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Poverty and Labor Force Participation Across Metropolitan Philadelphia

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Poverty and Labor Force Participation Across Metropolitan Philadelphia

Abstract

This study utilizes data drawn from municipalities across the Philadelphia metropolitan area to examine trends in poverty amongst communities. While some research has been done on urban and rural poverty, this paper seeks to fill the gap in literature regarding poverty across the subksnurban and metropolitan landscape. A multiple regression model is specified, so as to provide an in depth analysis of observed trends. The central hypothesis that a relationship exists between poverty and labor force participation is tested and affirmed. The implication of this finding, as well as auxiliary findings, are explored and expanded upon. Recommendations are made for more human focused development strategies to alleviate community poverty.

Keywords

Labor Force Participation, Poverty, Philadelphia, Suburban Poverty, Feminization of Poverty

Cover Page Footnote

I would like to thank and acknowledge my advisers and mentors at Bloomsburg University; in particular Dr. Mehdi Razzaghi of the Math Department, Dr. Saleem Khan, Dr. Carl Smith, Dr. Aberra Senbeta, Dr. Arian Moghadam, Dr. Mehdi Haririan and all of the Economics Department. I also would like to extend a special thank you to Dr. James Brown, Dean of the College of Liberal Arts at Bloomsburg University for all of his support throughout my education, without which I can certainly say I would not be where I am today.

Introduction

The twenty-first century has visibly been a time of prosperity for much of the country. Nowhere has this been more evident than in the revitalization of the nation's once forgotten urban centers. Millions of dollars and a wealth of redevelopment projects have flooded into long neglected urban cores across the country. However, this gentrification has not eliminated the poverty that once existed in cities nationwide. Rather, it has to a great extent shifted the onus of poverty away from the city center and outwards into the once prosperous suburbs that encircle our metropolitan areas.

Further, while the nation's prosperity in this new century has certainly been felt by many, it has not been felt by all. The disillusionment of those left behind in this economic growth is perhaps most acutely reflected in the consistently declining American labor force participation rate ¹. Following a peak in the year 2000, the share of adults ceasing to participate in the American labor force has grown consistently. We are now at low levels of labor force participation that have not been experienced since the 1960's and 1970's (Perez-Arce, Prados & Kohli, 2018, p. 2).

The study at hand examines the factors influencing poverty and the markers of that poverty across the Greater Philadelphia Area. This constitutes the nine county area consisting of Philadelphia, Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania; as well as Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Philadelphia region is of particular interest in that it is a remarkably economically diverse region, embodying the breadth of economic circumstance from extreme poverty to astounding wealth, as well as containing a range of rural, urban, and suburban communities. This paper will utilize a multiple regression model to examine the effects that various indicators have on the poverty rates of municipalities across this region. The working hypothesis that labor force participation and poverty rates are negatively related is tested. Cross sectional data from across the region will be utilized to test the theory that communities with lower labor force participation rates will also experience higher rates of poverty. This paper will also seek to examine and explain various other related trends observed across this metropolitan area.

¹ The labor force is considered to consist of those of the working-age population that are either employed or are seeking employment. The labor force participation rate is the labor force as a share of the total working age population. It bears stating that the unemployed portion of the population is considered to be part of the labor force. Labor force non-participants are solely those who do not seek employment.

Literature review

Poverty and trends in the labor force have long been tied in the minds of theorists. The recession of 2008 undoubtedly had an enormous effect on the labor market. While unemployment rates have since largely recovered, there has been little recovery in labor force participation rates (Perez-Arce, Prados & Kohli, 2018). The factors that have been hypothesized as being markers of poverty, are also viewed as being the same factors that influence an individual's choice to participate in the labor force.

The definition of what constitutes poverty is a subject of debate. Federal definitions are based upon threshold levels of income deemed necessary to purchase a minimal basket of goods. These levels vary further according to the size of the household being examined (Sandoval, Rank & Hirschl, 2009, p. 723). Under this definition, poverty has slowly migrated outwards over the past few decades. While poverty was once considered to largely be an urban or rural phenomena, the year 2000 represented the first time in American history that the largest share of those living in poverty resided in suburban areas (Murphy & Wallace, 2010, p. 1165). This growth in suburban poverty has continued, being exacerbated by the recession of 2008. Since the year 2000, there has been an observed 66% percent increase in suburban poverty ("Beyond the City Limits", 2015). This trend is particularly prominent across the Philadelphia region, where poorer people have left the city as they have been priced out of their former neighborhoods by gentrification ("Beyond the City Limits", 2015).

