-known and more complex than would seem to be the case at first glance. Setting a minimum wage or increasing it, all else the same (including hiring the same number of workers), increases the cost of labor, one of the important factors of production. That increase in factor cost causes firms to take one or more actions to deal with it. They might raise product price, passing the increased labor cost to customers; but, economists know that in competitive markets, raising price is not possible without losing sales and revenue. The simplest answer, and the one most discussed is that firms lay off some of their low-wage workers as they respond to higher labor costs. Some firms do this immediately, but many may require some amount of time to reduce labor costs by substituting capital.

The figure below illustrates what happens in response to a minimum wage increase in simple, competitive markets—in this case for low-skilled workers (**Figure 1**). The hourly minimum legal wage rate is increased from $7.25 to $10.10. The number of workers hired in the market falls from Q_0 to Q_3 because the number hired is determined by, or "read off of," the demand curve and measured along the horizontal quantity axis. There are several consequences to note from this figure:

- The workers who retain their jobs are earning more than before,
- The workers who retain their jobs may, or may not, earn total income as a group that is larger than the entire employed group earned at the old wage before the minimum wage increase. The employed workers as a group now receive a total income equal to Q_3 x $10.10. For that amount to be larger than the old amount of income, Q_0 x $7.25, the percentage increase in the minimum wage rate would have to have been larger than the percentage decrease in the number of workers employed.

Figure 1.
Minimum Wage Effects



Source: Hibbs Institute.

Firms have many more "levers" to use besides direct layoffs when the market wage is forced upward. They may keep the same number of workers, or reduce only a few. Or, they may respond by reducing the number of total hours worked each week by their hourly employees, or by eliminating overtime opportunities. Workers may continue to be able to work at the higher minimum wage rate, but have their benefits (e.g., vacation leave, personal and sick leave, even their health care) reduced or eliminated for the firm to recoup some of their higher labor costs from the higher minimum wage.

Of course, proprietors' income or profits may be reduced, despite efforts of firms to control labor costs, and this shift in income from owners to employees is exactly what many observers wish to see. However, to keep their income up in the longer term, proprietors may also reduce repairs and maintenance, put off capital improvements, ax a planned expansion, or begin making plans to move outside the minimum wage jurisdiction.

Since large stockholder-owned firms are really owned mostly by pensioners and 401k and IRA savers, those owners-at-a-distance may see a reduction in dividends, stock prices and overall returns to retirement portfolios—however slight—as a result of the actions of several jurisdictions raising minimum wages. These company-wide, labor market and even national responses may happen fairly rapidly, or over a period of time, depending on several factors, such as the type of industry involved, the size of the minimum wage increases, and myriad other factors, such as the elasticity of supply and demand in a given labor market and any given product market.

There are many theoretical and empirical research papers that approach the employment consequences of implementing binding minimum wage laws from the point of view of estimating the elasticity of demand for that type of labor versus its elasticity of supply. If low-skilled labor demand is highly inelastic, or unchanging because there are few substitutes for it, then (by definition) the wage rate can be raised with little or no reduction in employment. However, most economists believe it is unskilled labor that is most susceptible to being replaced, in part at least, with capital, or machines. Similarly, if the supply of a certain kind of labor happens to be highly inelastic, then again the wage rate can be raised with no negative employment consequences. However, this lack-of-large-supply is rarely the case with low-skilled labor. While ***Hibbs Institute*** researchers were not asked to look into labor elasticity in this study—mostly because there was insufficient time to do so—some research on this topic is included in **Appendix A. Elasticity of Demand for Low-Skilled Labor** (p. 37)**.**

Positive and negative effects make the analysis of minimum wage laws and rate increases exceedingly complex. This report cannot address the possible factors involved in the time and resources made available. Thus, the ***Hibbs Institute*** will focus on the questions that most governing authorities and their constituents ask:

- "When the minimum wage is increased, do some low-wage workers in Las Cruces lose their jobs?
- If yes, "Is this a large number or a small number of workers?"
- "What industries hire low-wage workers and are most likely to be affected?"
- "Does the total income paid to low-wage workers increase or decrease?"

- Does the total output of these industries that use low-wage workers, and all industries together in the Las Cruces MSA, increase or decrease? How much?"

One further reminder: neither economists nor ***Hibbs Institute*** researchers can answer whether the good fortune of workers who receive higher wages and retain their jobs after a minimum wage increase "outweighs" the misfortune of those who lose their jobs, work fewer hours per week, or lose certain benefits. Such an inference is a normative conclusion. Policymakers and city leaders must make their own judgments.

Hibbs Institute researchers can, however, help policymakers make decisions by shedding light on the economic effects and the relative sizes of those effects on different employees, including estimating job losses compared to labor income gains.

Other Theoretical Issues with Increasing Minimum Wage Rates

Hibbs Institute researchers found two basic areas of economic theory often ignored by minimum wage studies. First, any effective minimum wage redistributes income. Indeed, that is sometimes the stated purpose of such laws. What is seldom considered, though, is whether this market intervention is the best way to redistribute income to low-skilled workers in either the short run or long run. There may be alternative ways to make more income available to these low-wage workers in the long run with redistribution of a different kind in the short run—education and training—such that no redistributive intervention is needed in the long run.

To make the first point regarding redistribution clear, one could imagine that policymakers would not endorse having only one group of consumers be the primary group redistributing income to another group. For example, if hospital service workers—those who clean rooms, hallways and operating theaters, and prepare thousands of meals daily—were given higher wages through a minimum wage at the expense of the sick in the form of higher health costs, many policymakers might look for alternatives. The same might be true for a tourism-based city if a given minimum wage increase were to transfer income from travelers to workers in the form of higher room prices. In both instances, policymakers might prefer using tax policy to redistribute income (in the form of educational services, if not direct payments) to low-skilled workers with less disruption of the market. In the latter case, this could entail taking some other approach to the problem of low wages in order to avoid reducing tourist visits, the life-blood of some cities.

With respect to the second point, whether minimum wage laws are the best way to increase incomes for low-skilled workers in the long run, consideration is required of the effects of minimum wage increases on long-run output and income in the area. Most papers on minimum wage laws reviewed by ***Hibbs*** researchers ignored the lost output in the local region resulting from the higher production costs created by the increased minimum wage. Unequivocally, higher production costs result when minimum wages are increased. Just as unequivocally, higher production costs reduce regional output and equivalent regional income, below what

they would otherwise be, with all other conditions the same. Stated another way, reduced regional output and income means that the region is slightly poorer than it would otherwise be, again all else the same.[5]

Following an earlier example, with a given increase in the minimum wage, fewer motel rooms would be rented and fewer built over time, along with fewer meals served, less gasoline bought and fewer movies attended, with all else the same. This reduced output is often hard to pinpoint or calculate when an area is experiencing overall economic growth induced by other factors, such as a booming national economy or rising area demand for goods and services resulting, perhaps, from population growth. But, it is still true that the local economy would have been larger still, were it not for economic drag imposed by binding minimum wage rates. In the long run, increasing minimum wage rates reduces income and tends to make the income pie that is being redistributed, smaller.

This reduced total output and income—or drag on rising income in a growing economy—should, perhaps, cause policymakers to look at possible alternative measures to improve incomes for low-paid workers. One is to raise the productivity of these workers in the long run by increasing education and skills training. Since labor demand is always a derived demand that depends on the strength of the demand for the actual product, another way to increase wages and salaries all along the spectrum is to seek higher value industries that can then pay all workers, including low-skilled ones, more.

Clearly, increases in minimum wages have their pluses, chiefly in quickly redistributing income to the majority of unskilled workers. The downside is that some other unskilled workers must often pay for these increases. They do so in the form of lost jobs and/or lower hours. And, in the long run, capital expansion is reduced compared to what it would have been without minimum wages, and output and jobs are reduced further. Alternatively, if the demand for those workers is somewhat inelastic, then consumers and other factors of production (including proprietors) bear most of the burden of redistribution through higher prices and lower profits.

Economic theory suggests that direct redistribution through tax policy that can better target those who need income support benefits. And, tax policy can better target the individuals and companies who need to pay for such extra benefits for low-wage earners. Such direct redistribution policies might be superior to increasing minimum wages in an effort to making low-skilled workers better off without disturbing market forces.

[5] Many are willing to sacrifice income for all, usually in the form of reducing economic growth, to help make a few better off. That is quite alright or rational. But, policy makers should consider whether a non-reduced, or naturally higher growth rate, might make low-skilled workers better off in the long run, as well as everyone else. Again, this is an empirical question that could be examined, but is beyond the scope of this study.

Summary of Economic Theory and Minimum Wage Rates

When a minimum wage rate is increased, there are always winners and losers.

- Most workers retain their jobs at the higher wage rate and will have higher incomes and be better off.
- Some workers may lose their full-time jobs (be laid off) and be worse off.
- Most, some, or all workers may lose overtime opportunities, may be required to work reduced hours, or be changed to part-time status altogether and be worse off.
- Most, some, or all workers may lose in-kind pay, such as losing benefits like health care insurance, vacation days, sick pay, or may face greater cost-sharing for such benefits.

b. A minimum wage increase often creates a surplus of unskilled labor or adds to the existing surplus. This higher wage, if not universal in the greater region, will likely increase the existing surplus by drawing additional unskilled labor to the market from nearby areas where the wage rate is now relatively lower. These additional unemployed people, besides adding their own disappointment to that of the current unemployed group, may begin to pose a problem for the area.

c. When wage rates are in the lower half of the low-skilled labor demand curve (the inelastic region) one can expect the income gains from the increased minimum wage to be larger than the income losses experienced by those who lose their jobs (or have hours curtailed), and total unskilled labor income increases.

d. When wage rates are in the upper half of the low-skilled labor demand curve (the elastic region), one expects the income gains by the winners to be smaller than the income losses incurred by those who lose their jobs, and total income going to unskilled labor decreases.

e. While minimum wage increases help most low-skilled workers and are quick, policymakers may want to consider whether targeted tax policies might be a fairer and more efficient alternative to increases in minimum wages, the burden of which may fall on subgroups differentially.

f. For the longer-term, policymakers may want to consider market-oriented solutions to the income problem for low-skilled workers by increasing their skills through education and training, and by encouraging market forces to increase economic growth, and thereby, increase incomes for all groups.

Other than noting that there are legitimate distribution and market efficiency issues rooted in economic theory, the ***Hibbs Institute*** does not address these issues directly in this report.

Literature Review

The literature on minimum wage increases is varied. Different authors have discussed the minimum wage change from different perspectives, both economic and political. From an economic perspective, the increased income that the large majority of workers receive has several suggested benefits. Most authors note that increases in minimum wage usually add more to personal income than they subtract, helping to protect or promote consumption by households. But, they also note that, in the short run, such higher minimum wages also raise operating costs, thus reducing employment by some amount.

In the medium to longer term, increased minimum wages deter expansion of existing businesses and serve as an obstacle to new firms locating within the region covered by the minimum wage law. That reluctance to expand and locate in an area reduces employment in the long run, relative to what it would have been without the wage increases. In addition, higher minimums attract even more unskilled labor looking for work, pushing up the pool of unemployed workers and raising unemployment rates even higher than they otherwise would be for that area. Encouraging even more unskilled labor to an area with an existing surplus also invites additional social unhappiness, but deters business expansions by increasing operating costs, thus reducing employment.

The methodologies used to model minimum wage increases are also varied. Some authors use econometric statistical models to explore the effects of the changes in minimum wages, while others employ input-output models to explore possible effects of minimum wage increases in a local area.

Brown, Gilroy, and Kohen[6] studied evidence of the effect of minimum wages on youth employment. They use time-series data for employment of different groups and develop an econometric model to examine the effects of minimum wage increases on employment and unemployment rates for teenagers of different ethnic groups. Their results indicate that a 10 percent increase in the minimum wage would tend to reduce teenage employment by 1 to 3 percent.

This same question has been studied for specific industry sectors that many researchers believe are most likely to be affected by minimum wage increases, specifically food preparation and retail trade industries. Card and Krueger[7] studied the effects of changes in minimum wage and employment on the fast-food industry in New Jersey and Pennsylvania, while Kim and Taylor[8] researched similar effects in the retail trade industry in California. Card and Krueger utilized survey data to explore the changes in employment by establishment before and after increases in minimum wages. They found that stores that were unaffected by the minimum wage ordinance (relatively high paying wages) had equivalent employment growth as stores that had to

[6] Brown, C. C., Gilroy, C., & Kohen, A. I. (1981). "Time-series Evidence of the Effect of the Minimum Wage on Youth Employment and Unemployment." National Bureau of Economic Research Working Paper Series. No. 790.

[7] Card, D., & Krueger, A. B. (1993). "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania." National Bureau of Economic Research Working Paper Series. No. 4509.

[8] Kim, T., & Taylor, L. J. (1995). "The Employment Effect in Retail Trade of California's 1988 Minimum Wage Increase." Journal of Business & Economic Statistics, 13(2), 175-182.

increase their wages. These empirical findings challenge the conventional wisdom that increases in minimum wages reduce employment. On the other hand, their econometric technique, relying on dummy variables, was not a robust one. Conversely, Kim and Taylor's results suggest that increases in minimum wage rates do reduce employment, especially if the labor market is particularly competitive.

