**PROPOSAL**

Kenny Norman

Hypothesis: I believe that wage growth is best explained not by the total unemployment rate, but by the composition of the unemployed. I believe that when the percentage of short term unemployment is high, wage growth will also be high due to the wage pressure exerted by those who can quickly find new jobs. In the opposite scenario, wage growth will be low even if total unemployment is low due to the lack of wage pressure exerted by those who cannot quickly find a new job. I believe that this can be used as an explanation for the lack of inflation in the US economy following the Great Recession, as a historically high percentage of long term unemployment in the labor force held down wage growth even though total unemployment fell below 4%.

Wage Growth = B1 + B2 Short – B3Total + B4 Productivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable Name | Definition | Source | Expected Sign | Statistical Significance | Practical Significance |
| Wage Growth | The percent of the change of employees’ compensation shows the wage growth from the previous year. | (Non farm business sector: real compensation per hour) |  |  |  |
| Short Term Unemployment | The percentage of the total unemployed who have been unemployed for 5 or less weeks. A higher percentage of these workers should spell higher inflation because this would show a demand for employment, meaning that pressure on wages and prices throughout the economy are high. | Fred (Of Total Unemployed, Percent Unemployed Less than 5 Weeks) | + | Yes | I expect this variable to show a practically significant relationship between these two variables where when short term unemployment rates are high, so too is inflation. |
| Total Unemployment Rate | The total percentage of the labor force that is unemployed. This is the Phillips Curve definition of the main variable that explains inflation. | Fred (Civilian Unemployment Rate) | - | Yes | I expect this variable to be practically significant and to confirm the Phillips Curve; as total unemployment changes inflation reacts inversely. If my hypothesis is correct, this, while still significant, should be less so than short term unemployment. |
| Minimum Wage | The minimum hourly wage that an employer can pay an employee in the United States | Fred  100 \* (Federal Minimum Hourly Wage for Nonfarm Workers for the United States, May 2015 = 100/Consumer Price Index for all Urban Consumers; All Items, May 2015 = 100) |  | No | I do not expect this to be a significant variable because I do not believe that over the long run minimum wage has an impact on wage growth. While some argue that minimum wage increases will require employers to increase wages in periods when they occur, and this can spur wage pressure, I do not believe that this will prove true. Using real minimum wage data, I expect to show that real minimum wage does not explain wage growth. |
| Productivity | The percent change in output levels in nonfarm business sectors measured through real output per hour of all persons. | Fred (Nonfarm Business Sector: Real Output Per Hour of All Persons (% change from past year)) | + | Yes | I believe that this should be a practically significant variable, as productivity is a cause of wage growth. However, I do not know if this is a good way to quantify it. |
| Immigration | The percent change of the total number of legal immigrants to the US by year since the early 1800s | MPI (Migration Policy Institute)  (https:// [www.migrationpolicy.org](http://www.migrationpolicy.org) /programs/data-hub/charts/Annual-Number-of-US-Legal-Permanent-Residents) |  | No | Some have suggested that changes in net migration has been a cause of slow wage growth, as increases in migration increase the number of workers searching for low skill jobs. I do not believe this will be the case. |

**ECONOMETRICS PROJECT**

Kenny Norman

**INTRO**

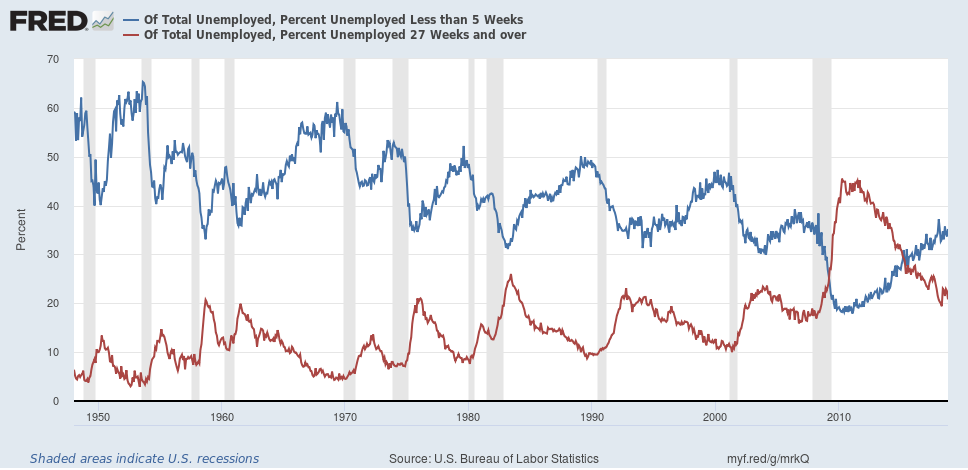
I believe that wage growth is better explained by the composition of the unemployed, not by the total unemployment rate. When the percentage of short-term unemployment is high, wage growth will also be high due to the wage pressure exerted by those who can quickly find new jobs. In the opposite scenario, wage growth will be low even if total unemployment is low due to the lack of wage pressure exerted by those who cannot quickly find a new job. I believe that this can be used as an explanation for the lack of inflation in the US economy following the Great Recession, as historically low percentages of short-term unemployment and historically high percentages of long-term unemployment in the labor force held down wage growth even though total unemployment fell below 4%.

I am testing this hypothesis because I believe that this can be used as an explanation for the lack of expected inflation in the years following the Great Recession. In these years, unemployment dropped from its peak of 10% to recent lows of 3.7%. The unemployment rate has not been this low since 2000, but inflation has not increased at the rate that this drop in unemployment suggests it should. A potential cause of this lack in inflationary pressure since the Great Recession was the shifting composition of the unemployed.

Rates of long-term unemployment, defined as an unemployed worker who is jobless for 27 weeks or more, and short-term unemployment, defined as an unemployed worker who is jobless for 5 weeks or less, will be tested as explaining factors of wage growth. Short term unemployed workers drive wage growth because they can quickly find a new job. An economy with a high percentage of short term unemployment should see increased wage pressure and a strong labor market. This economy will see workers who can quickly find a new job after leaving their old one, and will see higher levels of bargaining power, lower levels of insecurity, and a higher quit rate because of the prospect of a better opportunity at another job.

On the other hand, long term unemployed workers do not drive wage growth. An economy with a high percentage of long term unemployment should see decreased wage pressure and a weak labor market. This economy will see workers who cannot quickly find a new job after leaving their old one, usually after layoffs or other ways of being let go. Long term unemployed workers are detached from the labor force; they are viewed as less desirable job candidates by employers for reasons such as a perceived lack of motivation, a fear of skill erosion, and the physiological concern that there must be a reason someone has not hired them over the duration of their unemployment. Workers in this economy will have little bargaining power and high levels of insecurity, and will not be able to demand higher salaries and drive wage growth.

Because of these factors, the duration of average unemployment should be an important cause of wage growth, and I believe that it will be an even more significant cause than the total unemployment rate is. The short-term and long-term variables are not tested together because throughout the time that they have been recorded, they have moved almost exactly inverse to the other.



To test this hypothesis, six variables will be used:

Wage growth (wageGrowth), the dependent variable, tests the percent change of real compensation in all non-farm industries. This data is the annual percent change of the FRED data series “Non farm business sector: real compensation per hour”.

Short term unemployment (shortRun) is the percentage of all unemployed workers who have been unemployed for 5 weeks or fewer. This data was taken from the FRED data series “Of Total Unemployed, Percent Unemployed Less than 5 Weeks”.

Total unemployment rate (total) is the total measure of unemployment in the US. This data was taken from the FRED data series “Civilian Unemployment Rate”.

Minimum wage (minimumWage) is the percent change of the real US minimum wage from the previous year. It was calculated by dividing the FRED data series “Federal Minimum Hourly Wage for Nonfarm Workers for the United States, May 2015 = 100” by the FRED data series “Consumer Price Index for all Urban Consumers; All Items, May 2015 = 100”, and multiplying the result by 100. After the yearly real minimum wage was calculated, the percent change from the previous year was calculated as well.

Productivity (productivity) is the percent change of the real output of all nonfarm products from the previous year. This data is the annual percent change of the FRED data series “Nonfarm Business Sector: Real Output Per Hour of All Persons”.

Immigration (immigration) is the percent change in the amount of legal immigrants to the US from the past year. This data is the annual percent change of the Migration Policy Institute data series “Annual Number of U.S. Legal Permanent Residents, Fiscal Years 1820-2016”.

All data sets used for this project begin in 1948, the first year the percentage of short term unemployment was available, and end in 2016, the final year immigration data was available.