As was briefly mentioned earlier, poverty and labor force trends are inextricably tied. It has been documented that individuals are often pulled out of the labor force due to health issues that cannot be properly addressed (Richter, Chapman & Mihaylov, 2018, p. 3-4), incarceration or the lingering effects of prior criminal convictions (Perez-Arce, Prados & Kohli, 2018, p. 48), and the responsibilities of child care ("Factors Affecting the Labor Force Participation of People Ages 25-54", 2018). These factors are of particular importance in poor communities, where there are disproportionate percentages of individuals with criminal records, lower health care expenditures, and less disposable income with which to hire outside childcare services. The last of these factors is of particular interest in that it leads to the phenomena dubbed "the feminization of poverty" (Northrop, 1990). This refers to the high proportion of female headed households that fall below federal poverty level thresholds. This is a compound effect of child care demands, which often have the effect of pulling single women out of the labor force, and the observed fact that women more frequently work in the service sector, which is highly susceptible to market volatility (Northrop, 1990, p. 157).

Poverty has long been linked to lower levels of educational attainment (Holliday & Dwyer, 2009, p. 169) and lower quality of housing (Lucy & Phillips, 2000, p. 57). While there has been a wealth of research regarding the various markers of poverty, little has been done in regards to the actual link between poverty and labor force participation. A 1967 paper, focused solely on urban America, established that as poverty increases, lower rates of labor force participation are observed (Mooney, 1967, p. 110). However, there has been little examination of this axiom in the years since.

The study at hand seeks to reexamine the link between poverty and labor force participation, moving the focus away from the urban core, towards the whole of the metropolitan region. This paper will fill the gap in the current body of research regarding the interplay between poverty and the individual decision as to whether to participate in the labor force.

Data Description

All of the data utilized in this study was taken from the Delaware Valley Regional Planning Commission's Municipal Data Navigator database. All of the data is drawn from or based on the results of the 2012-2016 American Community Survey. The ACS is an ongoing survey conducted by the US Census Bureau ("American Community Survey (ACS)", 2019). The data utilized in this paper, as provided by the Delaware Valley Regional Planning Commission, is based on a sample collected over the five year period between 2012 and 2016 ("Census Data", 2016).

The below table of variables includes brief descriptions of the indicator and response variables included in this study:

| Predictor Variables | Description |
|--|---|
| Labor Force Participation Rate | Labor Force Participation Rate represents the percentage of the working age population that is participating in the labor force. Participants in the labor force consist of those who are currently holding a job and those who are currently seeking a job. It is the ratio of those employed and unemployed to the entire working age population. |
| Unemployment Rate | Unemployment Rate represents the percentage of those labor force participants that are not employed, but are actively seeking work. It is ratio of the total number of those who are unemployed to the total number of those in the labor force. |
| Percentage of Housing that is Renter Occupied | This is the percentage of housing units in the municipality that are occupied by renters. |
| Percentage of Housing that is Vacant | This is the percentage of housing units in the municipality that were vacant at the time of the survey. |
| Percentage of Adults with a College Degree | This is the percentage of working age adults that hold some college degree. This considers Associate's degrees, Bachelor's degrees, and Graduate degrees. |
| Percentage of Households headed by a Single Female | This is the percentage of households in the municipality that are headed by an unmarried woman. |
| Response Variable | Description |
| Poverty Rate | The Poverty Rate is the ratio of residents of a municipality that are living below the poverty threshold to the total number of residents of that municipality. The poverty threshold is federally designated by the Census Bureau and is dependent on household size and income. The various criteria in determining what constitutes poverty is beyond the scope of the study at hand. For the purposes of this paper, the Poverty Rate represents the percentage of the total municipal population that lives below the federally set poverty threshold. |

Table 1. Table of variables with descriptions.

Since all of the variables considered were given in the form of percentages and ratios between zero and one, all data was transformed by multiplying all values by 100 so as to work with whole numbers. This was done so as to simplify the interpretation of results. Not all data was provided in its present form. Labor force participation rate needed to be pulled together from the provided markers of number of labor force participants, number of females not participating in the labor force, and the number of males not participating in the labor force. The Unemployment Rate needed to be pieced together from the provided metrics for the number of males employed, the number of females employed, and the total number of labor force participants. The Percentage of Adults with a College Degree needed to be calculated from the various given metrics of number of adults with particular levels of educational attainment. The Percentage of Single Female Headed Households needed to be calculated from the number of single female headed households and the total number of households. Lastly, the Poverty Rate itself was calculated by dividing the total number of residents living below the poverty threshold by the total population of the municipality.

Initially all 353 municipalities in the nine county region being examined were considered. However, several were immediately removed from consideration due to their having incomplete sets of data for examination. Following this elimination, outliers in observations were controlled for. Any municipality that held

an outlier in any of its observed metrics was removed from consideration. For the purposes of this study, an outlier was held to be any observation on any of the indicator variables which was outside of three standard deviations from the mean of that indicator. This control was implemented so as to prevent any outlier observations from exerting undue leverage on the regression. In total, 24 municipalities were removed from consideration due to these controls. After controlling for incomplete data and for outliers, 329 municipalities were left for consideration.