More on point, minimum wage studies have been conducted with respect to cities in New Mexico in the past. Nicholas Potter[9] and Justin B. Hollis[10] studied the Santa Fe living wage ordinance passed in June 2004. Both studies utilize a common methodology, the difference-in-differences regression analysis with the City of Santa Fe as the treatment group and the City of Albuquerque as the control group. While Potter uses employment and wage data of local establishments in specific industries (retail trade, construction, and healthcare), Hollis utilizes employment and wage data of low-paid occupations via percentile levels. Potter finds no statistically significant difference in employment due to the minimum wage ordinance in Santa Fe for retail trade and health care, but he does find a loss in employment in the construction industry. Hollis concludes that low-wage workers received higher minimum wages without significant loss in employment. However, Hollis points out that many businesses were already paying higher than minimum wage salaries to their low-wage employees, so that particular law was ineffective, as then was the study.

Economic effects, such as employment changes, derived from a minimum wage increase, are difficult to capture via econometric and regression analyses. The lack of an effective variable that measures changes in employment related to minimum wage increases, as well as the copious number of factors that can impact employment in a local area, limits the reach of econometric and regression analysis models. Hence, other type of modeling techniques have been employed recently such as Input-Output (I-O) and Computable General Equilibrium (CGE) models.

In 2014, Fuller, Bedsole, and Nystrom[11] explored the effects of minimum wage increases for the State of Maryland. The study focuses on the changes that the State of Maryland put in place, raising the minimum wage from $7.25 in step increases to $9.00, $10.00, and $12.00. The authors use a robust and comprehensive software model that can be used to estimate economic effects derived from demographic, economic or policy changes in a local area, REMI PI+. Fuller, Bedsole and Nystrom's model projected that the minimum wage increases resulted in an increased price for consumer goods, reduction in employment, and a weakening in Maryland's competitive position compared to adjacent states.

[9] Potter, N. (2006). "Measuring the Employment Impacts of the Living Wage Ordinance in Santa Fe, New Mexico." University of New Mexico, Bureau of Business and Economic Research.

[10] Hollis, J. B. (2015). "Santa Fe, New Mexico's Living Wage Ordinance and Its Effects on the Employment and Wages of Workers in Low-Wage Occupations. University of New Mexico, Albuquerque, New Mexico.

[11] Fuller, S. S., Bedsole, P., & Nystrom, S. (2014). "The Impact of Raising the Minimum Wage on the Maryland Economy". Regional Economic Models, Inc, 20-21.

Pete Walley[12] also employs REMI PI+ to explore the effect of periodic minimum wage increases on employment in Mississippi. His modeling effort led him to conclude that increases in minimum wages would result in loss of employment for the State of Mississippi. Walley estimates a loss of 1,766 jobs initially (in 2014) and rising to 9,139 by 2028.

The current ***Hibbs Institute*** study first conducts an overview of the economy of Las Cruces via a simple descriptive analysis of relevant economic indicators such as Gross Regional Product (GRP), personal income, employment figures, and unemployment rates. Employment data are reviewed both by industry sector and by occupations.

Next, ***Hibbs*** researchers employ two significant, theoretical approaches for exploring the economic impacts of minimum wage increases on economic variables for Las Cruces. First, the REMI PI+ model is used to examine—using simulations of the local economy with and without minimum wage changes—potential economic impacts of changes in minimum wage rate changes on Las Cruces and Doña Ana County. Finally, an econometric model is used to examine changes in employment of some targeted occupations, mainly those occupations that employ a relatively higher percentage of low-wage workers.

[12] Walley, P. (2014). "Raising the Minimum Wage in Mississippi: An Econometric Analysis. Mississippi Public Universities, University Research Center.

Descriptive Analysis

We begin our analysis with a presentation of output, employment and other industry data in tables and charts in order to reveal simple changes in trends, if any, with respect to any of these economic measures or "metrics" before and after citywide minimum wage rates changed in 2015 and in 2017 when that more recent data is available. The purpose of these graphical representations of the data is to determine whether the minimum wage changes in Las Cruces affected local labor markets in obvious or noticeable ways.

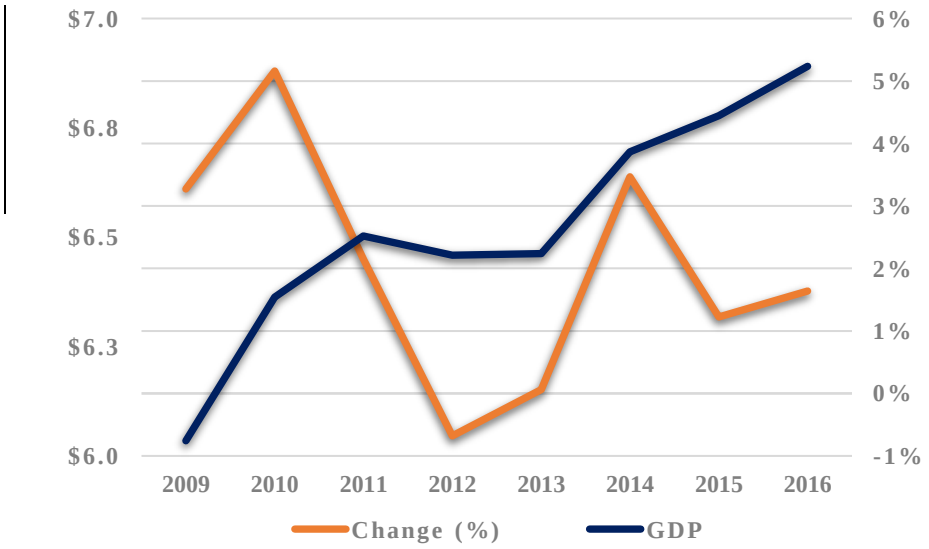
This less-sophisticated part of our analysis may very well reveal useful conclusions on its own. However, researchers and readers must be ever-vigilant against drawing definitive conclusions (or not drawing any conclusions) from looking at simple variations in data over time. There may be no cause and effect relationship at all, or the opposite could be true. There may be some actual causality that cannot be seen because it is covered up by strong effects from changes in another variable. Nevertheless, viewed carefully and with a good measure of caution, examination of the basic data can help inform researchers' choices of data and methods when moving on to more complicated econometric analysis techniques—sophisticated techniques employed to bring out actual economic impacts hidden among larger drivers like, for example, strong growth in the same period that might be part of, or the result of, an independent national economic rebound.

Hibbs researchers focus primarily on four low-wage occupation categories and their subcategories that have substantial low-wage employees. These occupation categories are *Food Preparation and Serving Related Occupations*, *Building and Grounds Cleaning and Maintenance Occupations*, *Sales and Related Occupations*, and *Healthcare Service Occupations*. Minimum wage increases are most likely to have an effect in these low-wage occupations.

Gross Regional Product

Gross Regional Product (GRP) is the total value of goods and services produced by a region. In 2016, the latest year for data of this type, total GRP in the Las Cruces MSA was $6.9 billion (**Figure 2**). The rate of growth of GRP for the Las Cruces MSA was slightly lower for 2015, the year in which the first minimum wage increase was introduced, compared to the prior year and the succeeding year. That is, in 2015 GRP grew 1.2 percent, compared to 3.2 percent in 2014 and a still-subdued growth of 1.6 percent in 2016. We caution against drawing any definitive conclusions from this sequence of Las Cruces MSA output growth, but the pattern is at least instructive—that perhaps the increase in the minimum wage suppressed output growth by half.

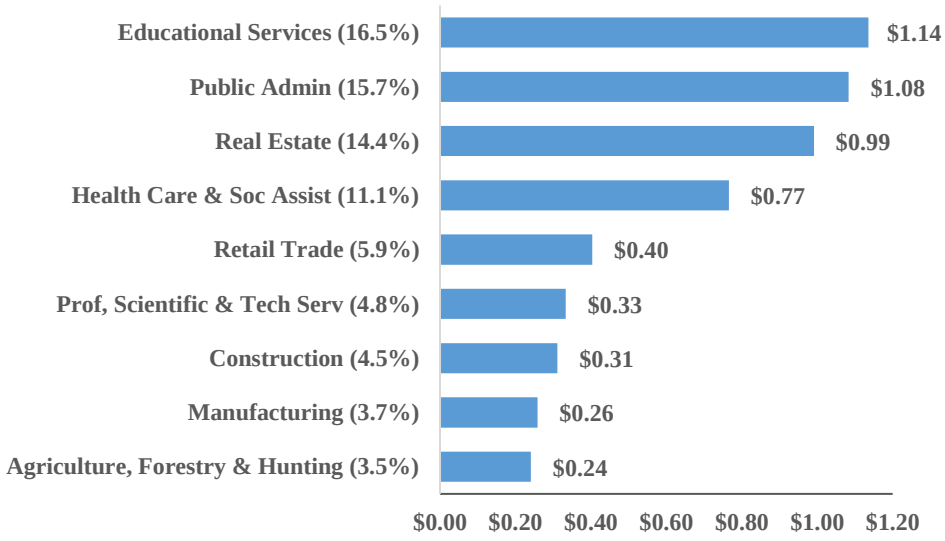
Figure 2.
Gross Regional Product
GRP In billions (left),
Percent change (right)



Source: Bureau of Economic Analysis (BEA).

Breaking down Gross Regional Product by industry sector for the Las Cruces MSA, *Educational Services* was the largest sector, contributing $1.14 billion, or 16.5 percent of total output (**Figure 3**). The next three largest industry sectors were *Public Administration* with $1.08 billion (15.7% share), *Real Estate* with almost $1 billion (14.4% share) and *Health Care & Social Services* at 0.77 billion (11.1% share). The nine largest industries in the Las Cruces MSA, shown below, together contribute about 80 percent of the region's total economic output.

Figure 3.
Gross Regional Product,
by Industry
GRP in billions, 2016 data
Nine largest industries

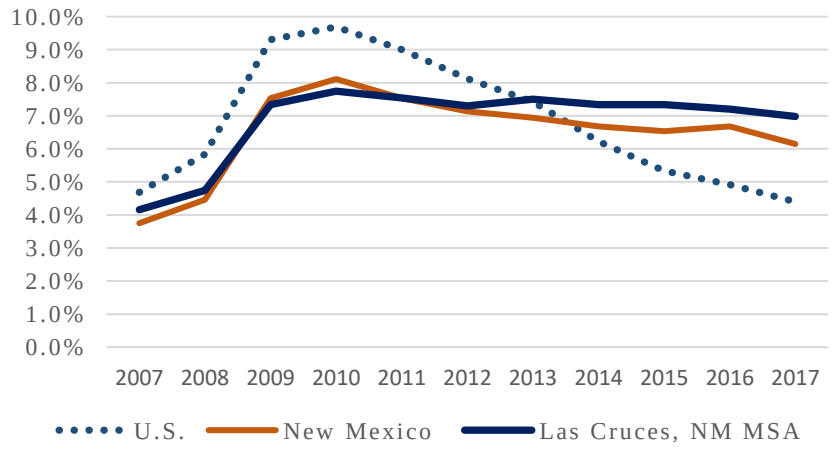


Note: 2016 Figures. Numbers in parentheses represent share of industry GRP; numbers may not add to 100 due to rounding.
Source: Bureau of Economic Analysis (BEA).

Unemployment Rate

The unemployment rate in the Las Cruces MSA has decreased since the recession period of 2008-10 when it peaked near 8 percent, weathering the downturn better than either the nation or New Mexico (**Figure 4**). From 2013 onward, however, the Las Cruces MSA's unemployment rate stagnated and remained higher than the State and national rates. Having noted the high rate, there is no indication in the figure that the Las Cruces MSA unemployment rate was affected visibly by the first minimum wage increase in 2015. The Las Cruces MSA unemployment rate has steadily declined by a small amount from the middle 7 percent to low 7 percent range from 2013 through 2017. Preliminary figures show rates under 7 percent during the first two months of 2018.

Figure 4.
Unemployment Rates

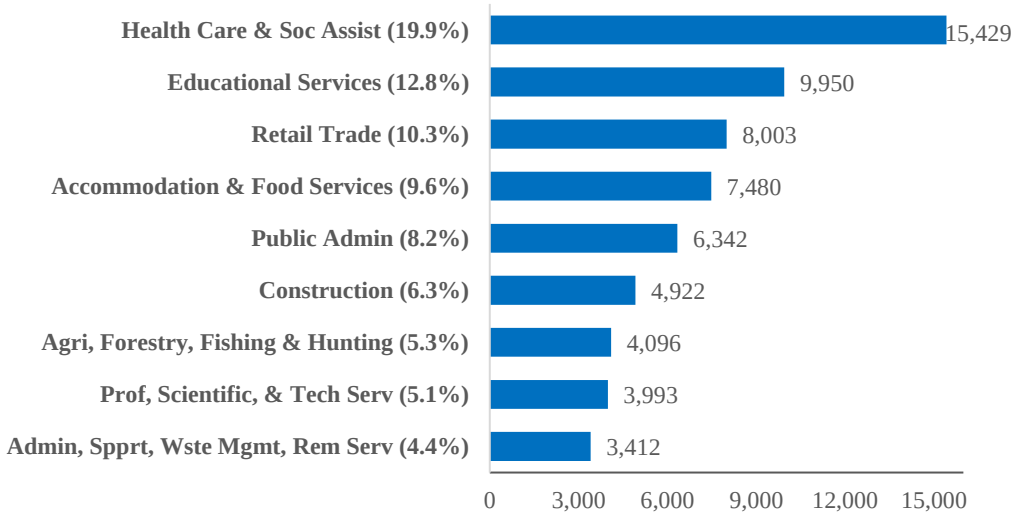


Source: Bureau of Labor Statistics (BLS).

