Research

The County-Level Effects of EPA's 2008 Ozone Standards on Employment and Pay

SAM BATKINS, BEN GITIS, DAN GOLDBECK, CURTIS ARNDT | NOVEMBER 5, 2015

Introduction

The Environmental Protection Agency (EPA) recently released a new round of air quality standards for ground-level ozone. The measure lowers the threshold for "nonattainment" status from 75 parts per billion (ppb) to 70 ppb and imposes $1.4 billion in nationwide annual costs. Generally, "nonattainment" counties exceed EPA's threshold for ozone ("smog") pollution. Counties deemed nonattainment must work with their states to devise a State Implementation Plan (SIP) to meet EPA goals. According to EPA, this must, "show how the nonattainment area will attain the primary [ozone] standard 'as expeditiously as practicable,' but no later than within the relevant time frame."

But what are the deeper economic effects? Looking back at the previous standard of 75 ppb, the American Action Forum (AAF) found that even this less stringent threshold reduced total wage earnings, average annual worker pay, and employment. Observed nonattainment counties experienced losses of $56.5 billion in total wage earnings, $690 in pay per worker, and 242,000 jobs between 2008 and 2013.

How EPA Regulates Ozone

Under the Clean Air Act, EPA must set air quality standards for six types of criteria pollutants, including ozone. Ozone regulation can be difficult for states and localities because unlike other pollutants, there is no factory or machine that directly emits ozone; it generally forms as a product of a number of chemical reactions between other pollutants and sunlight. When a particular county has ozone concentrations above EPA's threshold, 75 ppb as of 2008, it is considered a nonattainment area. Affected states and localities must develop a plan to both reduce the amount of ozone in their nonattainment counties as well as manage activities that could contribute to higher ozone levels. There is no one plan or pollution strategy that will allow a state or locality to comply with ozone regulation. In fact, EPA acknowledges there are some "unknown" technologies or strategies that will be required to comply with the most recent standards. Typically, compliance involves a combination of proposals from local governments, review by EPA, and constant monitoring by all jurisdictions to ensure a compliance pathway. Ozone regulation affects virtually every activity that burns fossil fuels.

Since there are so many factors involved in the formation of ozone, a nonattainment designation means that any economic activity involving emissions – including such industries as manufacturing and construction – could face certain operational restrictions. Since nonattainment is generally consistent throughout a county, it is possible that some of these industries could choose to slow hiring and limit raises or move their operations to other nearby counties that do not face such restrictions in order to be more productive and profitable. This study assesses these consequences by examining wage and employment patterns in nonattainment counties, relative to their neighboring attainment counties.

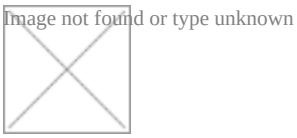
Methodology

In this paper, we study the 2008 Ozone rule, and specifically, its impact on county level labor markets — total wage earnings, average annual worker pay, and total employment. To accomplish this, we compare the 208[1] counties that the EPA deemed in nonattainment (and therefore subject to larger restrictions) to the 234 attainment counties that border nonattainment areas before and after the regulation took effect. As a result, we estimate the impact of the regulation on nonattainment county labor markets relative to labor markets in neighboring attainment counties, which are presumably legally, economically, and socially similar, but were not directly impacted by the rule. In total, we examine 442 counties from 28 states.

Empirical Model

In order to find the relationship between the ozone regulation and total wage earnings, average annual worker pay, and total employment growth in nonattainment counties, AAF performs regression analysis to test the change in the annual growth rates relative to neighboring attainment counties after the regulation was published and went into effect in 2008. For the pre-regulation period, we calculate the compound annual total wage earnings, average annual worker pay, and total employment growth rates from 2004 to 2007. The same is done for the regulation period, which is 2008 to 2013. For each variable, we pool the data from both time periods and use a binary variable to indicate if the regulation is in effect.

Our empirical model is captured in equation 1:



The dependent variable, *Labor Market Growth Rate*$_i$, represents the county level average annual growth rate of total wage earnings, average annual worker pay, or total employment; these data are based on county level wage and employment data found in the Bureau of Labor Statistics' Occupational Employment Statistics.[2] We use three binary variables to indicate whether a county is ever affected by the regulation, whether the regulation is in effect, and the interaction between them. The first binary variable, *Nonattainment*$_i$, equals 0 in both periods if the county is attainment or 1 if it is nonattainment. This variable by itself measures labor market growth in nonattainment counties relative to bordering attainment counties before the regulation took effect. The second binary, *Regulation*$_i$, equals 1 for every county in the period after the regulation took effect, 2008 to 2013, or 0 in the period before the regulation took effect, 2004 to 2007. This variable by itself captures the change in labor market growth in the attainment counties after the regulation took effect. Finally, the interaction term only equals 1 if both conditions, being a nonattainment county and being in the post-regulation period, are satisfied. If it is an attainment county, the pre-regulation period, or both, then the variable equals 0 and it drops from the model.

In this paper, we are interested in the combination of *Nonattainment*$_i$ and the interaction term. The sum of those two variables' estimated coefficients captures the total change in labor market growth rates in nonattainment counties when the regulation took effect relative to the change in bordering attainment counties, which were not impacted by the regulation.

In testing the impact of the regulation on total wage earnings, average annual worker pay, and total employment growth rates, there are plenty of other factors that influence the labor market and need to be held constant. We

include state Freddie Mac House Price Index[3] as a variable to control for the negative macroeconomic labor market trends during the Great Recession. Additionally, we control for the percent of county employment in the services industry,[4] population of each county,[5] and percent of the population with at least a Bachelor's degree [6] to reflect the quality and size of the labor force. Lastly, we include state-level tax rates[7] to control for the effect of state fiscal policy on the labor market. Similar to the employment measurements, we take the compound annual growth rates for each of these variables for before and after the regulation took effect. Finally, we cluster our standard errors to control for any analysis errors that may be correlated with the counties over time as well as potential heteroscedasticity present in our data.

Results

We find that nonattainment status had significant negative effects on total wage earnings, average annual worker pay, and total employment for a county. Table 1 illustrates the results for the impact of the ozone regulation on the labor market in nonattainment counties.

Table 1: Results

Employment Measurements	**Average Marginal Effect†**
Total Wage Earnings	-0.4***
Average Annual Worker pay	-0.3***
Total Employment	-0.1**
**Jointly Significant at the 5% Level	
***Jointly Significant at the 1% Level	
†Average marginal effect of ozone regulation on compound annual growth rate in nonattainment counties	