Methodology

The primary objective of this study is to test the hypothesis that labor force participation and poverty rates are negatively related. Based on established economic theory, the following model was selected to be fit to the data at hand. All predictor variables were selected due to their established status as indicators of poverty.

$$Y = \beta_0 + \beta_{\text{Labor Force Participation}} + \beta_{\text{Unemployment}} + \beta_{\text{Renter Occupied Housing}} + \beta_{\text{Vacant Housing}} + \beta_{\text{Education}} + \beta_{\text{Female Household}} + \epsilon$$

Model 1. Regression Model with all predictors included.

Before fitting the model, a scatter plot matrix was created and examined so to validate the assumption of linearity in the model.

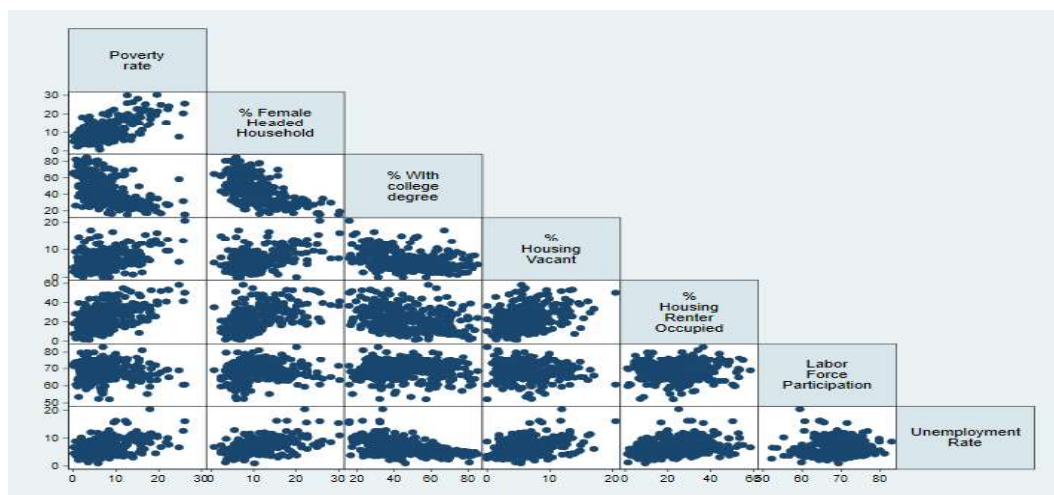


Figure 1. A scatterplot matrix depicting correlation between variables under consideration

Examination reveals that there is no cause to consider the assumption of linearity violated. In fact, immediately apparent upon examination, a strong positive relationship between poverty rate and the percentage of female headed households is apparent. Further visual examination does not provide cause to suspect issues of collinearity between predictor variables. These results, derived visually, were confirmed by checking Variable Inflation Factor values between individual predictor values and the model as a whole. No VIF values were close to the threshold levels that would indicate multicollinearity. Following the assessment of linearity, the model was fit to the prepared data using an OLS regression.

SUMMARY OUTPUT

| Regression Statistics | | | | | | | | |
|-----------------------|--------------|--|--|--|--|--|--|--|
| Multiple R | 0.7632444392 | | | | | | | |
| R Square | 0.582542074 | | | | | | | |
| Adjusted R Square | 0.5747391221 | | | | | | | |
| Standard Error | 3.118984778 | | | | | | | |
| Observations | 328 | | | | | | | |

| ANOVA | | | | | |
|------------|-----|-------------|-------------|-------------|----------------|
| | df | SS | MS | F | Significance F |
| Regression | 6 | 4357.587629 | 726.2646048 | 74.65662769 | 0 |
| Residual | 321 | 3122.7092 | 9.728066043 | | |
| Total | 327 | 7480.296829 | | | |

| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95% | Upper 95% |
|-------------------|----------------|----------------|--------------|----------------|----------------|----------------|----------------|----------------|
| Intercept | 10.53115927 | 2.676715353 | 3.934359048 | 0.000102282034 | 5.265038626 | 15.79727991 | 5.265038626 | 15.79727991 |
| Unemployment F | 0.1400659461 | 0.08058098999 | 1.73820086 | 0.08313433851 | -0.01846761412 | 0.2985995064 | -0.01846761412 | 0.2985995064 |
| Labor Force Part | -0.130832149 | 0.03513840696 | -3.723337518 | 0.000232145259 | -0.1999628057 | -0.06170149226 | -0.1999628057 | -0.06170149226 |
| % Housing Rent | 0.1101623956 | 0.0168818013 | 6.525511915 | 0.00000000264 | 0.07694944962 | 0.1433753415 | 0.07694944962 | 0.1433753415 |
| % Housing Vaca | 0.08693315086 | 0.06111117602 | 1.422540958 | 0.1558402846 | -0.03329585485 | 0.2071621566 | -0.03329585485 | 0.2071621566 |
| % W/ith college c | -0.04512778798 | 0.01411816308 | -3.196434815 | 0.001529819871 | -0.07290360281 | -0.01735197315 | -0.07290360281 | -0.01735197315 |
| % Female Heade | 0.3529685624 | 0.0493161376 | 7.157262909 | 0 | 0.2559448987 | 0.4499922261 | 0.2559448987 | 0.4499922261 |