Employment

The largest business sector providing employment in the Las Cruces MSA is *Health Care and Social Assistance*, employing 15,429 workers in 2016, or 19.9 percent of total employment (**Figure 5**). The next three largest sectors are *Educational Services* with 9,950 workers (12.8% share), *Retail Trade* with 8,003 workers (10.3%), and *Accommodation and Food Services* with 7,480 workers (9.6%). The nine largest industries in the Las Cruces MSA, shown below, account for 80 percent or more of total employment in the MSA.

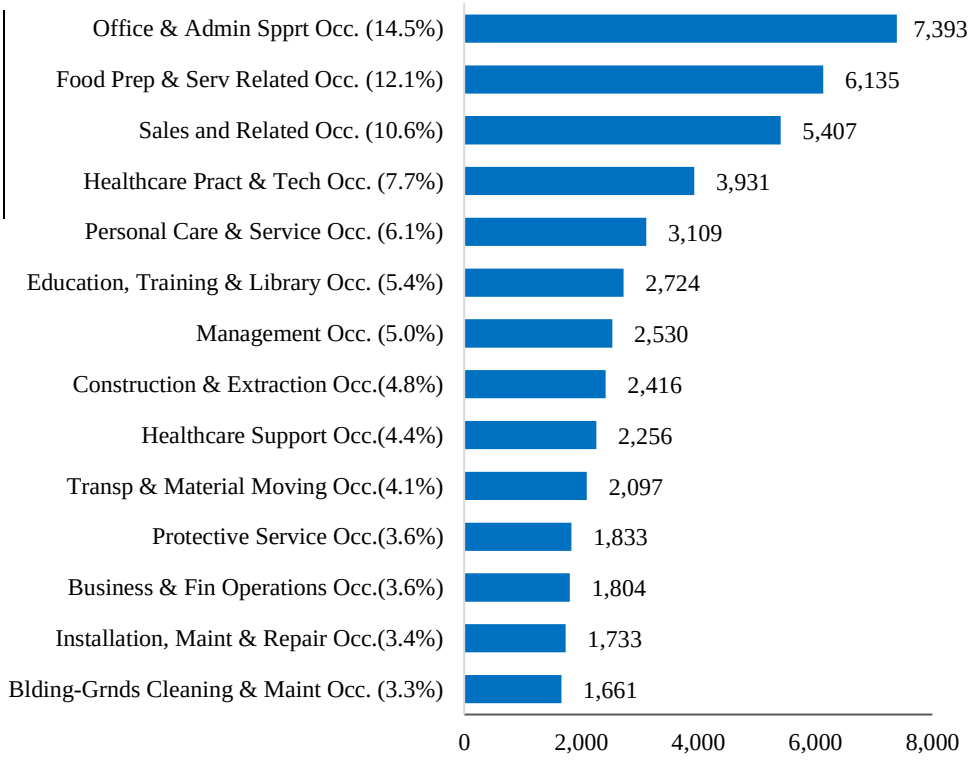
Figure 5.
Industry Employment
(Nine largest industries)



Note: 2016 Figures. Numbers in parentheses represent share of industry employment; numbers may not add to 100 due to rounding.
Source: Bureau of Economic Analysis (BEA).

The largest occupation type—crossing all industry sectors—in the Las Cruces MSA is the *Office and Administrative Support Occupations* category in which 7,393 employees worked in 2017 or 14.5 percent of total employment in the MSA (**Figure 6**). The next three largest occupations are *Food Preparation and Serving Related Occupations* with 6,135 workers (12.1%), *Sales and Related Occupations* with 5,407 workers (10.6%), and *Healthcare Practitioners and Technical Occupations* with 3,931 workers (7.7%). The fourteen largest occupational categories in the Las Cruces MSA are shown below in **Figure 6**. Together, they account for more than 85 percent of total employment in the MSA.

Figure 6.
Occupation Employment
(Fourteen largest occupations)



Note: 2017 figures. Numbers in parentheses represent share of occupation employment; numbers may not add up due to rounding.
Source: Bureau of Labor Statistics (BLS).

Selected Low-Wage Occupations (Most Potential to be Affected by a Minimum Wage Increase)

The ***Hibbs Institute*** research team examined specific categories of low-wage occupations and subcategories that might be more likely to be affected by the minimum wage ordinance. These low-wage jobs require little or no formal skills and also draw a large supply of potential workers. Employment and salary data for 2016, the most recent available, for the occupations requested by the City are shown in **Table 1**. The listed major SOC occupation classifications are these.

- 31-0000 *Healthcare Support Occupations*,
- 35-0000 *Food Preparation and Serving Related Occupations*,
- 37-0000 *Building and Grounds Cleaning and Maintenance Occupations*, and
- 41-0000 *Sales and Related Occupations*.

For discussion in this section, we assume that the detailed national data in **Table 1** regarding salary breakdowns around the median (lowest 10 percent, 25 percent, etc.) applies reasonably well to Las Cruces. Given that assumption, **Table 1** shows the 2016 median income for each of the large low-wage categories listed, and further, for every one of the sub-category occupations, too.

Note that workers in all occupation categories earn more than the federally required minimum wage rate of $7.25 per hour, or $14,500 annually.[13] Thus, with all categories of the median annual wages well above the minimum wage in 2016, there was little likelihood that increasing the citywide minimum wage in 2015 to $8.40, or $16,800 annually, impacted many workers.[14] Only workers in low-wage occupations that were also on the low end of the scale within their occupation type—receiving wages below the median—could have been affected by the first increase implemented by Las Cruces.

Considering the bottom 10 percent of wage earners in each occupation, rather than median incomes, the 2016 data in **Table 1** appear to show that only the very lowest earners in six of these potentially vulnerable occupations could have been affected by the 2015 minimum wage increase. Employees in the bottom 10th percentile in SOC subcategory 35-3000, *Food and Beverage Serving Workers* commanded only $16,500, which is less than the $8.40 hourly/$16,800 annual wage in 2016.[15] Employees in the lowest 10 percent of earners in subcategory 35-9000, *Other Food Preparation and Serving Related Workers*, at $16,600 annually, also earned below the new minimum $8.40 hourly/$16,800 annual rate. Two other occupational subcategories earned exactly $16,800, the minimum amount. These were 37-2000 *Building Cleaning and Pest Control*, and 31-1000 *Nursing, Psychiatric and Home Health Aides*. And, still, two other subcategories earned only slightly more than the minimum, both $16,900. These were 35-2000 *Cooks and Food Preparation Workers*, and 41-200 *Retail Sales Workers*.

Workers in the bottom earnings decile in these occupational subcategories were very likely affected by the minimum wage increase in 2015. To determine how many workers were affected in a positive way as their earnings increased and how many were affected negatively by, perhaps, losing their jobs requires further investigation. It is possible to say that the group of workers affected represent a small portion of the entire set of low-wage workers in Las Cruces because they represent the workers in the bottom 10 percent of earners in their respective occupations. Still, the four large SOC categories from which these occupations were drawn represented 30.4 percent of all occupations in the Las Cruces MSA, or 15,460 employees overall. Even 10 percent of these would still be more than 1,500 employees. What this cursory look at the raw data does not tell us is how many of these lowest-wage employees were helped by the minimum wage increase compared to the ones who might have been harmed by job loss.

Looking at the 2016 data in **Table 1** as information to help us understand what might happen as a result of the 2017 second minimum wage increase, more considerations come to light. At the new $9.20 per hour or $18,400 minimum annual earnings, the 2016 data show that a larger number of these occupations, and the

[13] $14,500 annual income = $7.25 per hour x 2000 hours annually.

[14] $16,800 annual income = $8.40 per hour x 2000 hours annually.

[15] Of course, many, if not most, food service workers also receive tips which would make their incomes higher than that indicated solely on the basis of hourly wage.

workers earning in the lower ranges within these occupations, would be able to benefit from the wage increase and possibly be affected negatively, too.

For subcategory 35-9000, *Other Food Preparation and Serving Related Workers*, at the new $9.20 minimum pay rate, all workers up to the median pay of $18,400, meaning half of all workers in the category, would get an increase. The same is true for SOC 35-3000, *Food and Beverage Serving Workers:* that half of all workers would be affected. In several other occupational subcategories, the new, higher 2017 minimum wage rate affects the lowest 25th percentile, rather than the median. Therefore, some 25 percent of workers would be affected.

In summary, this part of the descriptive analysis simply suggests that (a) not many workers could have benefitted or been affected by the 2015 minimum wage increase to $8.40, because most workers (even in the most vulnerable of low-wage occupations) were earning more than the minimum before the increase; and (b) many more workers could have benefitted and/or been negatively affected by the 2017 increase to $9.20. Even for this higher 2017 increase, despite more workers being eligible, the vast majority of other occupations and workers would not have been unaffected. Their wages and earnings were simply well above the minimum. Perhaps, for 2017, some small portion, well below 10 percent of workers, could have received an increase and see their incomes increase.

Table 1. Low-Wage Occupation Employment, 2016 (Selected Categories and Subcategories)

SOC Code	Category / Sub-category	Entry Level	Experi-enced	10%	25%	City of Las Cruces	Mean New Mexico	USA
35-0000	**Food Preparation and Serving Related Occ.**	$17,200	$23,100	$16,800	$17,900	$21,100	$21,300	$23,900
35-1000	Supervisors of Food Prep and Serving Workers	$20,000	$36,300	$18,400	$22,300	$30,900	$30,700	$36,400
35-2000	Cooks and Food Preparation Workers	$17,200	$22,300	$16,900	$17,900	$20,600	$21,900	$24,000
35-3000	Food and Beverage Serving Workers	$16,800	$21,900	$16,500	$17,200	$20,200	$20,000	$22,400
35-9000	Other Food Prep and Serving Related Workers	$16,800	$19,300	$16,600	$17,300	$18,500	$20,000	$21,700
37-0000	**Building and Grounds Cleaning and Maint Occ.**	$17,900	$24,300	$17,400	$18,700	$22,200	$24,500	$27,900
37-1000	Supervisors of Building and Grounds Cleaning and Maint Workers	$23,800	$37,800	$23,000	$25,700	$33,100	$43,600	$44,100
37-2000	Building Cleaning and Pest Control Workers	$17,200	$22,300	$16,800	$17,900	$20,600	$22,300	$26,200
37-3000	Grounds Maintenance Workers	$18,000	$26,200	$17,400	$19,100	$23,500	$27,400	$29,200
41-0000	**Sales and Related Occ.**	$20,000	$35,700	$19,200	$21,600	$30,500	$41,200	$40,700
41-1000	Supervisors of Sales Workers	$26,000	$65,100	$23,600	$30,400	$52,100	$54,000	$51,300
41-2000	Retail Sales Workers	$17,400	$25,600	$16,900	$18,100	$22,800	$24,900	$25,200
41-3000	Sales Representatives, Services	$26,400	$58,500	$25,300	$29,300	$47,800	$64,000	$70,500
41-4000	Sales Representatives, Wholesale and Manuf	$30,900	$58,600	$29,000	$34,700	$49,300	$79,600	$73,000
41-9000	Other Sales and Related Workers	$20,800	$38,000	$19,900	$22,500	$32,300	$50,300	$49,700
31-0000	**Healthcare Support Occ.**	$19,600	$27,700	$18,700	$20,700	$24,900	$27,900	$30,300
31-1000	Nursing, Psychiatric, and Home Health Aides	$17,400	$22,200	$16,800	$18,400	$20,600	$23,100	$26,300
31-2000	Occupational Therapy, Physical Therapist Assistants and Aides	$25,300	$50,100	$23,700	$28,500	$41,800	$58,700	$48,400
31-9000	Other Healthcare Support Occupations	$22,100	$35,200	$21,100	$23,900	$30,800	$33,000	$34,900

Source: JobsEQ, by Chmura Economics & Analytics.

Las Cruces Employment Changes (Selected Low-Wage Industries)

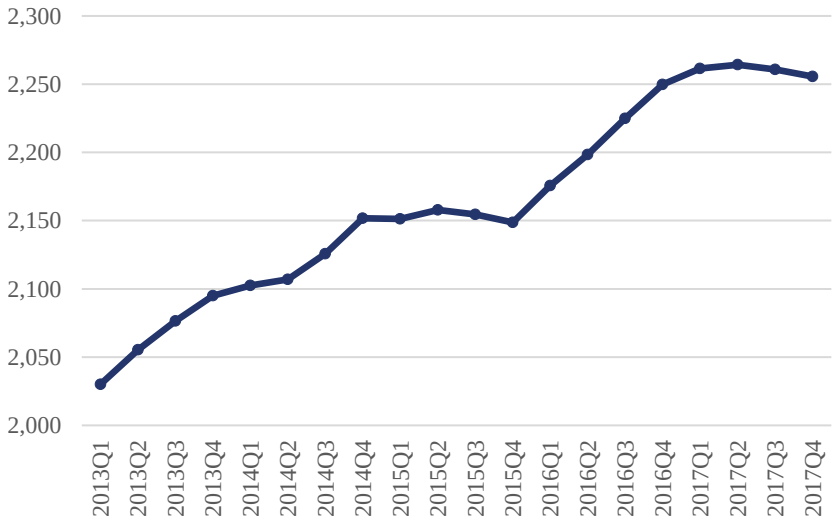
Healthcare Support Occupations

Figure 7a presents quarterly employment numbers for Las Cruces in the overall *Healthcare Support Occupations* category (SOC 31-0000) from the first quarter of 2013 through the last quarter of 2017. For this labor category overall, the familiar pattern appears, with a slowdown in growth in 2015, and even a very slight actual decline in employment in the fourth quarter. Growth in overall healthcare support positions resumed in 2016. Then, again, the rate of employment growth slowed again in the first two quarters of 2017 after the second increase in the minimum wage rate was implemented. And, the year closed with two quarters of actual, but small, employment decline.