Wage growth, short term unemployment, and total unemployment were all chosen as variables to test the hypothesis that the percentage of short term unemployment better explains wage growth than does the total unemployment rate. Real minimum wage was chosen as a variable because some economists and politicians argue that an increase in minimum wages will both strengthen the economy and allow for better living conditions amongst those who must work a minimum wage job. This can be quantified by testing real minimum wage changes’ impacts on wage growth. Productivity was chosen as a variable because productivity increases are a cause of increasing wage growth. Immigration was chosen as a variable because some politicians argue that an increase in immigration harms Americans because it increases the number of workers competing for minimum wage jobs, leading to higher unemployment and job losses for Americans. This can be tested by measuring changes on wage growth caused by changes in immigration.

**REGRESSION 1**

(APPROVED): Wage Growth = B1 + B2 Short – B3Total + B4 minimumWage + B5 Productivity

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | total, minimumWage, newImmigrants, productivity, shortRunb | . | Enter |
| a. Dependent Variable: wageGrowth | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .705a | .497 | .457 | 1.12622 |
| a. Predictors: (Constant), total, minimumWage, newImmigrants, productivity, shortRun | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 78.836 | 5 | 15.767 | 12.431 | .000b |
| Residual | 79.907 | 63 | 1.268 |  |  |
| Total | 158.743 | 68 |  |  |  |
| a. Dependent Variable: wageGrowth | | | | | | |
| b. Predictors: (Constant), total, minimumWage, newImmigrants, productivity, shortRun | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | -.158 | 1.446 |  | -.110 | .913 |
| shortRun | .041 | .020 | .258 | 2.023 | .047 |
| total | -.166 | .121 | -.175 | -1.374 | .174 |
| minimumWage | .029 | .013 | .218 | 2.250 | .028 |
| productivity | .450 | .096 | .445 | 4.687 | .000 |
| newImmigrants | -.008 | .007 | -.108 | -1.156 | .252 |
| a. Dependent Variable: wageGrowth | | | | | | |

Wage Growth = -.158 + .041Short + .029minimumWage + .45Productivity

This is the main regression containing all of the independent variables. The independent variables form a model than can explain about half of wage growth in America. The r squared is .497, meaning that in between the years 1948 and 2016, 49.7% of wage growth was explained by short-term unemployment, total unemployment, minimum wage, and productivity. The fact that the adjusted rsquared value of .457 is close to the actual r squaredvalue signifies that this is an accurate measure of r squared.

Only one of the main variables proved to be insignificant; immigration. For the theory that immigration can economically harm Americans to be true, this variable would have needed to be both significant and have a coefficient with a negative sign. This would show that increases in immigration result in declining wage growth. Since the variable is insignificant, changes in immigration rate do not affect wage growth and the sign, although negative, should not be interpreted. Although total unemployment is also insignificant here, this can be explained by multicollinearity between short-term unemployment percentage and total unemployment rate. Further tests prove total unemployment to be a significant variable in determining wage growth.

The parameters of the significant variables in this regression have practical significance as well. These results suggest that a single unit change in short run unemployment, real minimum wages, or productivity will result in respective changes of .041, .029, or .45 in wage growth. The explanation of the higher coefficient of productivity when compared to the other two variables is that it has a much smaller range. This smaller range means that the variable usually changes at a slower rate than variables with larger ranges, so equivalent changes in all variables will be affected in the dependent more heavily by this change. Productivity has a range of 8.28, while short-term unemployment and real minimum wage have ranges of 43.48 and 92.88 respectively. For future reference, the range of total unemployment is 6.78. Also, all the signs appeared in these results as expected.

MULTICOLLINEARITY

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | | |
|  | | wageGrowth | shortRun | total | minimumWage | productivity | newImmigrants |
| Pearson Correlation | wageGrowth | 1.000 | .408 | -.397 | .354 | .551 | .006 |
| shortRun | .408 | 1.000 | -.711 | .029 | .079 | .155 |
| total | -.397 | -.711 | 1.000 | -.059 | -.090 | -.137 |
| minimumWage | .354 | .029 | -.059 | 1.000 | .319 | .223 |
| productivity | .551 | .079 | -.090 | .319 | 1.000 | .003 |
| newImmigrants | .006 | .155 | -.137 | .223 | .003 | 1.000 |

DEPENDENT = SHORT RUN

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigrants, productivity, total, minimumWageb | . | Enter |
| a. Dependent Variable: shortRun | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .714a | .510 | .480 | 6.96716 |
| a. Predictors: (Constant), newImmigrants, productivity, total, minimumWage | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 3238.197 | 4 | 809.549 | 16.678 | .000b |
| Residual | 3106.642 | 64 | 48.541 |  |  |
| Total | 6344.839 | 68 |  |  |  |
| a. Dependent Variable: shortRun | | | | | | |
| b. Predictors: (Constant), newImmigrants, productivity, total, minimumWage | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 65.570 | 3.579 |  | 18.318 | .000 |
| total | -4.213 | .532 | -.702 | -7.914 | .000 |
| minimumWage | -.029 | .079 | -.035 | -.373 | .711 |
| productivity | .170 | .594 | .027 | .287 | .775 |
| newImmigrants | .033 | .045 | .066 | .731 | .467 |
| a. Dependent Variable: shortRun | | | | | | |

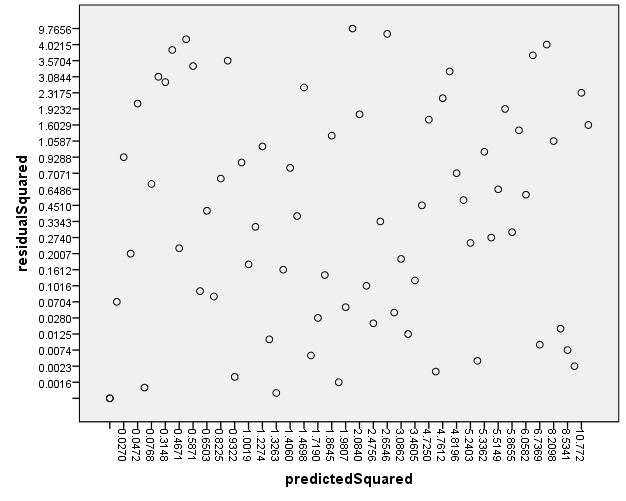
DEPENDENT = PRODUCTIVITY

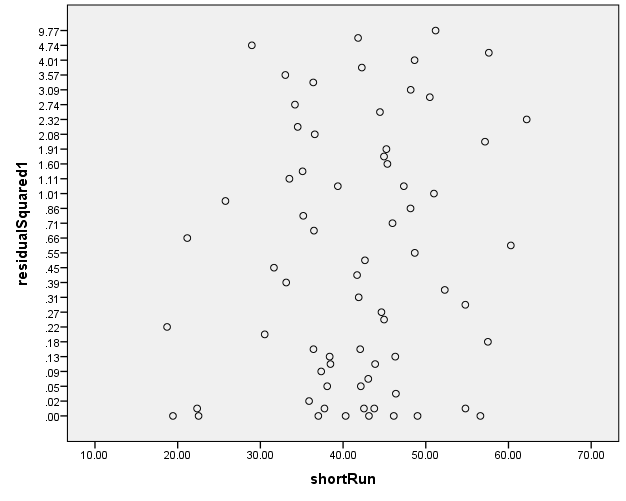
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| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .338a | .114 | .059 | 1.46541 |
| a. Predictors: (Constant), shortRun, minimumWage, newImmigrants, total | | | | |

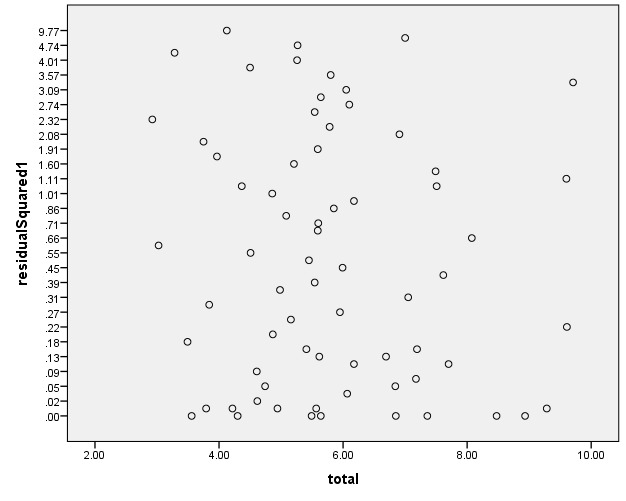
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 17.699 | 4 | 4.425 | 2.061 | .096b |
| Residual | 137.436 | 64 | 2.147 |  |  |
| Total | 155.135 | 68 |  |  |  |
| a. Dependent Variable: productivity | | | | | | |
| b. Predictors: (Constant), shortRun, minimumWage, newImmigrants, total | | | | | | |