Table 2. Output from regression model fitting

As is evidenced from the above regression table, the model utilized was able to explain a good deal of variability in the response variable, poverty rate. A modest adjusted R squared value of 0.575 was obtained. The F value of 74.66 is valuable in affirming that the model at hand is statistically significant as a whole. Also apparent, and noteworthy is that all predictors, with the exception of the percentage of housing that sits vacant were found to be significant at the 90% level. To ensure the accuracy of the results obtained, the model and its results need to be analyzed in some detail to ensure adherence to several common regression assumptions.

First, to ensure the accuracy of the model's predictions, tests for homoscedasticity were performed. Plotting the fitted values against their associated residuals provided the following:

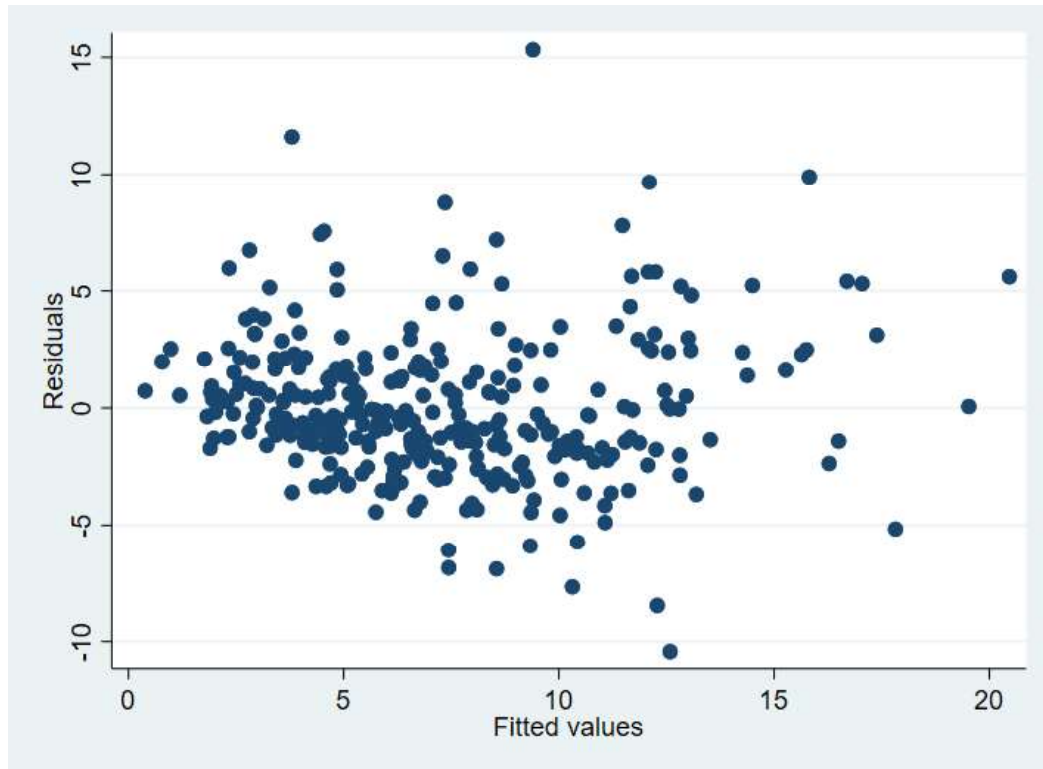


Figure 2. Plot of fitted values against residuals

There does appear to be a pattern present in the above figure. A data set with homoscedastic variance amongst error terms should exhibit much less of a pattern amongst the residuals. The error above looks to potentially illustrate what is called “fanning”, where the variance amongst error values grows larger as the fitted value grows larger. This is suggestive of heteroskedasticity. To confirm the results of this visual inspection, a statistical software package was used to run a Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity. This test takes homoscedasticity as the null hypothesis and heteroskedasticity as the alternative hypothesis. This test returned a chi squared value of 31.05 and a p value of nearly 0. This confirms what was deduced by visual inspection, that the data set at hand exhibits heteroskedasticity. This issue will need to be resolved if we are to trust any predictions or conclusions derived from the model.

In order to resolve the issue of heteroskedasticity, a Poisson transformation was utilized. This simple transformation takes the square root of the response variable Y. The model regression is then run with the predictor variables unchanged.