Figure 7b presents the employment curve over the same period for the subcategory of healthcare aides (nursing, psychiatric and home health aides), a vulnerable subcategory again because median wages are below $25,000 per year with 58 percent of the category's employment. The employment response for healthcare aides to the two minimum wage increases in Las Cruces was more pronounced. In both instances, when the minimum wage was increased, the number of aides employed decreased by the end of the year.

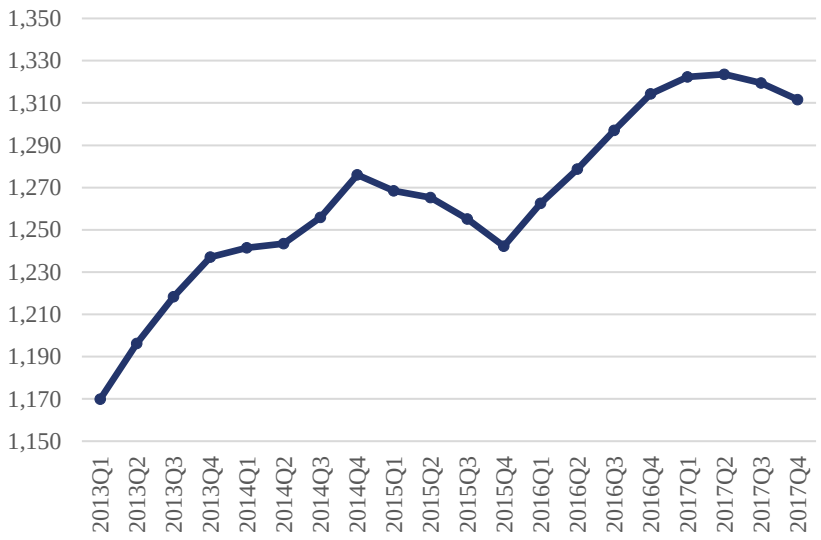
Again, however, the actual number of lost healthcare aide jobs in both years was small. The minimum wage increase in 2015 resulted in only about 40 fewer jobs for aides that entire year, out of about 1,275 at the start of 2015, or a 3 percent loss. After the 2017 increase, growth in employed aides increased in the first quarter, remained constant through the next quarter, and then fell in each of the last two quarters of the year. By the end of 2017, only about 15 fewer healthcare aides were employed compared to the beginning of 2017.

Figure 7a.
Employment in *Healthcare Support Occupations*,
by Quarter



Source: JobsEQ, by Chmura Economics & Analytics.

Figure 7b.
Employment in *Nursing, Psychiatric, and Home Health Aides Occupations,* by Quarter
Only Subcategory with Median Income < $25,000, in 2016



Source: JobsEQ, by Chmura Economics & Analytics.

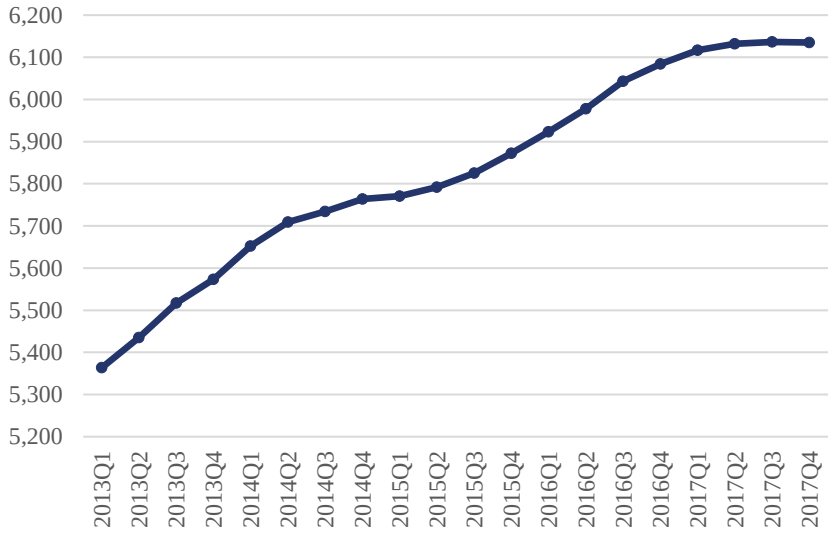
Food Preparation and Serving Related Occupations

Figure 8a presents quarterly employment numbers for Las Cruces in the *Food Preparation and Serving Related Occupations* (SOC 35-000) from the first quarter of 2013 through the last quarter of 2017. There is a distinct reduction in the rate of growth in Food Preparation employment in 2014 as the new minimum wage law is discussed and passed. Employment does not begin to increase again until the second and third quarters of 2015. The same thing happens again in late 2016, just prior to the second minimum wage increase in January 2017, and continues into the first half of that year. Employment growth in this category does not recover even by the end of 2017.

Figure 8b presents employment data in Las Cruces, also for *Food Preparation and Serving Related Occupations*, but only for the three lowest-paid subcategory occupations within that category—defined as any subcategories with median incomes below $25,000. The three low-wage subcategories combined account for 57 percent of the total employment in the food preparation category. The resulting graphical appearance of those three occupations combined is roughly the same as the curve for the full, overall food category shown in **Figure 8a**. The new employment curve does not become more or less severe. There is still a slow-down in the growth of employment for these three especially vulnerable occupations in the last half of 2014 just before the new 2015 minimum wage law is implemented. Employment, as before, does not begin to pick back up until the second and third quarters of 2015. The same fall off in employment happens again in the fourth quarter of 2016, just prior to the second minimum wage increase in January of 2017, and employment growth continues to decline at an increasing rate throughout 2017.

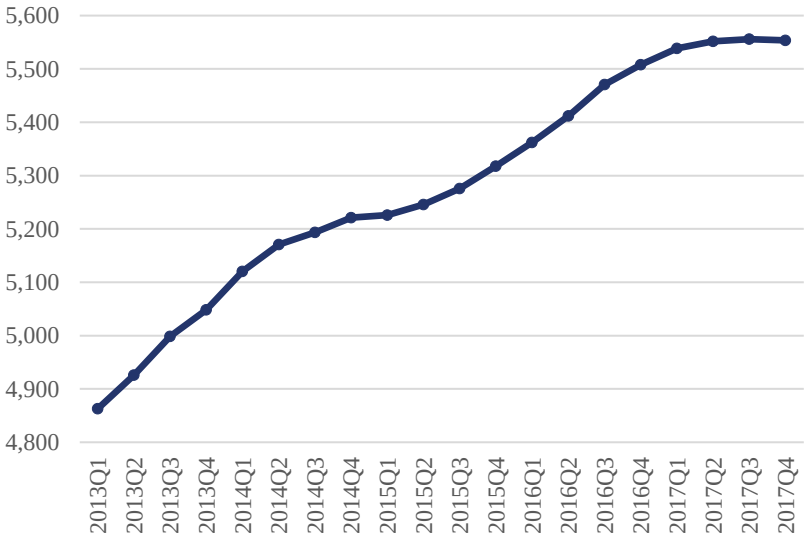
We make three observations. First, it appears that normal employment growth in food preparation is interrupted by minimum wage increases, even though there may be few actual jobs lost. Second, the falloff in growth in this instance of food preparation workers was stronger, or worse, with the second increase in the minimum wage. Third, we caution readers that apparent correlations between two variables over time do not mean that definite causality exists. There may be other factors at work.

Figure 8a.
Employment in *Food Preparation and Serving Related Occupations,* by Quarter



Source: JobsEQ, by Chmura Economics & Analytics.

Figure 8b.
Employment in *Food Preparation and Serving Related Occupations,* by Quarter
Three SOC Subcategories with Median Income < $25,000, in 2016



Source: JobsEQ, by Chmura Economics & Analytics.

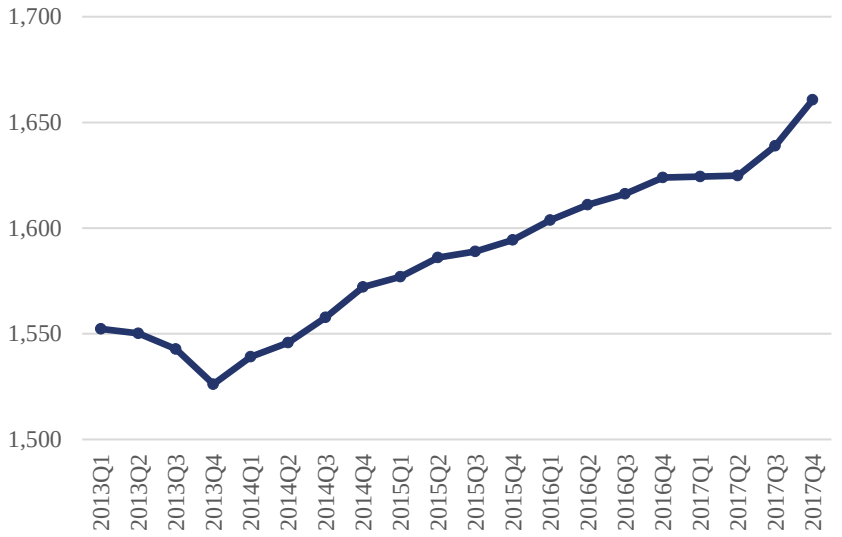
Buildings and Grounds Cleaning and Maintenance Occupations

Figure 9a presents quarterly employment numbers for Las Cruces in the overall *Buildings and Grounds Cleaning and Maintenance Occupations* category (SOC 37-0000) from the first quarter of 2013 through the last quarter of 2017. For this labor category overall, there was no substantial employment reaction in Las Cruces to either of the two minimum wage rate increases in 2015 and 2017. There was a very slight slowdown in hiring in the first two quarters of 2017, but past growth resumed thereafter. We include the graph here, primarily, to serve as a reference or comparison point.

Figure 9b presents the combined employment curve for the two most vulnerable subcategories of the buildings and grounds category, both with median earnings below $25,000. Again, nothing substantial is apparent. There was a brief (and slight) slowdown in growth in the fourth quarter of 2016, right before the second increase was implemented. There was a brief (and slight) quarter of actual decline in employment in

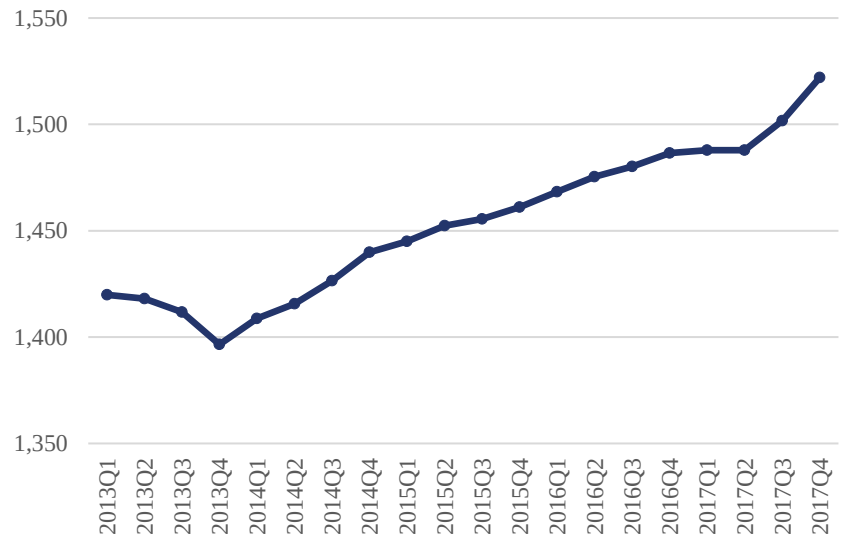
the first quarter of 2017 that followed the small slowdown in the prior quarter. Note the strong growth in the third and fourth quarters of 2017. Again, though, we include the graph here, primarily, to serve as a reference or comparison point.

Figure 9a.
Employment in *Building and Grounds Cleaning & Maintenance Occupations*, by Quarter



Source: JobsEQ, by Chmura Economics & Analytics.

Figure 9b.
Employment in *Building and Grounds Cleaning & Maintenance Occupations*, by Quarter
Two Subcategories with Median Income < $25,000, in 2016



Source: JobsEQ, by Chmura Economics & Analytics.

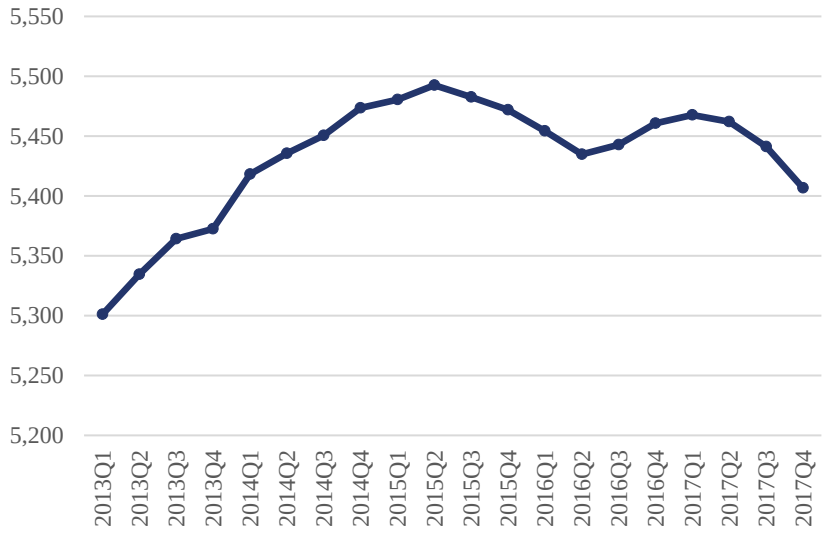
Sales and Related Occupations

Figure 10a presents quarterly employment numbers for Las Cruces in the overall *Sales and Related Occupations* category (SOC 41-0000) from the first quarter of 2013 through the last quarter of 2017. For sales workers overall, employment fell only after full implementation of the first minimum wage increase in 2015, with employment beginning actually to decline by the end of the third quarter of that year. In 2016, employment of overall sales workers began to increase again, only to begin falling again in the second quarter of 2017 after the implementation of the second minimum wage increase.