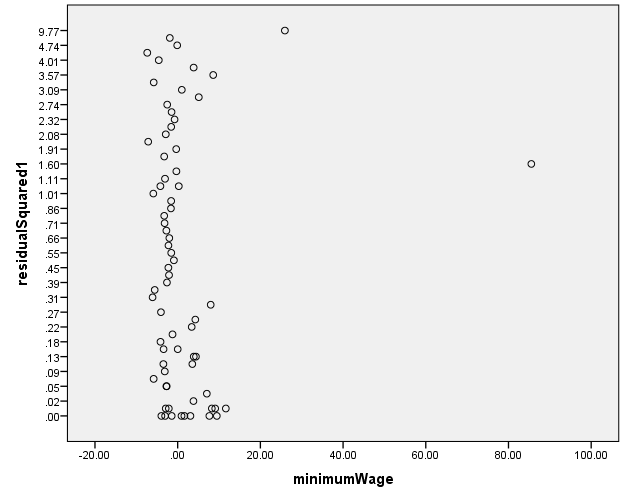
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 2.096 | 1.863 |  | 1.125 | .265 |
| total | -.045 | .157 | -.048 | -.285 | .776 |
| minimumWage | .043 | .016 | .333 | 2.760 | .008 |
| newImmigrants | -.007 | .009 | -.086 | -.701 | .486 |
| shortRun | .008 | .026 | .048 | .287 | .775 |
| 1. Dependent Variable: productivity   These tests show a significant amount of multicollinearity present between short run unemployment and total unemployment. Their Pearson table coefficient (all Pearson table values will be discussed in absolute value terms) of .711 is well above the value of .6 that indicates multicollinearity. Also, when short term unemployment was run as the dependent variable, total unemployment proved statistically significant. This shows clear multicollinearity between the two variables. This problem was expected, and will be corrected by running two further regressions with this main data; one with total unemployment as the main independent variable and one with short term unemployment as the main independent variable. These regressions will give a better measure of how both variables independently affect wage growth.  It should also be noted that productivity and minimum wage are co-linear. Although their Pearson table coefficient of .551 does not necessarily indicate multicollinearity, when productivity is tested as the dependent variable, minimum wage proves significant. Despite these two variable’s multicollinearity, neither are insignificant in the main regression. For this reason, this multicollinearity is not accounted for in the following regressions. | | | | | | |

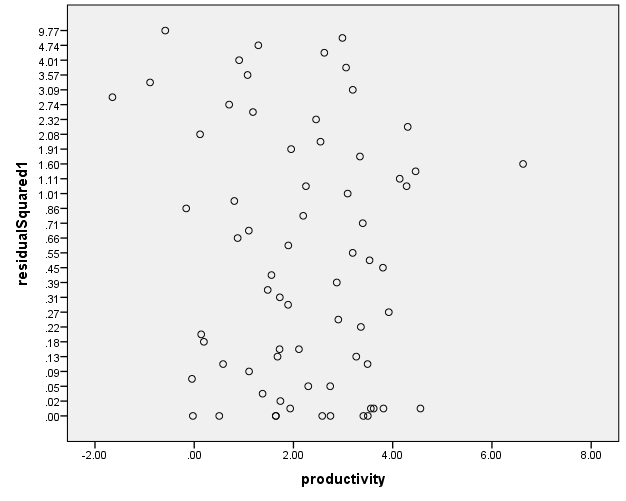
HETEROSCEDASTICITY

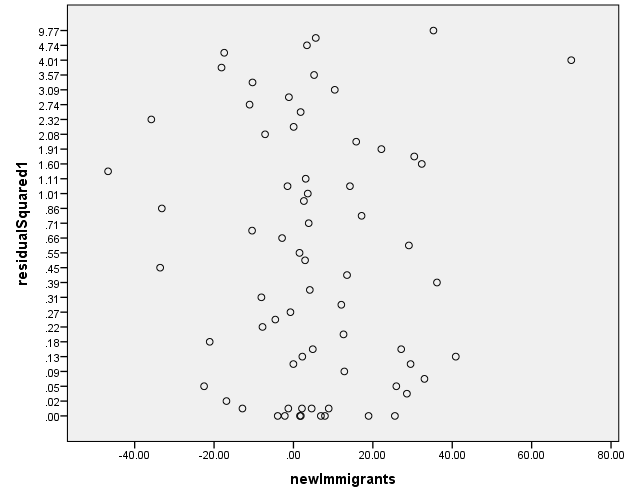












|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | productivity, newImmigrants, total, minimumWage, shortRunb | . | Enter |
| a. Dependent Variable: Unstandardized Residual | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .000a | .000 | -.079 | 1.12621905 |
| a. Predictors: (Constant), productivity, newImmigrants, total, minimumWage, shortRun | | | | |

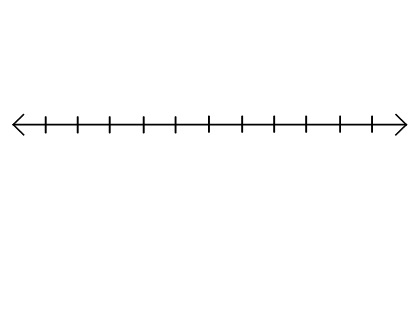
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .000 | 5 | .000 | .000 | 1.000b |
| Residual | 79.907 | 63 | 1.268 |  |  |
| Total | 79.907 | 68 |  |  |  |
| a. Dependent Variable: Unstandardized Residual | | | | | | |
| b. Predictors: (Constant), productivity, newImmigrants, total, minimumWage, shortRun | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 9.847E-16 | 1.446 |  | .000 | 1.000 |
| total | .000 | .121 | .000 | .000 | 1.000 |
| minimumWage | .000 | .013 | .000 | .000 | 1.000 |
| newImmigrants | .000 | .007 | .000 | .000 | 1.000 |
| shortRun | .000 | .020 | .000 | .000 | 1.000 |
| productivity | .000 | .096 | .000 | .000 | 1.000 |
| a. Dependent Variable: Unstandardized Residual | | | | | | |

This regression shows no signs of heteroscedasticity. After obtaining the value of the residuals and running a regression to test the residual as the dependent variable, the results of this regression were an r squared of zero and a significance level of 1 for every independent variable.

AUTOCORRELATION (X = 5, N = 69)

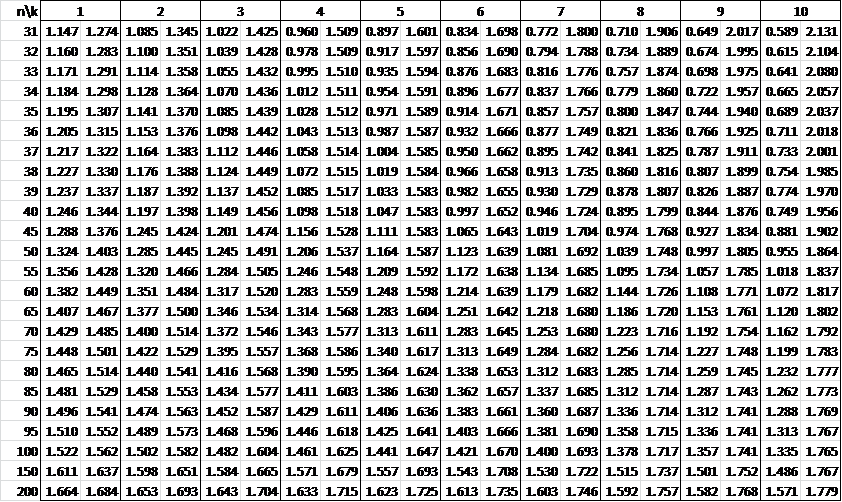
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .705a | .497 | .457 | 1.12622 | 1.733 |
| a. Predictors: (Constant), newImmigrants, productivity, total, minimumWage, shortRun | | | | | |
| b. Dependent Variable: wageGrowth | | | | | |



0 1 2 3 4

dL= 1.313 1.733 2.687

dU= 1.611 2.389



This regression does not show any signs of autocorrelation. The Durbin-Watson coefficient of 1.733 falls in between the upper coefficient for five variables and 69 observations, 1.611, and 2.