The new model with the Poisson transformation is:

$$\sqrt{Y} = \beta_0 + \beta_{\text{Labor Force Participation}} + \beta_{\text{Unemployment}} + \beta_{\text{Renter Occupied Housing}} + \beta_{\text{Vacant Housing}} + \beta_{\text{Education}} + \beta_{\text{Female Household}} + \epsilon$$

Model 2. Regression Model with Poisson transformation to address heteroskedasticity.

Fitting the data to this model provided the following regression output:

SUMMARY OUTPUT

Regression Statistics

| | |
|-------------------|--------------|
| Multiple R | 0.7548294815 |
| R Square | 0.5697675461 |
| Adjusted R Square | 0.561725818 |
| Standard Error | 0.5617340551 |
| Observations | 328 |

ANOVA

| | df | SS | MS | F | Significance F |
|------------|-----|-------------|--------------|-------------|----------------|
| Regression | 6 | 134.1408582 | 22.3568097 | 70.85138148 | 0 |
| Residual | 321 | 101.2899927 | 0.3155451487 | | |
| Total | 327 | 235.4308509 | | | |

| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95% | Upper 95% |
|------------------|----------------|----------------|--------------|----------------|----------------|-----------------|----------------|-----------------|
| Intercept | 3.134663541 | 0.4820806374 | 6.5023635 | 0.000000000302 | 2.186226946 | 4.083100136 | 2.186226946 | 4.083100136 |
| Unemployment F | 0.02385163997 | 0.01451276281 | 1.643494095 | 0.1012598106 | -0.00470050312 | 0.05240378306 | -0.00470050312 | 0.05240378306 |
| Labor Force Part | -0.0198351248 | 0.00632848226 | -3.134262528 | 0.001881944206 | -0.03228566461 | -0.007384584996 | -0.03228566461 | -0.007384584996 |
| % Housing Rentr | 0.02042631849 | 0.003040438919 | 6.718213732 | 0 | 0.01444461479 | 0.0264080222 | 0.01444461479 | 0.0264080222 |
| % Housing Vaca | 0.008998429797 | 0.01100621874 | 0.8175768633 | 0.414205245 | -0.01265500289 | 0.03065186248 | -0.01265500289 | 0.03065186248 |
| % With college c | -0.01084531956 | 0.002542703335 | -4.2652713 | 0.000026297524 | -0.01584778742 | -0.005842851703 | -0.01584778742 | -0.005842851703 |
| % Female Head | 0.05575962577 | 0.008881913805 | 6.277884136 | 0.000000001112 | 0.03828551162 | 0.07323373992 | 0.03828551162 | 0.07323373992 |

Table 3. Regression output of Model 2 following Poisson transformation

Following this transformation, the same tests for heteroskedasticity needed to be conducted. First a new plot of the fitted values versus the residuals was generated.

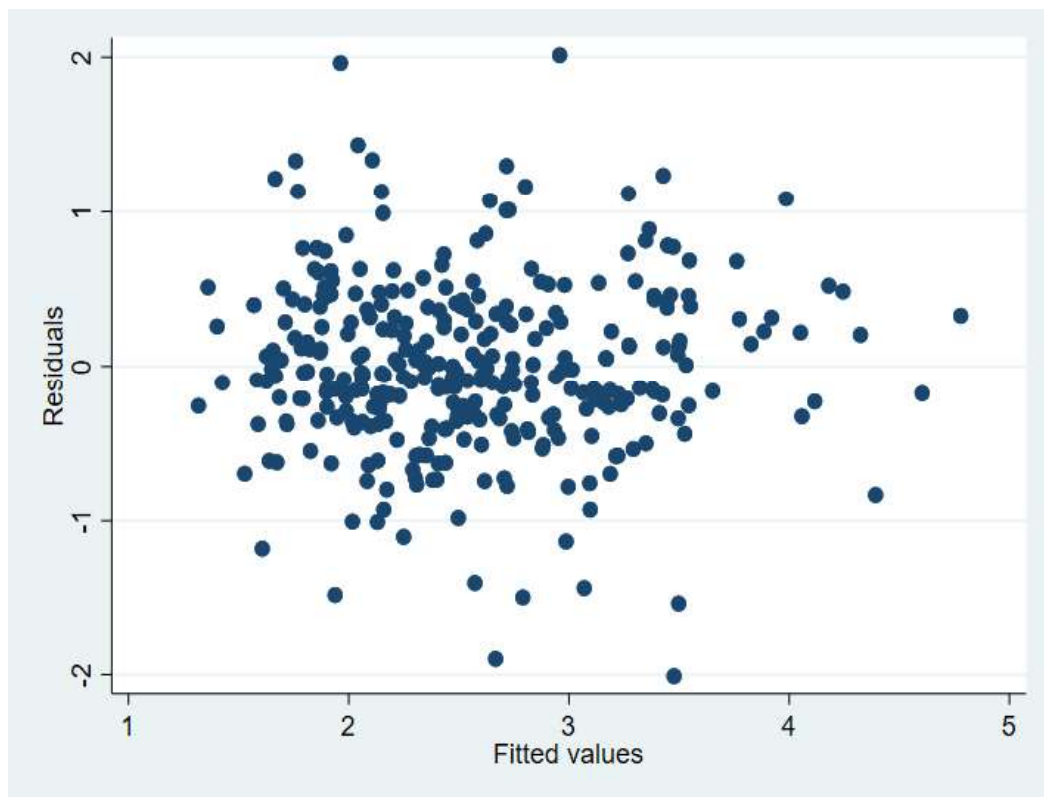


Figure 3. Plot of residuals versus fitted values following Poisson transformation