Figure 10b shows the same employment curve, but only for retail sales workers, a subcategory that accounts for 66 percent or two-thirds of all sales employees. Retail sales workers were the only subcategory of sales occupations that had median earnings below $25,000. One might expect more vulnerability among the lowest paid workers within the sales category, but this was not the case. Retail sales workers held their positions all the way through the first year of the minimum wage increase in 2015, not showing actual declines until the first two quarters of 2016. Retail sales employment in Las Cruces then began growing again and continued to grow until retail employment then fell in the last quarter of 2017, after the second minimum wage increase.

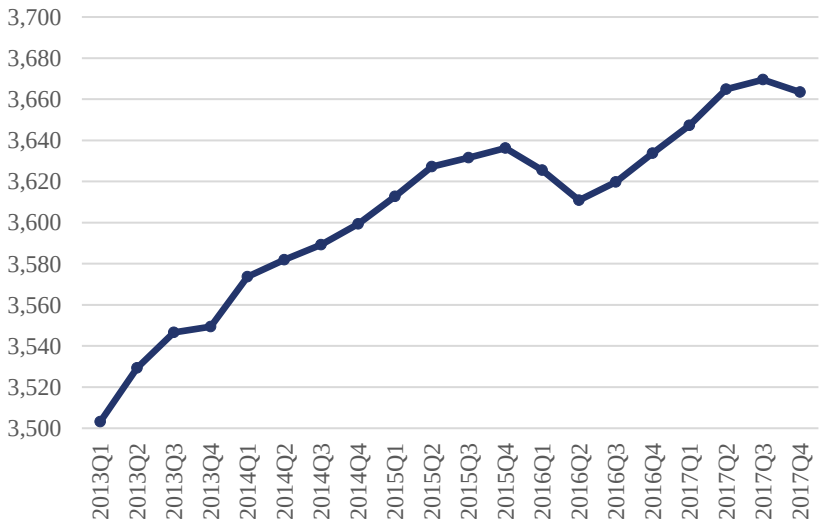
We make three observations, as in the last section. First, it appears that normal employment growth in sales is interrupted by minimum wage increases, even though there is a longer delay than for the food preparation labor category. Second, rather than a falloff in growth as was the case in food preparation, there were actual declines among workers in sales. Third, again, we caution readers that apparent correlations between two variables over time do not mean that definite causality exists, because other factors may be at work.

Figure 10a.
Employment in *Sales and Related Occupations*, by Quarter



Source: JobsEQ, by Chmura Economics & Analytics.

Figure 10b.
Employment in *Retail Sales Workers*, by Quarter
Only Subcategory with Median Income < $25,000, in 2016



Source: JobsEQ, by Chmura Economics & Analytics.

Economic Impact Simulation Analysis

Hibbs Institute researchers analyzed the economic impacts of two previous City of Las Cruces minimum wage increases in 2015 and 2017, and estimated the expected results of the next increase set for January 1, 2019.[16] For this purpose, researchers used a robust and comprehensive economic impact model constructed by Regional Economy Models, Inc. REMI models are widely accepted and extensively used by numerous public and private organizations to conduct economic impact studies. Specifically, researchers use the REMI PI+ V2.1 for Doña Ana County (hereafter, REMI-DAC).

The REMI-DAC model employed by the ***Hibbs Institute*** is a dynamic economic and demographic model designed to simulate the County's economy across a very broad spectrum of 70 economic sectors (3 digit NAICS codes). This level of detail was requested by the Las Cruces City economic development division. This unique model used historical business data for Doña Ana County to then estimate its interaction with the regional and national economies of which it is a part.

The REMI-DAC model uses a matrix of equations to replicate or simulate how economic variables in Doña Ana County both react to and contribute to changing conditions and variables in that economy within the larger economy. This model allowed researchers to run multiple simulations of Doña Ana County's economy while changing local (and/or other regional and national) economic variables. Thus, researchers can create different economic scenarios for the County and learn how variables such as business output (GRP), labor income and employment change when a minimum wage rate is introduced (by increasing the price of a factor of production, labor, in this instance resulting from increases in the minimum wage). Indeed, the model shows how the full structure of employment and relative productivities change across the County's economic sectors as the City of Las Cruces' minimum wage increases. This deep detail allows researchers to see, for example, how the model projects employment to change in the different major industry sectors and how employment is expected to change in various occupations across all industries.

Methodology

The general methodology ***Hibbs Institute*** researchers used in this section to compare local economic results obtained by running the simulation model with and without the minimum wage increases included. ***Hibbs Institute*** researchers use the REMI-DAC model to simulate the progression of the County's economy during the years 2016 – 2020. Researchers first went back in time, starting with the model's 2014 coefficients, equations and data without any minimum wage increases, and then let the model draw in actual (and in later years, estimated) regional and national GDP and other economic variables. Next, researchers introduced into the model estimated higher labor costs associated with each increase in the City's minimum wage. The differences in employment, output, and labor income variables for each year estimated by the two REMI simulation runs represent the economic impacts of the minimum wage changes.

[16] This ordinance changed the worked hour minimum wage rate within the municipal limits of the City from $7.25 to $8.40 beginning on January 1, 2015; $8.40 to $9.20 beginning on January 1, 2017; and $9.20 to $10.10 on January 1, 2019.

The City of Las Cruces is part of Doña Ana County in the state of New Mexico. The estimated population in Las Cruces was 101,759, as of 2016, which represents about 47 percent of the County population (214,579).[17] In 2016, the civilian employed population, 16 years and over, in Las Cruces was 43,938, of which 25,582 were considered full-time employees.[18] For the purpose of this study, the remainder (18,356) are considered part-time employees.

Using an appropriate wage distribution table, 1,705 full-time employees and another 1,880 part-time workers are eligible to receive a wage rate increase and resulting income increase, due to the minimum wage ordinance beginning in 2015 and continuing in 2016. In 2017 and continuing in 2018, some 2,758 full-time and 3,038 part-time workers are estimated to be eligible to receive the second minimum wage increase. Finally, in 2019 and continuing in 2020 and following years, 4,127 full-time, plus 4,330 part-time workers are eligible to receive that scheduled minimum wage increase.[19]

A proportional wage increase per hour, with respect to the previous hourly wage, was calculated for each occupation category and multiplied by the number of estimated hours worked annually. The Bureau of Labor publishes statistics for the hours worked by full-time employees, 2,087,[20] and part-time workers, 1,393.6.[21] These calculations were completed for each year of the analyzed period, 2016-2020. Thereby, researchers obtained a total dollar increase in labor income resulting from the minimum wage increase for full-time and part-time workers for each year, by industry and occupation. The main increased income amounts (increased factor cost) are shown in **Table 2**.

Those totals are the inputs used in the REMI-DAC model to represent the increased cost of labor in the simulation of the region's dynamic economy with these new labor costs.

Table 2. Estimated total increase in labor dollar income/cost increase, as a result of the minimum wage ordinance.

	2016	2017	2018	2019	2020
Full-time workers	$2,233,162.99	$5,950,420.17	$5,950,420.17	$12,271,834.75	$12,271,834.75
Part-time workers	$1,664,123.04	$4,430,054.94	$4,430,054.94	$8,998,030.19	$8,998,030.19
Total	$3,897,286.03	$10,380,475.11	$10,380,475.11	$21,269,864.95	$21,269,864.95

Source: Estimates by the Hibbs Institute.

[17] Estimates published by the U.S. Census, Department of Commerce: *QuickFacts*.
https://www.census.gov/quickfacts/fact/table/lascrucescitynewmexico,doaanacountynewmexico,NM/PST045217

[18] Estimates published by the U.S. Census, Department of Commerce: *American Fact Finder, 2016 American Community Survey 1 Year Estimates, Tables S2401 and S2402*.
https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_1YR_S2401&prodType=table

[19] Estimates published by the Bureau of Labor Statistics: *Occupational Employment Statistics*.
https://www.bls.gov/oes/2015/may/distribution.htm

[20] The U.S. Office of Personnel Management establishes that covered employees have computing hourly rates of pay using 2,087-hour divisor at almost all federal civilian employees: *Pay & Leave, Pay Administration.*
https://www.opm.gov/policy-data-oversight/pay-leave/pay-administration/fact-sheets/computing-hourly-rates-of-pay-using-the-2087-hour-divisor/

[21] An average number of working hours per week was calculated for part-time workers in Doña Ana County, using the U.S. Census PUMS survey, 5-year estimates (2012-2016). The resulting number, 26.8 hours, is multiplied by 52 weeks to obtain the average number of worked hours in a year, used in this study.

The REMI-DAC model includes historical values up to 2015 and allows simulation forecasts from 2016 onward. The model was *calibrated*[22] using annual real Gross Domestic Product (GDP) values for years 2016 and 2017 provided by the Federal Reserve Economic Data (FRED) and forecasted annual values for years 2018 through 2020 provided by the Federal Reserve Bank of Philadelphia.[23] Once the model was calibrated, estimates of the dollar changes in labor costs are incorporated in the model.

Increases in the cost of labor, or said another way, increases in the cost of production, create a disequilibrium in the analyzed region's existing economic relationships, or equilibrium. The particular policy variables changed in the REMI-DAC model were *Production Costs*, *Self-Proprietors Income*, both due to higher labor costs, *Local Government Spending*, due to higher wages paid and *Wage Bill*, due to higher earnings by employees. Next, the model computes and measures the resulting changes in all variables, including the important variables of interest, as the simulated economy seeks to regain its general equilibrium. As Doña Ana County gains a new equilibrium in order to adjust to higher labor costs, the County will see increases or decreases in employment, changes in personal consumption, as well as changes in a number of other variables including price levels and productivity. The resulting changes in these variables of interest represent the economic impact effects of the minimum wage increases.

Results

Output or GRP for Doña Ana County. The REMI-DAC model simulates the progression of the County's economy during the years 2016 through 2020, given the regional and national data drawn into the model. The simulation indicates a growth in Doña Ana's Gross Regional Product (GRP) of 1.98 percent in 2017, 2.46 percent in 2018, 2.13 percent in 2019, and 1.73 percent in 2020 reaching $6,618 million—see the green dashed line in **Figure 11**. These values give the model the County economy's baseline.[24] The ***Hibbs Institute*** is reasonably confident in these estimates, but is reluctant to make estimates for years further into the future.

Next, researchers introduce into the model the higher labor costs associated with each increase in the City's minimum wage for the appropriate years. The results of that latter simulation are shown by the orange dotted line in **Figure 11**. The difference between the baseline simulation and the minimum wage simulation represents the economic impact of the minimum wage policy implemented by Las Cruces. The difference in the two simulations for 2020 GRP is -$6 million. See **Table 3.** That is the amount of reduction in output for Doña Ana's economy, believed to be the negative consequence of the three Las Cruces minimum wage rate increases, a net reduction in output of 0.09 percent of Doña Ana's economy, or less than one-tenth of one percent.

[22] In order to develop more accurate and realistic estimates, REMI PI+ models allow users to calibrate simulations via a National/Regional Control. This process, basically, consists on the adjustment of the model to a pre-determined condition (real or not). In this case, GDP values for years 2016 and 2017 are known, and years 2018 through 2020 predictions are obtained from a respected organization.

[23] The Federal Reserve Bank of Philadelphia conducted a survey of professional forecasters during the first quarter of 2018, and developed annual projections based on annual average levels. As a respected organization, these projections were utilized in this study to calibrate the forecasting simulations.
https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/2018/survq118

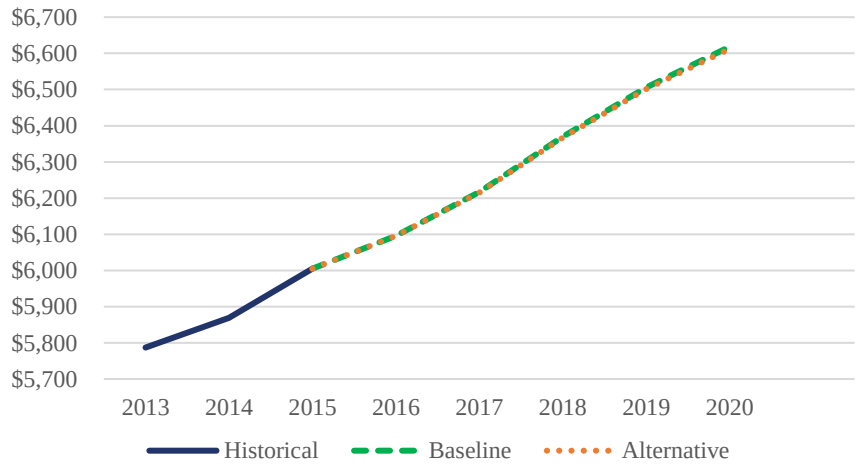
[24] Dollar amounts are reported in real 2009 figures.