**REGRESSION 2**

wageGrowth = B1 - B2 total + B3productivity + B4 minimumWage

To test the hypothesis that the percentage of short-term unemployment better explains wage growth than total unemployment rate does, two more regressions will be run. This regression will test total unemployment rate, without short-term unemployment, along with the other three independent variables, and the following regression will test short-term unemployment, without total unemployment rate. If my hypothesis is correct, the third regression should have a higher r squared than this one. These regressions solve for the problem of multicollinearity by eliminating one of the collinear variables from each regression.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigrants, productivity, total, minimumWageb | . | Enter |
| a. Dependent Variable: wageGrowth | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .681a | .464 | .430 | 1.15310 | 1.690 |
| a. Predictors: (Constant), newImmigrants, productivity, total, minimumWage | | | | | |
| b. Dependent Variable: wageGrowth | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 73.646 | 4 | 18.412 | 13.847 | .000b |
| Residual | 85.097 | 64 | 1.330 |  |  |
| Total | 158.743 | 68 |  |  |  |
| a. Dependent Variable: wageGrowth | | | | | | |
| b. Predictors: (Constant), newImmigrants, productivity, total, minimumWage | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 2.521 | .592 |  | 4.256 | .000 |
| total | -.339 | .088 | -.356 | -3.842 | .000 |
| minimumWage | .028 | .013 | .209 | 2.107 | .039 |
| productivity | .457 | .098 | .452 | 4.652 | .000 |
| newImmigrants | -.007 | .007 | -.091 | -.953 | .344 |
| a. Dependent Variable: wageGrowth | | | | | | |

wageGrowth = 2.521 - .339total + .457 productivity + .028minimumWage

These independent variables form a model than can explain 46.4% of wage growth between 1948 and 2016. The proximity of the r squared and adjusted r squared values indicate that this is an accurate measure of r squared.

Again, immigration proved to be an insignificant variable. Multicollinearity exists again between productivity and minimum wage, but does not cause either variable to become insignificant.

The parameters of the significant variables in this regression have practical significance as well. These results suggest that a single unit change in total unemployment, real minimum wages, or productivity will result in respective changes of -.339, .028, or .457 in wage growth. The variations in the size of the coefficients can be again explained by the differences in ranges of the data. In addition, all the signs appeared as expected in these results.

MULTICOLINEARITY

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | |
|  | | wageGrowth | total | minimumWage | productivity | newImmigrants |
| Pearson Correlation | wageGrowth | 1.000 | -.397 | .354 | .551 | .006 |
| total | -.397 | 1.000 | -.059 | -.090 | -.137 |
| minimumWage | .354 | -.059 | 1.000 | .319 | .223 |
| productivity | .551 | -.090 | .319 | 1.000 | .003 |
| newImmigrants | .006 | -.137 | .223 | .003 | 1.000 |

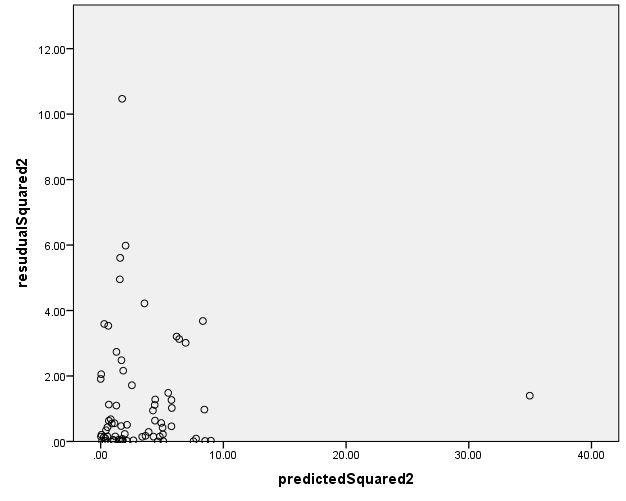
DEPENDENT = PRODUCTIVITY

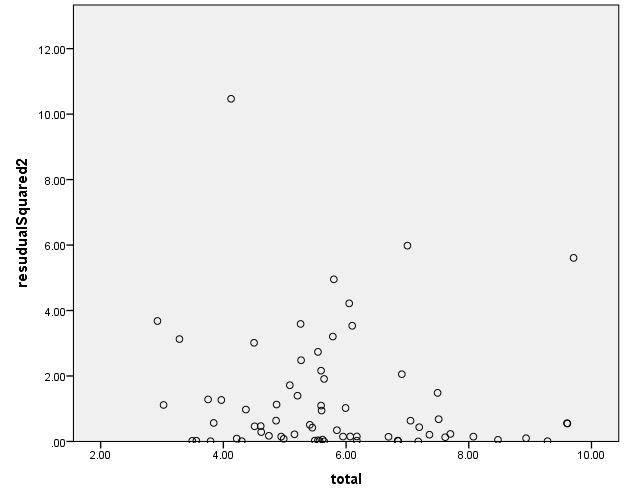
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .336a | .113 | .072 | 1.45503 |
| a. Predictors: (Constant), newImmigrants, total, minimumWage | | | | |
| b. Dependent Variable: productivity | | | | |

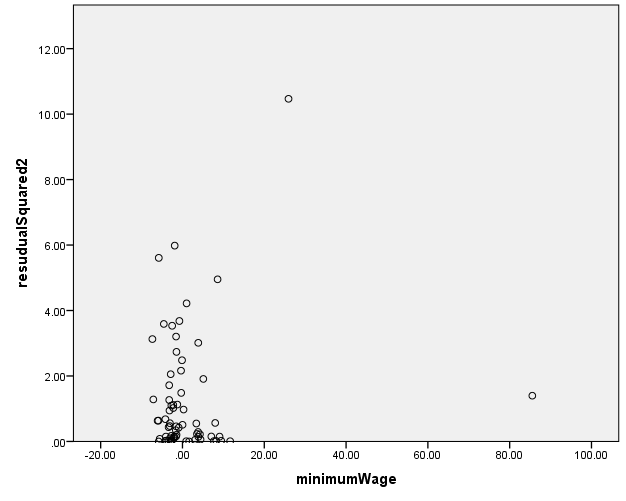
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 2.594 | .675 |  | 3.843 | .000 |
| total | -.077 | .111 | -.082 | -.693 | .491 |
| minimumWage | .043 | .016 | .332 | 2.771 | .007 |
| newImmigrants | -.006 | .009 | -.082 | -.683 | .497 |
| a. Dependent Variable: productivity | | | | | | |

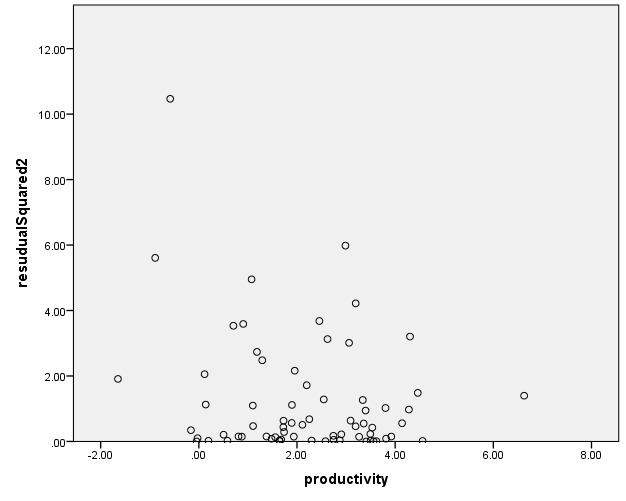
As expected, removing one of the unemployment variables solved the multicollinearity problem in the main regression. Total unemployment is now a significant variable. There again exists a certain amount of multicollinearity between productivity and minimum wage growth, but neither experiences enough to become an insignificant variable.