There is no longer any visual evidence of heteroskedasticity in the error. The error terms seem to be distributed more or less evenly. However, to affirm this result a Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity was deemed necessary. Following the transformation, this test provided a chi squared value of 0.84 with a p value of 0.3586. The null hypothesis of homoscedasticity is not rejected. This issue of heteroscedasticity has been dealt with, and is no longer present in the model.

Next, it was necessary to test the new model for collinearity and to verify the assumption of linearity. Once again a scatter plot matrix was generated for visual inspection.

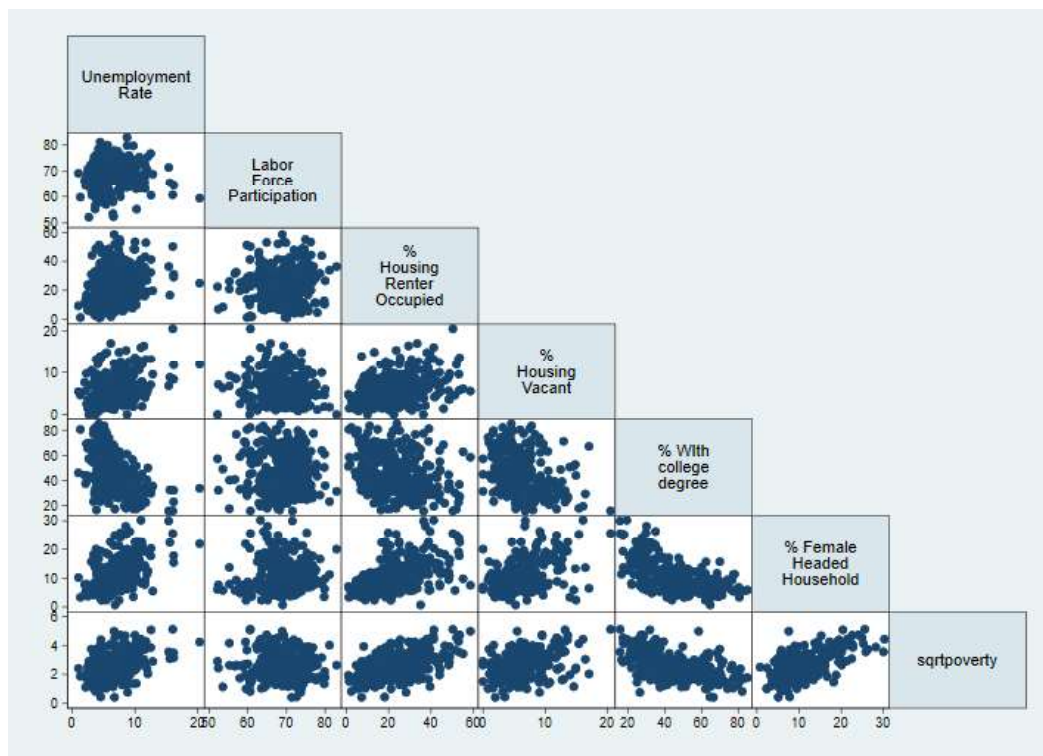


Figure 4. Scatter plot matrix following Poisson transformation

There is strong visual evidence to support the confirmation of the assumption of linearity following the transformation. There still is reasonable visual evidence of the existence of a linear relationship between the predictors and the new square root of the poverty rate response variable. Further, there does not appear to be cause for concern regarding collinearity. There may be some correlation between the variable for female headed households and the other predictors. However, based upon the output of this regression it does not seem as if any potential relationship has enough of an effect on the model to merit concerns over collinearity.

Next, the model was tested for autocorrelation, to verify the assumption of the model exhibiting independent errors. To verify this assumption, first an index plot of standardized residuals was generated.