Table 3. Doña Ana Gross Regional Product (Baseline, Alternative, and Economic Impact)

Year	Baseline	Alternative	Economic Impact (Difference)	Economic Impact (Accum.)
2016	$6,095.69	$6,095.35	-$0.34	-$0.34
2017	$6,216.42	$6,215.12	-$1.29	-$1.64
2018	$6,369.54	$6,367.19	-$2.34	-$3.98
2019	$6,505.49	$6,501.34	-$4.15	-$8.13
2020	$6,618.09	$6,612.12	-$5.97	-$14.10

Note: Amounts are expressed in millions of real 2009 dollars.
Source: Baseline, Alternative, and Economic Impact values estimated by Hibbs Institute using REMI PI+ V2.1.

Figure 11.
Doña Ana Gross Regional Product (in millions); Historical, Baseline, and Minimum Wage



Source: Historical values, Bureau of Economic Analysis (BEA); Estimates, Hibbs Institute.

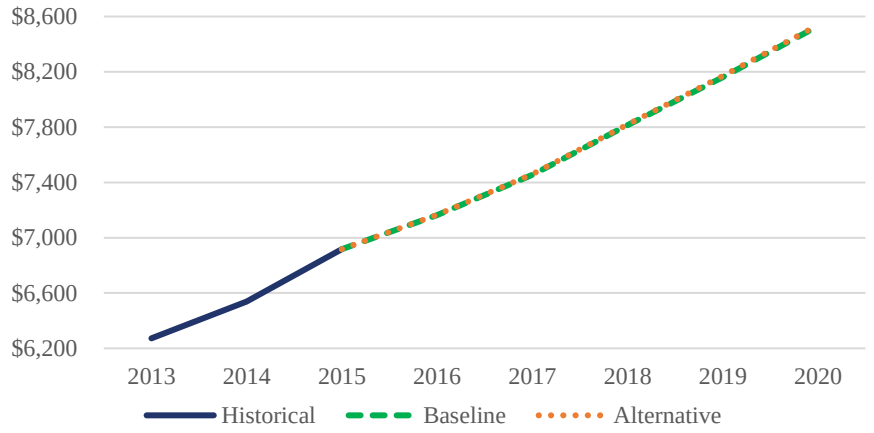
Personal Income for Doña Ana. Doña Ana County personal income was also simulated by the REMI-DAC model. See **Figure 12**. The forecast indicates a significant and consistent growth of 4 percent or more during the 2016 – 2020 period. The differences between the baseline and minimum wage simulations for each analyzed year are represented by the lines in **Table 4**. The economic impact of the minimum wage ordinance on personal income is, as expected, projected to be a positive one. Annual personal income increases (differences in the simulations) in the simulation with the wage rate increases by as much as $9.40 million (in 2019 the highest increase), or 0.11 percent for that year. Personal income for the entire period totals $28.6 million more.

Table 4. Doña Ana Personal Income (Baseline, Alternative, and Economic Impact)

Year	Baseline	Alternative	Economic Impact (Difference)	Economic Impact (Accum.)
2016	$7,162.68	$7,164.92	$2.24	$2.24
2017	$7,455.17	$7,460.70	$5.53	$7.77
2018	$7,813.69	$7,818.01	$4.32	$12.09
2019	$8,161.65	$8,171.04	$9.40	$21.49
2020	$8,530.18	$8,537.26	$7.08	$28.57

Note: Amounts are expressed in millions of real 2009 dollars.
Source: Baseline, Alternative, and Economic Impact values estimated by Hibbs Institute using REMI PI+ V2.1.

Figure 12.
Dona Ana Personal Income; Historical, Baseline, and Alternative



Source: Historical values, Bureau of Economic Analysis (BEA); Estimates, Hibbs Institute.

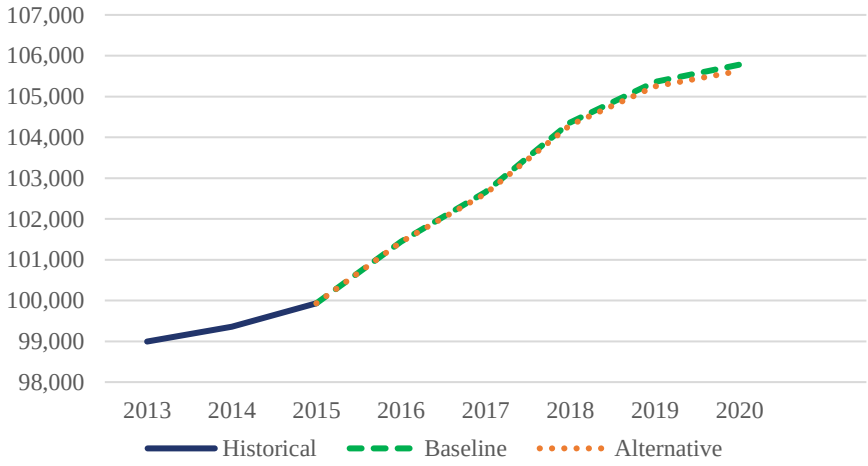
Employment for Doña Ana. The base REMI-DAC simulation without the minimum wage increases projects moderate employment growth for the forecasted period (**Table 5**). Employment increases to 101,446 jobs in 2016 (1.52% growth) to 105,780 jobs in 2020 (0.40% growth over the previous year). See **Figure 13**. The same simulation, but with the minimum wage increases included yields slightly slower employment growth year to year, represented by the dotted orange line in **Figure 13**. By 2020, the projection is for 105,630 jobs, 154 fewer employed persons than in the baseline projection, or -0.15 percent fewer.

Table 5. Doña Ana Total Employment (Baseline, Alternative, and Economic Impact)

Year	Baseline	Alternative	Economic Impact (Difference)	Economic Impact (Accum.)
2016	101,446	101,434	-12	-12
2017	102,660	102,620	-40	-52
2018	104,362	104,298	-65	-117
2019	105,361	105,247	-114	-231
2020	105,780	105,626	-154	-385

Note: Amounts are expressed in number of jobs.
Source: Baseline, Alternative, and Economic Impact values estimated by Hibbs Institute using REMI PI+ V2.1.

Figure 13.
Doña Ana Total Employment; Historical, Baseline, and Alternative



Source: Historical values, Bureau of Economic Analysis (BEA); Estimates, Hibbs Institute.

Employment Changes by Industry. The employment economic impact, depicted above, is further disaggregated by industry sector, as shown in **Table 6**. This level of disaggregation by the REMI-DAC model, again based on historical data and interactions in the region, gives policymakers a first approximation of the industries in which job losses are likely to occur. The two industries with the largest job losses totaled over the five years through 2020 are, not unexpectedly, *Accommodation and Food Services* with 137 (with most of the losses in the Food Services side) and *Health Care and Social Assistance* with 67 (again, with the bulk of these losses in the Social Assistance side of this industry classification).

Over the entire five-year period, 385 jobs are lost, also shown in **Table 6**. As economic theory would suggest, when a factor of production (labor in this instance) costs more, less of it will be used. In this instance, the projected employment loss is numerically relatively small. Again, policymakers must make the judgment as to whether the job losses are worth the positive gains from this minimum wage policy.

Table 6. Doña Ana County Simulated Total Employment Loss, by Industry (2016 - 2020)

	2016	2017	2018	2019	2020	Total
Forestry, Fishing, and Related Activities	0	0	0	0	0	0
Mining	0	0	0	0	0	0
Utilities	0	0	0	0	0	0
Construction	0	1	4	7	11	23
Manufacturing	0	0	1	1	2	4
Wholesale Trade	0	0	1	1	1	3
Retail Trade	1	4	7	12	17	41
Transportation and Warehousing	0	1	2	4	5	12
Information	0	0	0	0	0	0
Finance and Insurance	0	0	0	0	1	1
Real Estate and Rental and Leasing	0	0	0	0	1	1
Professional, Scientific, and Technical Services	0	1	1	2	4	8
Management of Companies and Enterprises	0	0	0	0	0	0
Administrative and Waste Management Services	0	1	2	4	5	12
Educational services; private	1	2	2	4	6	15
Health Care and Social Assistance	2	8	11	20	26	67
Ambulatory health care services	0	2	3	5	7	17
Hospitals; private	0	0	0	0	0	0
Nursing and residential care facilities	0	1	1	2	3	7
Social assistance	2	5	7	13	16	43
Arts, Entertainment, and Recreation	0	0	1	1	1	3
Accommodation and Food Services	6	17	23	41	50	137
Accommodation	0	0	1	2	2	5
Food Services	6	17	22	39	48	132
Other Services, except Public Administration	1	4	6	11	13	35
Repair and maintenance	0	0	0	0	0	0
Personal and laundry services	1	2	2	5	6	16
Membership associations and organizations	0	1	2	3	4	10
Private households	0	1	2	3	3	9
Public Administration	1	1	4	6	11	23
Total employment loss	**12**	**40**	**65**	**114**	**154**	**385**

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Additionally, the ***Hibbs Institute*** estimated the negative employment impact on different occupations that cross all industries. This occupational disaggregation, presented in **Table 7**, shows that *the Food Preparation and Serving* occupation is hardest hit with 125 fewer jobs over the five-year period. The next most affected group is *Office and Administrative Support* with 38 fewer jobs. Once again, the reader can see how the 385 lost jobs over the five-year period are distributed by occupation. For the reader's convenience and further interest, the ***Hibbs Institute*** disaggregated some selected occupations (SOC 3-digit): *Healthcare Occupations*, *Food Preparation and Serving Related Occupations*, *Building and Grounds Cleaning and Maintenance Occupations*, and *Sales and Related Occupations*. These occupations are included **in Appendix B. Doña Ana County Simulated Employment Loss, Selected Occupations.**

Table 7. Doña Ana County Simulated Total Employment Loss, by Occupation (2016-2020)

	2016	2017	2018	2019	2020	Total
Management, business, and financial occupations	0	2	4	7	10	23
Computer, mathematical, architecture, and engineering occupations	0	0	1	2	2	5
Life, physical, and social science occupations	0	0	0	0	1	1
Community and social service occupations	0	1	2	3	4	10
Legal occupations	0	0	0	0	0	0
Education, training, and library occupations	1	2	4	7	9	23
Arts, design, entertainment, sports, and media occupations	0	0	0	1	1	2
Healthcare occupations	1	2	4	7	10	24
Protective service occupations	0	0	1	1	2	4
Food preparation and serving related occupations	5	16	21	37	46	125
Building and grounds cleaning and maintenance occupations	1	2	3	4	5	15
Personal care and service occupations	1	4	5	10	13	33
Sales and related occupations	1	2	5	9	12	29
Office and administrative support occupations	1	4	6	11	16	38
Farming, fishing, and forestry occupations	0	0	0	0	0	0
Construction and extraction occupations	0	1	3	5	8	17
Installation, maintenance, and repair occupations	0	1	1	2	4	8
Production occupations	0	1	1	2	3	7
Transportation and material moving occupations	1	2	4	6	8	21
Total employment loss	**12**	**40**	**65**	**114**	**154**	**385**

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Econometric Analysis

The ***Hibbs Institute***, as requested by the City of Las Cruces staff, complemented the economic impact simulation analysis, described above, with an econometric analysis of The City of Las Cruces' Minimum Wage Ordinance. Researchers reviewed a number of studies (see Literature Review) to find an econometric technique, or model, which might be able to isolate econometrically the effect of minimum wage rate changes on employment in certain occupations.

The most promising technique was the regression analysis used by Justin B. Hollis of the University of New Mexico at Albuquerque. The Hollis study examined changes in a minimum wage ordinance in Santa Fe, NM and its employment effects in low-wage occupations.[25] ***Hibbs Institute*** researchers used that model as a base for examining the impact of Las Cruces minimum wage increases on several occupational employment categories.

Methodology

The data include quarterly employment figures from 2010 to 2017 (the most recent year available) for Las Cruces, NM - Metropolitan Statistical Area (MSA) and other comparison or baseline locations in Texas and New Mexico.[26] The employment figures include four major groups of occupational employment categories (2-digit SOC)[27] targeted as occupations with low-skilled workers that would most likely see the effects of the minimum wage increases, as well as seven subgroup occupational categories (3-digit SOC),[28] noted below:

- 31-0000 Healthcare Support Occupations
- 31-1000 Nursing, Psychiatric, and Home Health Aides
- 35-0000 Food Preparation and Serving Related Occupations
- 35-2000 Cooks and Food Preparation Workers
- 35-3000 Food and Beverage Serving Workers
- 35-9000 Other Food Preparation and Serving Related Workers
- 37-0000 Building and Grounds Cleaning and Maintenance Occupations
- 37-2000 Building Cleaning and Pest Control Workers
- 37-3000 Grounds Maintenance Workers
- 41-0000 Sales and Related Occupations
- 41-2000 Retail Sales Workers

[25] Hollis, Justin B. (2015) "Santa Fe, New Mexico's Living Wage Ordinance And Its Effects On The Employment And Wages Of Workers In Low-Wage Occupations"; Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Economics, in the University of New Mexico, at Albuquerque, NM.

[26] The data series are obtained from JobsEQ, a software developed by Chmura Economics & Analytics. Chmura imputes employment numbers using Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics (BLS) and other published data sources (the County Business Patterns from the U.S. Census Bureau as well as others). Care is taken to make the employment data set internally consistent—that is, the lower levels of detail in sum match higher reported levels. The ***Hibbs Institute*** appreciates the cooperation of the City of Las Cruces staff members, who gathered these numbers on our behalf.