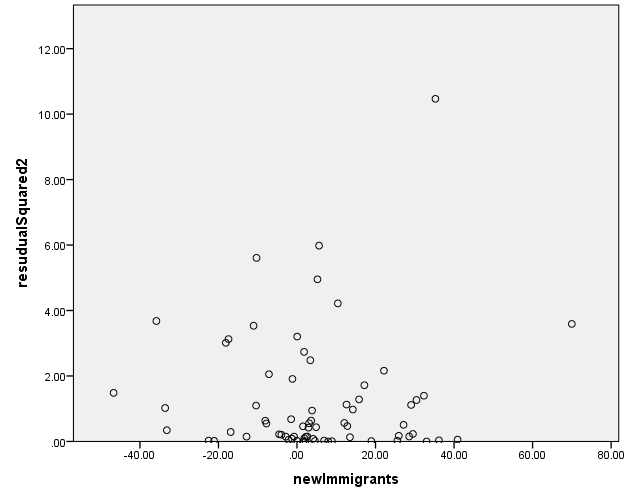
HETEROSCEDASTICITY











|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | productivity, newImmigrants, total, minimumWageb | . | Enter |
| a. Dependent Variable: residual2 | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .000a | .000 | -.063 | 1.15310 | 1.690 |
| a. Predictors: (Constant), productivity, newImmigrants, total, minimumWage | | | | | |
| b. Dependent Variable: residual2 | | | | | |

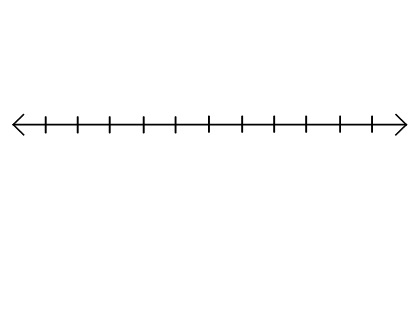
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .000 | 4 | .000 | .000 | 1.000b |
| Residual | 85.097 | 64 | 1.330 |  |  |
| Total | 85.097 | 68 |  |  |  |
| a. Dependent Variable: residual2 | | | | | | |
| b. Predictors: (Constant), productivity, newImmigrants, total, minimumWage | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | -3.186E-16 | .592 |  | .000 | 1.000 |
| total | .000 | .088 | .000 | .000 | 1.000 |
| minimumWage | .000 | .013 | .000 | .000 | 1.000 |
| newImmigrants | .000 | .007 | .000 | .000 | 1.000 |
| productivity | .000 | .098 | .000 | .000 | 1.000 |
| a. Dependent Variable: residual2 | | | | | | |

This regression shows no signs of heteroscedasticity. After obtaining the value of the residuals and running a regression to test the residual as the dependent variable, the results of this regression were an r squared of zero and a significance level of 1 for every independent variable.

AUTOCORRELATION (X = 4, N = 69)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .681a | .464 | .430 | 1.15310 | 1.690 |
| a. Predictors: (Constant), productivity, newImmigrants, total, minimumWage | | | | | |
| b. Dependent Variable: wageGrowth | | | | | |



0 1 2 3 4

dL= 1.343 1.690 2.657

dU= 1.577 2.423

This regression does not show any signs of autocorrelation. The Durbin-Watson coefficient of 1.690 falls in between the upper coefficient for 4 variables and 69 observations, 1.577, and 2.

**REGRESSION 3**

wageGrowth = B1 + B2 shortRun + B3productivity + B4 minimumWage

This regression tests short run unemployment as the main independent variable instead of total unemployment. If my hypothesis is correct, this regression should have a higher r squared than the previous regression.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigrants, productivity, shortRun, minimumWageb | . | Enter |
| a. Dependent Variable: wageGrowth | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .694a | .482 | .449 | 1.13400 | 1.621 |
| a. Predictors: (Constant), newImmigrants, productivity, shortRun, minimumWage | | | | | |
| b. Dependent Variable: wageGrowth | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 76.441 | 4 | 19.110 | 14.861 | .000b |
| Residual | 82.302 | 64 | 1.286 |  |  |
| Total | 158.743 | 68 |  |  |  |
| a. Dependent Variable: wageGrowth | | | | | | |
| b. Predictors: (Constant), newImmigrants, productivity, shortRun, minimumWage | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | -1.949 | .630 |  | -3.094 | .003 |
| shortRun | .060 | .014 | .382 | 4.176 | .000 |
| minimumWage | .029 | .013 | .223 | 2.280 | .026 |
| productivity | .455 | .097 | .450 | 4.707 | .000 |
| newImmigrants | -.008 | .007 | -.104 | -1.107 | .273 |
| a. Dependent Variable: wageGrowth | | | | | | |

wageGrowth = -1.949 + .06shortRun + .455 productivity + .029minimumWage

These independent variables form a model than can explain 48.2% of wage growth between 1948 and 2016. The proximity of the r squared and adjusted r squared values indicate that this is an accurate measure of r squared.

This regression containing short-term unemployment explains about 2% more of wage growth than does the regression containing total unemployment. Although the difference of 1.8% is not as high as I might have expected, these results do support my hypothesis.

Again, immigration proved to be an insignificant variable. Multicollinearity exists again between productivity and minimum wage, but does not cause either variable to become insignificant.

The parameters of the significant variables in this regression have practical significance as well. These results suggest that a single unit change in short run unemployment, real minimum wages, or productivity will result in respective changes of .06, .029, or .455 in wage growth. While it can be noted that the coefficient of total unemployment variable in the last regression is much larger (in absolute value terms) than that of the short-term unemployment variable in this regression, it is important to remember that the range of total unemployment changes is much smaller than the changes in short-term unemployment. For this reason, I do not believe there is any less practical significance in this regression than the last. While the coefficient here is about 6 times smaller than in regression 2, the range of the total unemployment data is about 7 times smaller than short-term unemployment. In addition, all the signs appeared as expected in these results.

MULTICOLINEARITY

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | |
|  | | wageGrowth | minimumWage | newImmigrants | productivity | shortRun |
| Pearson Correlation | wageGrowth | 1.000 | .354 | .006 | .551 | .408 |
| minimumWage | .354 | 1.000 | .223 | .319 | .029 |
| newImmigrants | .006 | .223 | 1.000 | .003 | .155 |
| productivity | .551 | .319 | .003 | 1.000 | .079 |
| shortRun | .408 | .029 | .155 | .079 | 1.000 |

DEPENDENT = PRODUCTIVITY

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | shortRun, minimumWage, newImmigrantsb | . | Enter |
| a. Dependent Variable: productivity | | | |
| b. All requested variables entered. | | | |

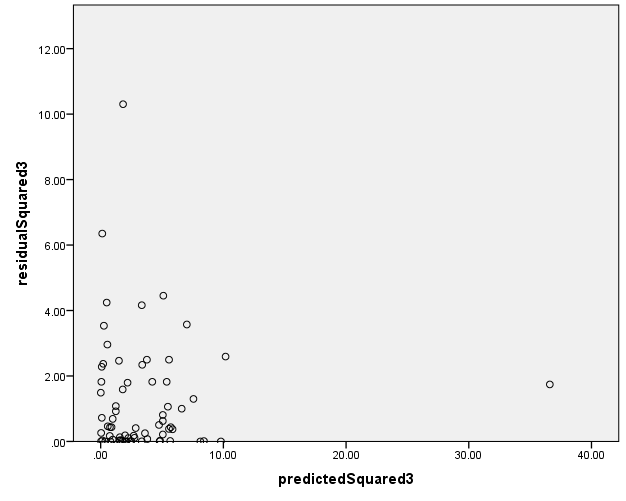
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .336a | .113 | .072 | 1.45502 | 1.818 |
| a. Predictors: (Constant), shortRun, minimumWage, newImmigrants | | | | | |
| b. Dependent Variable: productivity | | | | | |

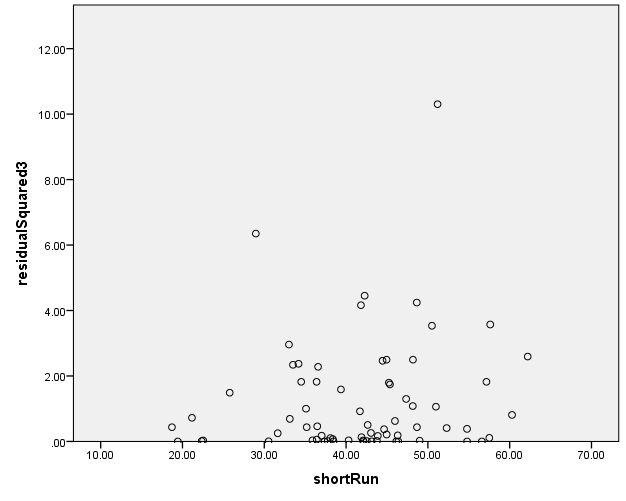
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 17.525 | 3 | 5.842 | 2.759 | .049b |
| Residual | 137.611 | 65 | 2.117 |  |  |
| Total | 155.135 | 68 |  |  |  |
| a. Dependent Variable: productivity | | | | | | |
| b. Predictors: (Constant), shortRun, minimumWage, newImmigrants | | | | | | |