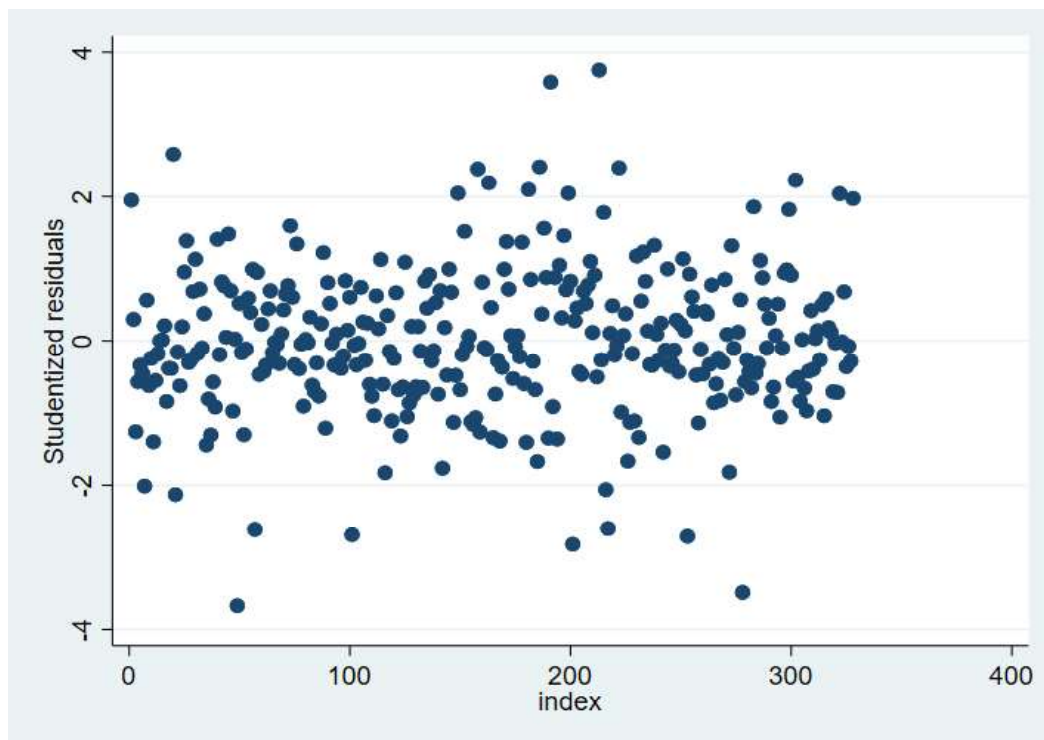


Figure 5. Index plot of standardized residuals

The above figure shows residuals more or less evenly distributed around the zero line. To confirm what has been deduced from the visual observation, a statistical software package was used to perform a Durbin-Watson test for autocorrelation. Under this test, the null hypothesis of no autocorrelation is considered along with an alternative hypothesis of some autocorrelation. For our purposes a lower limit of 1.707 and an upper limit of 1.831 were considered. The statistical software output a test value of 2.1815. As such, the null hypothesis is not rejected. There is no evidence of autocorrelation. This has affirmed what was observed in Figure 5.

Lastly, a plot of normalized residuals squared against leverage values was generated to verify that earlier controls were successful in preventing any observations from having excessive influence on the regression.

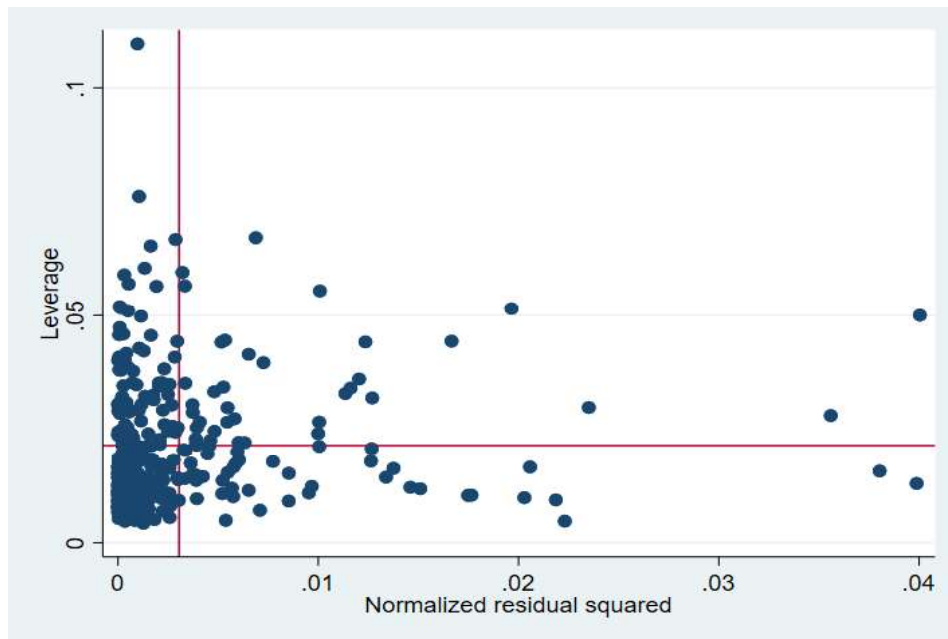


Figure 6. Leverage-Residual Plot

The leverage-residual plot did not show any observations with excessive leverage values, and as such there does not appear to be any observations that exert an excessive influence on the model.