[27] The 2000 Standard Occupational Classification (SOC) System was developed in response to a growing need for a universal occupational classification system. Such a classification system allows government agencies and private industry to produce comparable data. The 2000 SOC classifies workers at four levels of aggregation: 1) major group; 2) minor group; 3) broad occupation; and 4) detailed occupation. All occupations are clustered into one of 23 major groups. https://www.bls.gov/soc/socguide.htm

[28] The minor group occupational categories (within the four targeted major groups) that reported a mean income of $25,000 or more were excluded from the analysis.

The regression model used examines potential changes in employment between two periods, before and after Las Cruces minimum wage increases are in place, and for two regions, the treatment and the control groups. The treatment group (affected by the policy change) is the City of Las Cruces. The control group (not affected by the policy change) varies for the different occupational employment categories depending on how similar they are with respect to the corresponding category in Las Cruces.[29] Systematic differences between the control and treatment groups were captured by the different sets of years, before and after the wage rate increase. The resulting, difference-in-differences estimator can be evaluated via a regression analysis to test whether it is statistically different from zero[30].

The model can be described as:

$$\ln(\text{employment}) = \beta_o + \delta_o dp2 + \beta_1 dLCR + \delta_1 dp2 * dLCR + u$$

where the outcome variable of interest, employment, is in its log form to get an approximate percentage effect. The intercept, β_o, is the average employment in New Mexico (control group), and the parameter, δ_o, captures changes in the second period (after the policy change) via a dummy variable *dp2*. The coefficient β_1, measures the location effect related to the treatment group (City of Las Cruces) using a dummy variable *dLCR*. The parameter of interest, δ_1, measures the interaction term *dp2 * dLCR* such that δ_1 measures the change in employment remaining and due to the policy minimum wage rate increase.

Since the minimum wage ordinance was set to increase periodically with progressively larger increases, two different specifications were made for the model described above. One examines the potential change in employment after the first increase on January 1, 2015, and included quarters 1-4 for 2015, 2016, 2017, and the first quarter of 2018 (a total of 13 observations). The other specification examined the potential change in employment after the second increase on January 1, 2017. That model includes quarters 1-4 for 2017, and the first quarter of 2018 (a total of 5 observations).

Results

The regression results are presented in **Table 8**. The coefficient δ_1 of the parameter *dp2 * dLCR* (Period * Las Cruces) is the approximate percentage reduction (or increase) in employment for the examined category.

The results were inconclusive.

The coefficient, δ_1, was not statistically significant in four occupational categories out of the eleven assessed in *Period 1*. Another four categories were not statistically significant in *Period 2*. This lack of statistical significance means that researchers cannot conclude that minimum wage increases had any impact on any differences in employment levels found for those 8 employment categories (4 in *Period 1*, 4 in *Period 2*).

[29] As with any comparison analysis, the selection of a useful control region is crucial to the conclusiveness of the results. To determine the most adequate control group for each examined category, we compared employment in Las Cruces from 2010 to 2014 (quarterly observations) to employment in several different areas, including El Paso-MSA, New Mexico (less Las Cruces City, Smith County, Tyler City, Gregg County, and Longview City. We chose the most adequate region based on a simple t-test of annual percent change in employment in the potential control region on the annual percent change in employment in Santa Fe. The most adequate region (for each category) is used as the control group in the regression analysis.

[30] As described in Chapter 13.2, in "Introductory Econometrics: A Modern Approach" by Jeffrey M. Wooldridge (2003).

Further, the results for other occupation categories were—even when apparently statistically significant—all over the board in terms of both magnitude and sign. For example, the important *Nursing, Psychiatric, and Home Health Aides* occupations SOC subcategory, which represents about 58 percent of the employment in the parent *Healthcare Support* occupations category, was statistically significant at the 1 percent level during *Period 1*. However, the results for this occupational category suggest that employment levels actually increased by about 3 percent during *Period 1* due to the minimum wage increase. No difference was captured by the model during *Period 2*.

Second, the *Food Preparation and Serving Related Occupations* category was statistically significant at the 1 percent level, with employment levels decreasing less than 1 percent during *Period 1*, but then increasing about the same amount during *Period 2*. Subcategories of this major occupation group, such as *Cooks and Food Preparation Workers* and *Food and Beverage Serving Workers*, present similar alternating outcomes.

Hibbs Institute researchers decided, ultimately, that this model was not convenient for at least two reasons. First, since there is no numerical data series for minimum wage rate changes (monthly, quarterly, or annually), time series analysis techniques (the other name for regression analysis) are not appropriate for this study. Minimum wage rate changes happen occasionally and behave more like events.

Second, the actual effects of minimum wage rate changes are often relatively subtle and can easily be obscured in time series analysis by other, larger variables. Most minimum wage rate changes—at least in the past and including those in Las Cruces—occur near or just above existing equilibrium wage rates and cannot have very large effects on larger employment categories. For example, a booming local economy with substantial increases in GRP or substantial growth in population can easily obscure the effects on employment of minimum wage rate increases.

Thus, we conclude that the results of this regression model, used elsewhere by other researchers, needs much more work to use with minimum wage rate changes, to better identify realistic control cities and to exclude the effects of general economic growth (and many other variables) on employment in various occupation categories.

The complete regression results (the intercept and all the parameters) for both, *Period 1* and *Period 2*, are included in **Appendix C. Regression Results (All parameters).**

Table 8. Regression Results

SOC Code	Occupational Employment Categories	Period 1 * Las Cruces	Period 2 * Las Cruces
31-0000	Healthcare Support Occupations	0.0069 *	0.0031
31-1000	Nursing, Psychiatric, and Home Health Aides	0.0308 ***	-0.0351
35-0000	Food Preparation and Serving Related Occupations	-0.0074 ***	0.0091 ***
35-2000	Cooks and Food Preparation Workers	-0.0074 ***	0.0106 ***
35-3000	Food and Beverage Serving Workers	-0.0062 ***	0.0079 **
35-9000	Other Food Preparation and Serving Related Workers	0.0015	-0.0063**
37-0000	Building and Grounds Cleaning and Maintenance Occupations	-0.0109	-0.0288
37-2000	Building Cleaning and Pest Control Workers	-0.0086	0.0415 **
37-3000	Grounds Maintenance Workers	-0.0015	0.0355
41-0000	Sales and Related Occupations	-0.0178 ***	0.0250 ***
41-2000	Retail Sales Workers	-0.0295 ***	0.0270 **

Note:
*** Statistical Significance at 1% level
** Statistical Significance at 5% level
* Statistical Significance at 10% level
Source: Estimates by Hibbs Institute.

Conclusions

Economic Theory

Hibbs Institute researchers established from the economic and management literature that imposing and increasing minimum wage rates can have either positive or negative results, or both. The weight of economic theory suggests that in competitive markets for low-skilled labor, where a plentiful supply of such labor exists, some jobs will be lost when binding minimum wage rates are put in place or increased. However, little is known about the positive effects of minimum wage increases which may add to the satisfaction of existing labor, increase productivity and somewhat mitigate the expected negative employment effects. Finally, many recent studies of the effects of minimum wage rate increases have not found large negative employment effects. Indeed, many empirical studies have found relatively small job losses in the 1 percent or 2 percent range for minimum wage rates set not too far from the equilibrium market rate.

Descriptive Statistics

The ***Hibbs Institute*** looked at employment curves for certain low-wage occupations in Las Cruces, using quarterly data over the five-year period of 2013 through 2017. Researchers found that, for most of the low-wage occupations examined, the two past increases in the Las Cruces minimum wage each appear to have had negative effects on employment. Those effects took the form of slowed employment growth, or even negative growth (decreasing employment), for a period of two or more quarters just before and/or after a minimum wage rate increase.

However, these negative employment effects were short-lived for the low-wage occupations studied. The effects lasted from two quarters to a year, with original rates of employment growth resuming after the disruption from the minimum wage increase had run its course. Furthermore, the 2013-2017 quarterly data for this Las Cruces sample of low-wage occupations showed that the negative employment effects were small, ranging from affecting a handful of workers in some occupations to up to forty workers in another (with over 1,300 employees in that occupation). In percentage terms, these short-lived job losses ranged from less than 1 percent up to as much as 3 percent of the total number of workers in a given low-wage occupation. These numerically small effects (on the low-wage occupations most likely to be affected at all) may help explain why other studies often find small negative effects on overall total employment for all occupations.

Economic Impact Simulation Analysis

Hibbs Institute researchers used a powerful, comprehensive REMI-DAC model to simulate the progression of Doña Ana County's economy during the years 2016 through 2020 with and without the wage rate changes for some workers introduced by Las Cruces' Minimum Wage Ordinance (increasing minimum wages in 2015, 2017 and proposed for 2019). Comparing the simulation results, researchers estimated how County output (or GRP), personal income and employment levels differed. Given the robust model, they were also able to project how employment changes would occur in different industries and across different occupations.

The simulations projected a net reduction in business output in Doña Ana's economy in 2020 of less than one percent (-0.09%) or -$5.97 million. Over the entire five years 2016-2020, total lost output (GRP) is $14.09 million. Annual personal income is higher in the simulation with minimum wage increases (as would be expected) by as much as $9.40 million in 2019 (the highest annual difference), or 0.11 percent for that year. Personal income for the entire period totals $28.6 million more. Projected employment falls in the simulation scenario with minimum wage rates, but the number of lost employees is numerically relatively small. By 2020, the minimum wage rate scenario projects total employment to be 105,626, rather than 105,780 under the baseline simulation. Thus, the employment loss for 2020 is 154 workers, or 0.15 percent fewer (less than one-sixth of a percent). Including the 2019 scheduled minimum wage increase, the total job loss over the five years is 385.

The two industries with the largest simulated job losses over the five years through 2020, not unexpectedly, include the *Accommodation and Food Services* sector with 137 (with most of the losses in the Food Services side) and *Healthcare and Social Assistance* with 67 (again, with the bulk of these losses in the Social Assistance side of this industry classification).

The two occupations with the greatest job losses over the five years are the *Food Preparation and Serving Occupation* which lost 125 and the *Office and Administrative Support Occupational* category with 38 fewer jobs.

Econometric Analysis

The results gained from the particular econometric approach chosen for this study to examine the effects of minimum wage rate increases on Las Cruces MSA employment were inconclusive. The model awaits better data and better control cities before useful results can be obtained.

Final Word

Increases in the Las Cruces minimum wage have (in our graphs and simulations) increased personal income for low-wage families while depressing business output somewhat and reducing employment marginally—even through 2020. Given that this is an issue about which different groups feel very passionately, ***Hibbs Institute*** researchers have been as carefully and deliberately independent and unbiased as possible. The results, unfortunately, do not provide an easy, simple answer for policymakers. ***Hibbs Institute*** researchers can lay out the facts as we determine them, but policymakers must weigh these facts and make their own decisions about whether to go ahead with future minimum wage increases, as planned or not.

The elasticity of demand for low-skilled labor will increase as minimum wage rates are raised much above current minimum wage rates. All should remain very aware that almost all of these empirical studies cited in the literature (see Appendix A.) used data where the minimum wage was very close to—sometimes began below—existing market wage rates. Thus, it was not possible for historical minimum wage rate increases to have much impact on employment. The impact on employment of future increases may rise dramatically as minimum rates are raised noticeably above the equilibrium rate—or substantially higher than the U.S. minimum.

We add this final caveat, that it is important to consider long-run alternatives to direct wage redistribution, which certainly has its place. Perhaps alternatives could be sought, such as the even more fierce promotion of education that brings positive social change, raises individual productivity, attracts higher-paying industries and strongly encourages people to work in friendly competition with others large and small across the world. As Bill Gates recently said, it is not true that the rich are getting richer and the poor are getting poorer. He notes that in just 25 years, astonishingly, China's poverty rate has fallen from 60 percent of its citizens to just 10 percent. He points to a similar transformation taking place in Brazil and even more countries. He notes that central to these transformations is reliance on markets, belief in education and cultivating a desire to compete and excel. [31]

[31] Indeed, Bill Gates recently made the point that the richer are not getting richer while the poor are getting poorer. He noted that in China, the poverty rate of its citizens has been reduced from 60 percent to just 10 percent over the last 20 years. He noted that better education and the use of capital and markets were the answer there and in countries like Brazil, where a similar transformation has been going on over the last three decades. This businessman, certainly not a conservative, reminds us that there are important and effective ways to reduce poverty besides redistributive transfers. Further, Mr. Gates notes that "You have to be careful that if you raise the minimum wage, you're encouraging labor substitution, that you're going to go buy machines and automate things or cause jobs to appear outside that jurisdiction." Bill Gates, MSNBC Fighting Poverty Video, published June 21, 2014, See https://m.youtube.com/watch?v=W6An60U

Appendix A. Elasticity of Demand for Low-Skilled Labor

One way to help determine the relative sizes of the two most-considered positive and negative consequences of an increase in a minimum wage is to look at the elasticity of demand for low-skilled workers. That is, what is the responsiveness of employers who hire low-skilled workers to changes in their wage rates? The elasticity of demand for labor is usually expressed as:

$$e_L = - \frac{\%\Delta \text{ Labor}}{\%\Delta \text{ Wage}}$$

The minus sign simply means that the two variables move in opposite directions, or that an increase in the minimum wage will produce a decrease in employment of some amount, given time for adjustment.

If the absolute value of the coefficient is greater than 1, quantity of labor demanded is said to be elastic. That is, firms in such an industry could have a strong response to the increase in the wage rate (price of labor), perhaps substituting capital for labor as the relative prices change. In the case of the security industry, for example, it might be fairly easy to substitute cameras and automated police calling equipment for regular security guards if wage rates were raised.[32] With elastic labor demand of -2, for example, a given 10 percent increase in a minimum wage might cause a 20 percent decline in the quantity of low-wage workers employed over a period of time. Firms might substitute capital for labor, or they might just reduce output (get smaller) to remain profitable.