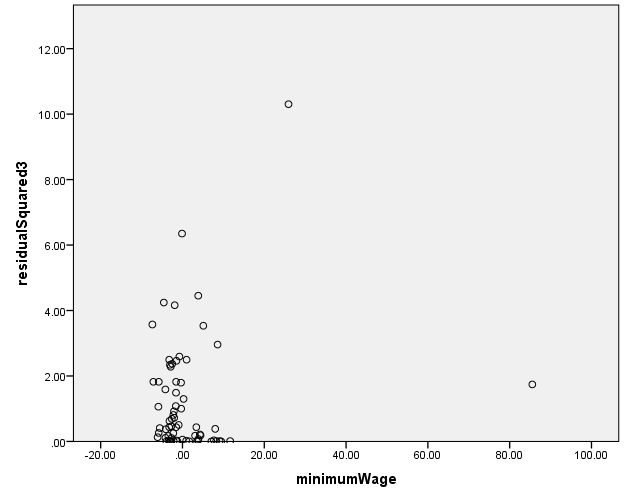
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 1.615 | .783 |  | 2.062 | .043 |
| minimumWage | .044 | .016 | .335 | 2.796 | .007 |
| newImmigrants | -.007 | .009 | -.085 | -.698 | .488 |
| shortRun | .013 | .018 | .082 | .694 | .490 |
| a. Dependent Variable: productivity | | | | | | |

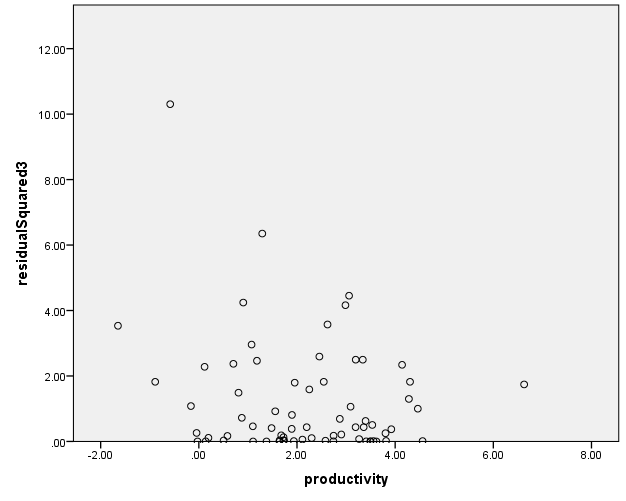
Again, testing only one of the unemployment variables eliminates the multicollinearity problem. There is still a certain amount of multicollinearity between productivity and minimum wage growth, but neither is an insignificant variable because of it.

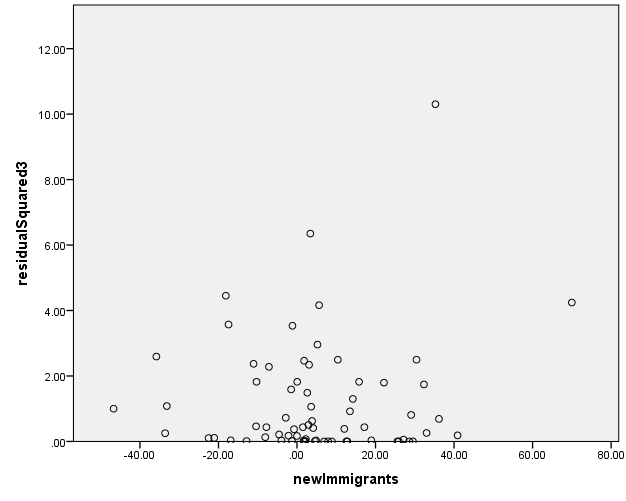
HETEROSCEDASTICITY











|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | productivity, newImmigrants, shortRun, minimumWageb | . | Enter |
| a. Dependent Variable: residual3 | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .000a | .000 | -.063 | 1.13400 |
| a. Predictors: (Constant), productivity, newImmigrants, shortRun, minimumWage | | | | |

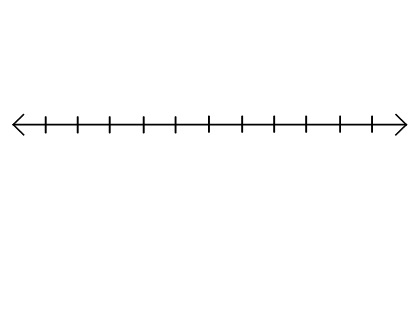
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .000 | 4 | .000 | .000 | 1.000b |
| Residual | 82.302 | 64 | 1.286 |  |  |
| Total | 82.302 | 68 |  |  |  |
| a. Dependent Variable: residual3 | | | | | | |
| b. Predictors: (Constant), productivity, newImmigrants, shortRun, minimumWage | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 1.339E-15 | .630 |  | .000 | 1.000 |
| minimumWage | .000 | .013 | .000 | .000 | 1.000 |
| newImmigrants | .000 | .007 | .000 | .000 | 1.000 |
| shortRun | .000 | .014 | .000 | .000 | 1.000 |
| productivity | .000 | .097 | .000 | .000 | 1.000 |
| a. Dependent Variable: residual3 | | | | | | |

This regression shows no signs of heteroscedasticity. After obtaining the value of the residuals and running a regression to test the residual as the dependent variable, the results of this regression were an r squared of zero and a significance level of 1 for every independent variable.

AUTOCORRELATION (X = 4, N = 69)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .694a | .482 | .449 | 1.13400 | 1.621 |
| a. Predictors: (Constant), productivity, newImmigrants, shortRun, minimumWage | | | | | |
| 1. Dependent Variable: wageGrowth | | | | | |



0 1 2 3 4

dL= 1.343 1.621 2.657

dU= 1.577 2.423

This regression does not show any signs of autocorrelation. The Durbin-Watson coefficient of 1.621 falls in between the upper coefficient for 4 variables and 69 observations, 1.577, and 2.

**REGRESSION 4**

wageGrowth = B1 + B2 total + B3productivity + B4 minimumWage (since 2010)

Since part of the reason this hypothesis was tested was to attempt to explain the lack of expected inflation in the recovery from the Great Recession, I decided to run two more regressions. These regressions use the same variables and structure as regressions 2 and 3, but only contain data since the end of the Great Recession in 2010. These tests attempt to show that the cause of the lack of expected inflation in these years was a stagnation in wage growth caused by the historically low rates of short-term unemployment and high rates of long-term unemployment.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigration, minimumWage, total, productivityb | . | Enter |
| a. Dependent Variable: wageGrowth | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .918a | .842 | .527 | .85198 |
| a. Predictors: (Constant), newImmigration, minimumWage, total, productivity | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7.755 | 4 | 1.939 | 2.671 | .290b |
| Residual | 1.452 | 2 | .726 |  |  |
| Total | 9.207 | 6 |  |  |  |
| a. Dependent Variable: wageGrowth | | | | | | |
| b. Predictors: (Constant), newImmigration, minimumWage, total, productivity | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 3.319 | 2.992 |  | 1.109 | .383 |
| total | -.884 | .325 | -1.297 | -2.723 | .113 |
| minimumWage | -1.093 | .709 | -1.826 | -1.541 | .263 |
| productivity | 2.622 | 1.486 | 2.404 | 1.765 | .220 |
| newImmigration | -.049 | .112 | -.262 | -.439 | .703 |
| a. Dependent Variable: wageGrowth | | | | | | |

These independent variables form a model than can explain 84.2% of wage growth between 2010 and 2016; however, the vast difference between the r squared and adjusted r squared values indicate that this could be an inaccurate measure of r squared.

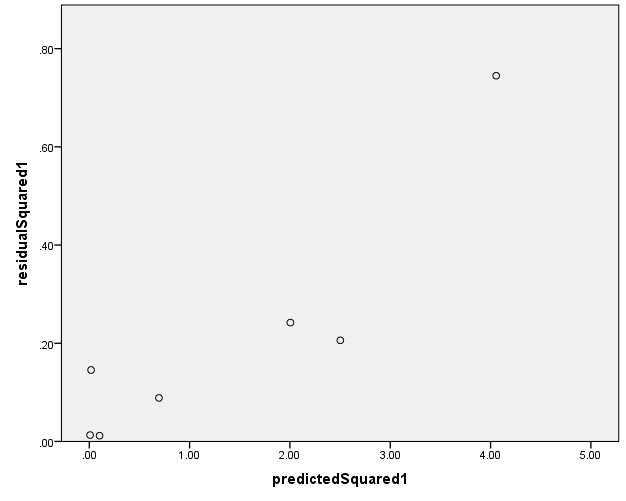
Every variable proved insignificant; however, since all but minimum wage have proven to be significant it can be assumed that the cause of these low significance levels are high levels of multicollinearity. Multicollinearity does not affect r-squared values, but none of the coefficients or signs of the coefficient, like the negative sign on minimum wage, should be interpreted.