The overarching question of the research at hand is whether labor force participation is related to poverty rates. To test this the following hypotheses were considered:

$$H_0 : \beta_{\text{Labor Force Participation Rate}} = 0$$

$$H_1 : \beta_{\text{Labor Force Participation Rate}} \neq 0$$

As seen in the regression output in Table 3, the t value for $\beta_{\text{Labor Force}}$ and the null hypothesis above is equal to 3.13. As such, when compared to t values at 90%, 95%, and 99% significance levels, the null hypothesis is rejected. As such, it can be stated with 99% certainty that labor force participation is in fact related to poverty. This relationship, as well as the other relationships made apparent in this study will be discussed in the following section.

Discussion

The study at hand was successful in reaffirming the conclusions Dr. Mooney derived in 1967 (Mooney, 1967). A negative relationship does exist between poverty and labor force participation rates. Whereas Mooney limited the scope of his analysis to the impoverished urban cores or his era, this study has demonstrated that this in fact holds true amongst rural and suburban communities as well.

While the Poisson transformation makes interpretation of the results slightly more labor intensive, algebraic transformations and plugging in values allow for us to isolate and quantify the impact individual variables are able to have on the model. It is observed that when all other considered factors are held constant, each percentage point increase in labor force participation, will decrease poverty rates by nearly 0.13. Likewise, each point decrease in labor force participation will have an effect of the same magnitude in the opposite direction, increasing poverty. Significant changes in a community's poverty level can be had through enticing labor force non-participants to take an active role in seeking employment.

Also of interest is the conclusion that the percentage of vacant housing in a community is not a significant predictor of a community's poverty level. While images of boarded up and abandoned housing units are prevalent in media depictions of impoverished neighborhoods, this finding is not as counterintuitive as it appears at first glance. Lower purchasing and bargaining power in lower income communities may drive impoverished residents to effectively "settle" and occupy housing of a lower standard that would otherwise sit vacant in higher income communities with higher purchasing power. Not surprisingly, renter occupied housing was found to have a highly significant relationship with poverty levels. This conclusion is supported by a wealth of literature. A recent Department of Housing and Urban Development study that found only 50.9% of very-low income households owned their home. This is compared to 87.7% of high income households that are homeowners ("Homeownership Gaps Among Low-Income and Minority Borrowers and Neighborhoods", 2005, p. vii).

Unemployment rates were found to be significant to the model at the 90% level. Unsurprisingly, they move in tandem with poverty rates, showcasing a positive relationship. The magnitude of this factor's impact is slightly greater than that of labor force participation, but acts in the opposite direction. A community with a high rate of unemployment alongside a low labor force participation rate would face a doubly heightened risk of high poverty levels.

Another interesting conclusion of this study is the confirmation of the existence of the so-called "feminization of poverty". Not only did this factor exhibit the second highest t value of the study, indicating a very high significance, it also

shows the highest beta coefficient value. This indicates that this is in fact the most accurate predictor of a community's poverty level of those factors considered. With all other factors held constant an increase of one percentage point in the total percentage of single female headed households, can be seen to increase the poverty level of a community by 0.37 percentage points. This gives more ammunition towards confirmation of the work by Emily Northrop (1990), and the various other studies that have followed in her footsteps. Across the Philadelphia region, poverty increasing has a female face.

Conclusion and Policy Recommendations

The paper at hand has sought to fill an existing gap in the body of research regarding the effect in which labor force participation has on poverty rates. It has been demonstrated that a strong negative relationship exists between the two variables. Perhaps the most striking conclusion to be drawn is that labor force participation has a more statistically significant relationship with poverty than does unemployment (which came in at the threshold of 90% significance). This implies that the alienating factors that can cause an individual to abandon the workforce share a stronger link with poverty than does the long associated problems behind an inability to find work. It bears stating that this relationship has only been demonstrated as valid across the Philadelphia region, and these results possibly would not be replicated elsewhere.

However, the Philadelphia metropolitan area does offer a decent approximation of the breadth and range of economic, demographic, and social circumstances that exist across the United States. In that regard, the Delaware Valley Region can be viewed as a microcosm of the greater trends existent across the nation. Future studies could focus on replicating these same results and methods with a greater nationwide scope. Further, examination of the time series of the examined trends may also prove valuable in future research.

Any policy aimed at minimizing the poverty present in today's metropolitan areas would do well to consider the human aspects of economic development, addressing those factors that may cause some to leave the labor force. This paper has posited evidence that individual human capital and human development related factors, including educational level, single mother parenthood, and health status, are key determinant factors in the wellbeing of a community as a whole (as measured by its poverty level). Addressing the issues related to these factors would allow for a more productive and engaged workforce, increasing the wellbeing of the community as a whole.

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