Because low-skilled workers are paid wage rates at the lower end of the wage rate spectrum (by definition), it is often posited that the value of the coefficient of elasticity for demand for low-skilled labor will likely have an absolute value less than 1, or be said to be inelastic.[33]

A numerical example of inelastic demand would be both illustrative and helpful at this point. Assume a coefficient of elasticity for low-skilled labor demand, eL = -0.5.[34] This number simply means that a 10 percent increase in the minimum wage rate in this example would result in a 5 percent decrease in employment of low-skilled labor. Assume, also, a minimum wage increase from $10 to $11 per hour (the assumed 10% increase) and 5,000 workers before the wage increase and 4,750 after (the 5% decrease of 250 workers).[35]

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[32] See "2. The ease and cost of factor substitution: Labour demand will be more elastic when a firm can substitute quickly and easily between labour and capital inputs. . . . . For example it might be fairly easy and cheap to replace security guards with cameras but a hotel wuod find it almost impossible to replace hotel cleaning staff with machinery." Tutor2u, Explore Economics, Elasticity of Labour Demand (Labour Markets) accessed May 6, 2018. //www.tutor2u.net/economics, reference/labour-market-elasticity-of-demand.

[33] If the wage rate "strikes" the labor demand curve anywhere in its lower half—below its mathematical mid-point—the elasticity of demand will be a fraction between -0 and -1.

[34] Momentarily, we will present empirical data from other studies that this elasticity assumption is reasonable.

[35] Example:
e_L = -0.5
5,000 low-skilled workers employed before the minimum wage increase
$10 prior minimum wage per hour
$11 new minimum wage (10% increase = $1) per hour
4,750 workers (5% decrease = -250 workers)

In this example of inelastic demand, the total annual income going to unskilled labor before the increase in the minimum wage is $100 million ($10/hr x 5,000 workers x 2000 hrs per year) and the total going to unskilled labor after the increase is $104.5 million. Thus, with the assumption of inelastic labor demand, overall labor income going to unskilled workers increases—the new total income going to a smaller number of workers exceeds the total amount received by the larger number of workers that were employed at the old $10 wage rate. Said a different way, in this example of inelastic labor demand, the increase in total labor income for the employees who retain their jobs, more than offsets the lost total labor total income for the workers who no longer have jobs.

Important reminder: although we have just shown that under certain circumstances those who remain employed may see benefits greater than the losses of those who lose employment, there are still winners and losers. As researchers, we caution again that we cannot say that that result is good, or that it justifies a minimum wage increase. The fact that the winners' gains might under sometimes common circumstances exceed the losers' losses—in money terms—still does not allow any researchers to say that such an outcome should be sought. The answer is not clear because job losses, even for a small group, may cause more pain than the joy created by income gains for minimum wage workers who retain their jobs. That is a judgment only for policymakers.

In addition to not being able to compare the feelings of workers who get the higher wage with the feelings of pain of those willing to work who lost their jobs, we cannot consider the heightened feelings of concern by those willing to work at the now higher wage. Some workers are drawn to this jurisdiction and this industry because of the new, higher wage rate—whether they were people who were willing to work at the old wage, but were unemployed, or whether they are new workers drawn to the market from another labor market because of the now higher wage, but are simply adding to the excess supply of (now unemployed) labor. In general, this report does not consider the ramifications of the additions to the existing excess supply that inevitably come from surrounding areas as minimum wages for low-skilled work in one jurisdiction become ever more attractive.

What is shown in this example is the "best case scenario" where inelastic demand for low-skilled labor gives the most favorable, or least damaging situation—for having local authorities step in to change wage rates, or set a wage floor. An important observation, perhaps a caution, is that the higher a locality raises its minimum wage, the greater the probability they will enter the elastic (or upper, above the midpoint) portion of the unskilled labor demand curve. In this elastic region, industries will react more strongly to wage increases, and reduce employment by a greater amount, certainly in the intermediate and longer terms.

One important conclusion from this discussion of economic theory is that knowing more about the coefficient of elasticity for low-skilled workers would help leaders make policy decisions. We will review the literature and present the results of other studies that calculated coefficients of elasticity for labor demand in other cities and countries.

2000 hours worked annually (40 hours per week x 50 weeks)
Thus, previous annual labor income = 5,000 workers x $10/hr x 2000 hours = $100,000,000
And, new annual labor income = 4,750 workers x $11/hr x 2000 hours = $104.500,000

Estimates of Labor Demand Elasticity, e_L

One principle of economics textbook, supported by the Ministry of Higher Education in British Columbia and the Hewlett Foundation, notes that "Economists have attempted to estimate how much the minimum wage reduces quantity demanded pf low-skill labor. A typical result of such studies is that a 10 percent increase in the minimum wage would decrease the hiring of unskilled workers by 1 to 2 percent, which seems like a relatively small reduction."[36] They go on to note that this small result is partly the product of the U.S. minimum wage law being set near, and sometimes just below, the existing equilibrium rate and therefore would have little effect except for downturns where the U.S. minimum wage rate might serve as a floor during market fluctuations. There are myriad other complications, such as many low-skilled employees working several part-time jobs, either simultaneously or serially with bouts of unemployment in between.[37] These complications affect elasticity calculations.

Some early studies suggest that young workers are most vulnerable to minimum wage increases. Consider the wage rate elasticities below:

Labor Age Group	e_L	Study[38]
Teens	-1.34	Welch and Cunningham (1978)
16-24	-7.41	Anderson (1977)
14-24	-9.68	Grant (1979)
14-24	-0.59	Hamermesh (1982)
Men <21	-1.80	Lewis (1985)
Women <21	-4.58	Lewis (1985)
Unskilled workers in mfg.	-0.42	Arango *et. al.* (2018)

Arango, et. al. study the demand for unskilled labor (and skilled labor) in Columbia. Their estimate for the elasticity of labor demand for unskilled workers is -0.415. The authors state that "Unskilled worker are generally more sensitive than skilled ones [to own-wage changes], in line with previous research.[39]

R. Riley, in a well-done study made available in 2013 by the National Institute of Economic and Social Research, estimates mean elasticities for individuals with no education beyond high school working in different industries. In production sectors, the elasticity of demand for low-skilled workers was -0.683; for service sectors, it was -0.835.[40]

A. Lichter, et. al., in a 2014 IZA Discussion Paper from the Institute for the Study of Labor (Bonn, Germany), provide a meta-regression analysis for more than 1,560 previous estimates of labor demand elasticities. Their conclusion for a "best guess" for unskilled labor (not controlling for year of publication or country) is –0.323.

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[36] BCcampus, "4.1 Demand and Supply at Work in Markets" in *Principles of Economics*, accessed online at //opentectbc.ca/principlesofeconomics/4-1-demand-and-supply-at-work-in-labor-markets/, May4, 2018, page 10.

[37] Ibid.

[38] Hamermesh, Daniel. 1993. *Labor Demand.* Princeton and Chester, UK: Princeton University Press; and Microlectures50.docx

[39] L. E. Arango, F. Castellani and N. Obando. August, 2016. *It is Mainly about Where You Work! Labor Demand in the Colombia Manufacturing Sector*. Inter-American Development Bank. www.iadb.org. Accessed May,4, 2018. Page 12.

[40] R. Riley. Modelling Demand for Low Skilled/Low Paid Labour: Exploring the Employment Trade-Offs of a Living Wage. National Institute of Economic and Social Research Disscussion Paper No. 404. Pages 19-20.

As a result of a review by ***Hibbs Institute*** researchers of past estimations in the literature, the elasticity of demand for labor applicable to Las Cruces can be considered to be between -0.3 and -0.6 for most unskilled labor. However, the elasticity is likely much higher for teenagers and other very unskilled labor.

Appendix B. Doña Ana County Simulated Employment Loss, Selected Occupations.

Table B1. Doña Ana County Simulated Employment Loss, *Healthcare Occupations* (2016-2020)

31-0000	2016	2017	2018	2019	2020	Total
Healthcare occupations	1	1	2	3	5	12
Nursing, psychiatric, and home health aides	1	1	1	2	3	8
Occupational therapy and physical therapist assistants and aides	0	0	0	0	0	0
Other healthcare support occupations	0	0	1	1	2	4

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Table B2. Doña Ana County Simulated Employment Loss, *Food Preparation and Serving Related Occ.* (2016-2020)

35-0000	2016	2017	2018	2019	2020	Total
Food preparation and serving related occupations	5	16	21	37	46	125
Supervisors of food preparation and serving workers	0	1	2	3	4	10
Cooks and food preparation workers	1	4	5	9	11	30
Food and beverage serving workers	3	9	12	21	26	71
Other food preparation and serving related workers	1	2	2	4	5	14

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Table B3. Doña Ana County Simulated Employment Loss, *Building and Grounds Cleaning and Maintenance Occupations* (2016-2020)

37-0000	2016	2017	2018	2019	2020	Total
Building and grounds cleaning and maintenance occupations	1	2	3	4	5	15
Supervisors of building and grounds cleaning and maintenance workers	0	0	0	0	0	0
Building cleaning and pest control workers	1	1	2	3	4	11
Grounds maintenance workers	0	1	1	1	1	4

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Table B4. Doña Ana County Simulated Employment Loss, *Sales and Related Occupations* (2016-2020)

41-0000	2016	2017	2018	2019	2020	Total
Sales and related occupations	1	2	5	9	12	29
Supervisors of sales workers	0	0	1	1	1	3
Retail sales workers	1	2	4	7	10	24
Sales representatives, services	0	0	0	1	1	2
Sales representatives, wholesale and manufacturing	0	0	0	0	0	0
Other sales and related workers	0	0	0	0	0	0

Note: Amounts are expressed in number of jobs.
Source: Estimates by Hibbs Institute using REMI PI+ V2.1.

Appendix C. Regression Results (All parameters).

Table C1. Regression Results, Period 1 (All parameters)

SOC Code	Occupational Employment Categories	Intercept	Las Cruces	Period 1	Period 1 * Las Cruces
31-0000	Healthcare Support Occupations	3.9008 ***	-0.6032 ***	0.0215	0.0069 *
31-1000	Nursing, Psychiatric, and Home Health Aides	3.4704 ***	-0.4256 ***	-0.0031	0.0308 ***
35-0000	Food Preparation and Serving Related Occupations	4.4731 ***	-0.7221 ***	0.0045	-0.0074 ***
35-2000	Cooks and Food Preparation Workers	3.8614 ***	-0.7551 ***	0.0063	-0.0074 ***
35-3000	Food and Beverage Serving Workers	4.2358 ***	-0.7270 ***	0.0037	-0.0062 ***
35-9000	Other Food Preparation and Serving Related Workers	3.8751 ***	-1.1006 ***	0.0030	0.0015
37-0000	Building and Grounds Cleaning and Maintenance Occupations	3.1975 ***	0.0124 ***	0.0093	-0.0109
37-2000	Building Cleaning and Pest Control Workers	3.0389 ***	0.0274 ***	0.0119	-0.0086
37-3000	Grounds Maintenance Workers	2.7806 ***	-0.2715 ***	0.0034	-0.0015
41-0000	Sales and Related Occupations	4.5528 ***	-0.8298 ***	0.0268 ***	-0.0178 ***
41-2000	Retail Sales Workers	3.8187 ***	-0.2725 ***	0.0302 ***	-0.0295 ***

Note:
*** Statistical Significance at 1% level
** Statistical Significance at 5% level
* Statistical Significance at 10% level
Source: Estimates by Hibbs Institute.

Table C2. Regression Results, Period 2 (All parameters)

SOC Code	Occupational Employment Categories	Intercept	Las Cruces	Period 2	Period 2 * Las Cruces
31-0000	Healthcare Support Occupations	3.9050 ***	-0.5998 ***	0.0099	0.0031
31-1000	Nursing, Psychiatric, and Home Health Aides	3.4671 ***	-0.4189 ***	0.0044	-0.0351
35-0000	Food Preparation and Serving Related Occupations	4.4723 ***	-0.7238 ***	0.0003	0.0091 ***
35-2000	Cooks and Food Preparation Workers	3.8611 ***	-0.7565 ***	-0.0007	0.0106 ***
35-3000	Food and Beverage Serving Workers	4.2345 ***	-0.7284 ***	0.0012	0.0079 **
35-9000	Other Food Preparation and Serving Related Workers	3.8730 ***	-1.1011 ***	0.0102	-0.0063**
37-0000	Building and Grounds Cleaning and Maintenance Occupations	3.1970 ***	0.0123 ***	-0.0015	-0.0288
37-2000	Building Cleaning and Pest Control Workers	3.0369 ***	0.0300 ***	0.0016	0.0415 **
37-3000	Grounds Maintenance Workers	2.7633 ***	-0.2632 ***	-0.0097	0.0355
41-0000	Sales and Related Occupations	4.5604 ***	-0.8327 ***	-0.0143	0.0250 ***
41-2000	Retail Sales Workers	3.8296 ***	-0.2798 ***	-0.0164	0.0425 **

Note:
*** Statistical Significance at 1% level
** Statistical Significance at 5% level
* Statistical Significance at 10% level
Source: Estimates by Hibbs Institute.

End of ***Hibbs Institute* Las Cruces Minimum Wage Report Narrative**

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[41] Jesus Mendoza, M.S. collaborated with the Hibbs research team during the months of March, April and up to May 7th, 2018.

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End of ***Hibbs Institute* Las Cruces Minimum Wage Report #2018-02**