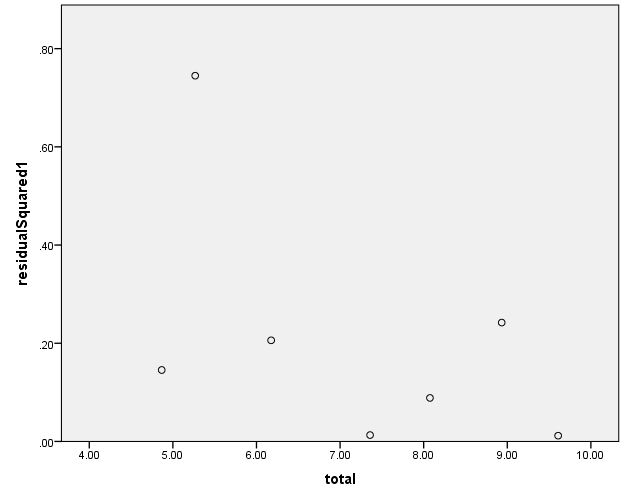
MULTICOLINEARITY

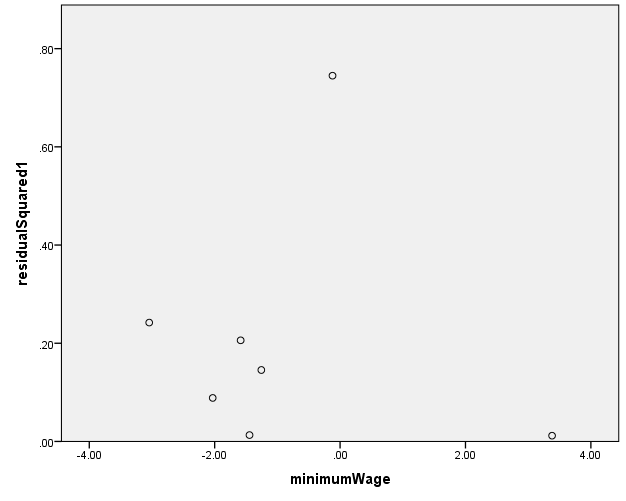
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | |
|  | | wageGrowth | total | minimumWage | productivity | newImmigration |
| Pearson Correlation | wageGrowth | 1.000 | -.499 | .251 | .277 | .055 |
| total | -.499 | 1.000 | .246 | .432 | -.796 |
| minimumWage | .251 | .246 | 1.000 | .948 | -.437 |
| productivity | .277 | .432 | .948 | 1.000 | -.630 |
| newImmigration | .055 | -.796 | -.437 | -.630 | 1.000 |

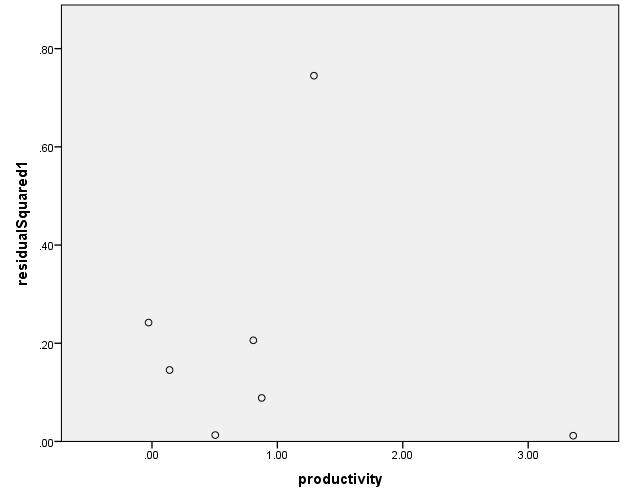
There is a high level of multicollinearity for many variables in this regression; however, since these variables have already been proven significant this is probably caused by the small sample size of this regression, and the fact that it only takes into account part of a single expansion in a single business cycle. Since r squared values are not affected by multicollinearity, nothing will be done to correct for this multicollinearity.

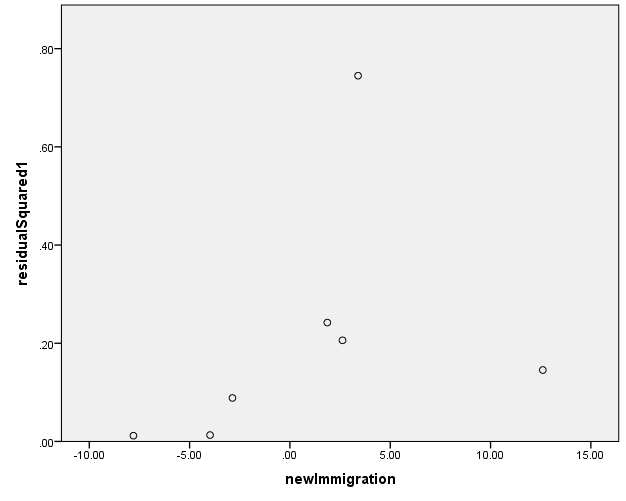
HETEROSCEDASTICITY











|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigration, minimumWage, total, productivityb | . | Enter |
| a. Dependent Variable: residual1 | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .000a | .000 | -2.000 | .85198 |
| a. Predictors: (Constant), newImmigration, minimumWage, total, productivity | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .000 | 4 | .000 | .000 | 1.000b |
| Residual | 1.452 | 2 | .726 |  |  |
| Total | 1.452 | 6 |  |  |  |
| a. Dependent Variable: residual1 | | | | | | |
| b. Predictors: (Constant), newImmigration, minimumWage, total, productivity | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | -8.327E-16 | 2.992 |  | .000 | 1.000 |
| total | .000 | .325 | .000 | .000 | 1.000 |
| minimumWage | .000 | .709 | .000 | .000 | 1.000 |
| productivity | .000 | 1.486 | .000 | .000 | 1.000 |
| newImmigration | .000 | .112 | .000 | .000 | 1.000 |
| a. Dependent Variable: residual1 | | | | | | |

This regression shows no signs of heteroscedasticity. After obtaining the value of the residuals and running a regression to test the residual as the dependent variable, the results of this regression were an rsquared of zero and a significance level of 1 for every independent variable.

AUTOCORRELATION (X = 4, N = 7)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .000a | .000 | -2.000 | .85198 | 3.042 |
| a. Predictors: (Constant), newImmigration, minimumWage, total, productivity | | | | | |
| b. Dependent Variable: residual1 | | | | | |

There are no Durbin- Watson upper and lower values available for a regression containing four independent variables and seven observations. Despite this, I believe it can be assumed that there is autocorrelation, due to the Durbin-Watson coefficient of 3.042, which is significantly removed from 2. I believe this autocorrelation is also caused by the fact that this regression only takes into account a small sample size that only considers part of a single expansion in a single business cycle.

**REGRESSION 5**

wageGrowth = B1 + B2 shortRun + B3productivity + B4 minimumWage (since 2010)

This regression tests short run unemployment as the main independent variable instead of total unemployment. If my hypothesis that wage growth stagnation caused by low rates of short-term unemployment is the cause of the lack of expected inflation in the wake of the Great Recession is correct, this r squared value should be higher than the last.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigration, minimumWage, shortRun, productivityb | . | Enter |
| a. Dependent Variable: wageGrowth | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .931a | .867 | .602 | .78135 |
| a. Predictors: (Constant), newImmigration, minimumWage, shortRun, productivity | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7.986 | 4 | 1.996 | 3.270 | .248b |
| Residual | 1.221 | 2 | .611 |  |  |
| Total | 9.207 | 6 |  |  |  |
| a. Dependent Variable: wageGrowth | | | | | | |
| b. Predictors: (Constant), newImmigration, minimumWage, shortRun, productivity | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | -12.794 | 3.952 |  | -3.237 | .084 |
| shortRun | .407 | .134 | 1.525 | 3.032 | .094 |
| minimumWage | -1.227 | .659 | -2.050 | -1.862 | .204 |
| productivity | 2.604 | 1.361 | 2.388 | 1.912 | .196 |
| newImmigration | -.112 | .115 | -.594 | -.966 | .436 |
| a. Dependent Variable: wageGrowth | | | | | | |

These independent variables form a model than can explain 86.7% of wage growth between 2010 and 2016; however once again, the vast difference between the r squared and adjusted r squared values indicate that this could be an inaccurate measure of r squared.

Every variable proved insignificant; however, since all but minimum wage have proven to be significant it can be again assumed that the cause of these low significance levels are high levels of multicollinearity. Multicollinearity does not affect r squared values, but none of the coefficients or signs of the coefficient, like the negative sign on minimum wage, should be interpreted.

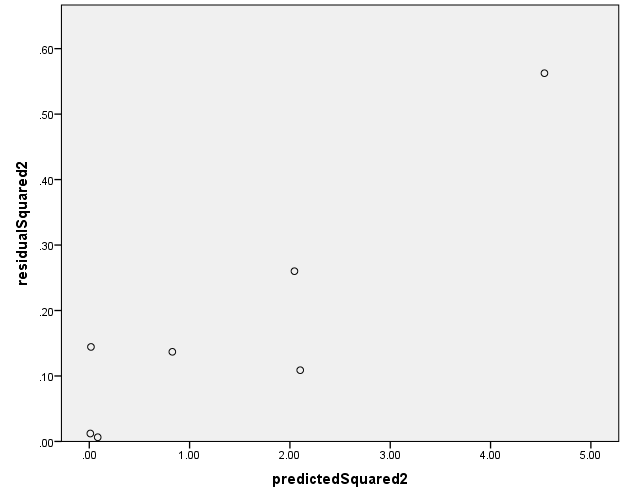
It should also be noted that although this r squared value is consistent with the findings in regressions 2 and 3, that short term rates of unemployment can explain about 2% more of wage growth than can total unemployment rate, the difference between adjusted r squared and r squared is significant. In addition, autocorrelation is likely present in these results. These factors mean that while these numbers do support my theory, they cannot be used as evidence to prove it because there is a chance that they are inaccurate.

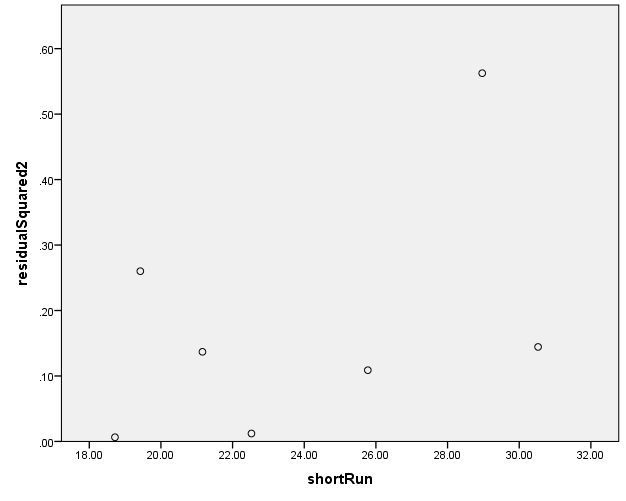
MULTICOLINEARITY

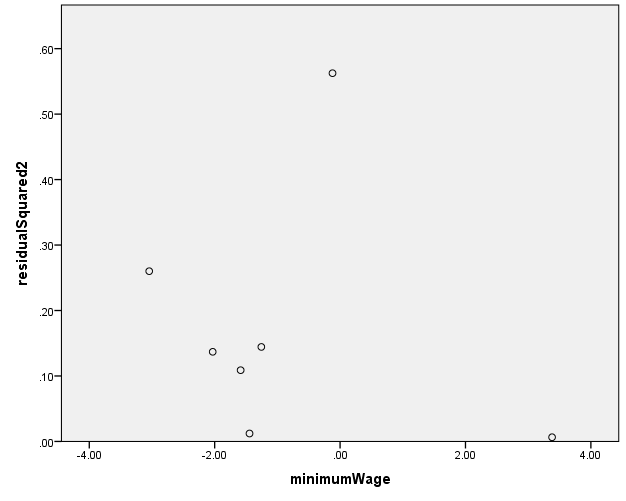
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | |
|  | | wageGrowth | shortRun | minimumWage | productivity | newImmigration |
| Pearson Correlation | wageGrowth | 1.000 | .493 | .251 | .277 | .055 |
| shortRun | .493 | 1.000 | -.146 | -.354 | .823 |
| minimumWage | .251 | -.146 | 1.000 | .948 | -.437 |
| productivity | .277 | -.354 | .948 | 1.000 | -.630 |
| newImmigration | .055 | .823 | -.437 | -.630 | 1.000 |

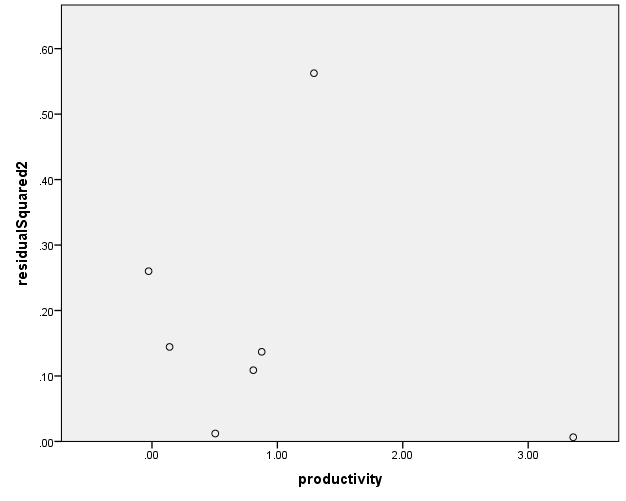
There is a high level of multicollinearity for many variables in this regression; however, since these variables have already been proven significant this is again probably caused by the small sample size of this regression, and the fact that it only takes into account part of a single expansion in a single business cycle. Since r squared values are not affected by multicollinearity, once again nothing will be done to correct for this multicollinearity.

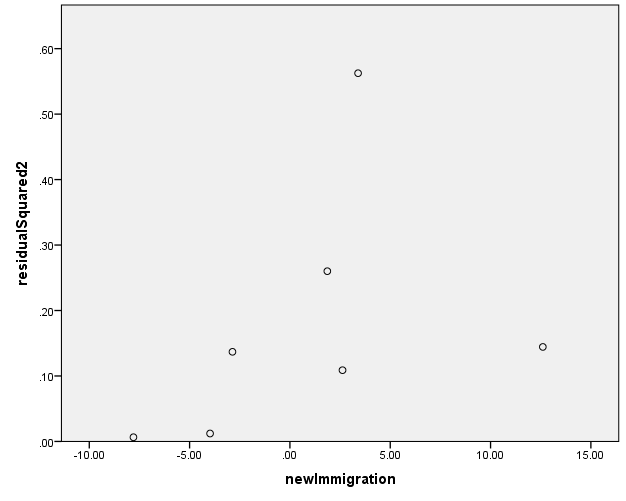
HETEROSCEDASTICITY











|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | newImmigration, minimumWage, shortRun, productivityb | . | Enter |
| a. Dependent Variable: residual2 | | | |
| b. All requested variables entered. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Summary** | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .000a | .000 | -2.000 | .78135 |
| a. Predictors: (Constant), newImmigration, minimumWage, shortRun, productivity | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .000 | 4 | .000 | .000 | 1.000b |
| Residual | 1.221 | 2 | .611 |  |  |
| Total | 1.221 | 6 |  |  |  |
| a. Dependent Variable: residual2 | | | | | | |
| b. Predictors: (Constant), newImmigration, minimumWage, shortRun, productivity | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 2.561E-15 | 3.952 |  | .000 | 1.000 |
| shortRun | .000 | .134 | .000 | .000 | 1.000 |
| minimumWage | .000 | .659 | .000 | .000 | 1.000 |
| productivity | .000 | 1.361 | .000 | .000 | 1.000 |
| newImmigration | .000 | .115 | .000 | .000 | 1.000 |
| a. Dependent Variable: residual2 | | | | | | |

This regression shows no signs of heteroscedasticity. After obtaining the value of the residuals and running a regression to test the residual as the dependent variable, the results of this regression were an r squared of zero and a significance level of 1 for every independent variable.

AUTOCORRELATION (X = 4, N = 7)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .931a | .867 | .602 | .78135 | 2.990 |
| a. Predictors: (Constant), newImmigration, minimumWage, shortRun, productivity | | | | | |
| b. Dependent Variable: wageGrowth | | | | | |

Again, there is no Durbin- Watson upper and lower values available for a regression containing four independent variables and seven observations. Despite this, I believe it can be assumed that there is autocorrelation, due to the Durbin-Watson coefficient of 2.99, which is significantly removed from 2. I believe this autocorrelation is again caused by the fact that this regression only takes into account a small sample size that only considers part of a single expansion in a single business cycle.

**CONCLUSION**

The results of regressions 2 and 3 prove my hypothesis that short term rates of unemployment better explain wage growth, and thus inflation, then does total unemployment rate. In the years 1948 to 2016, 1.8% more of wage growth was explained by the regression with short-term unemployment than the regression with total unemployment. Although this is difference lower than what I thought it might have been, it is consistent with my hypothesis.

The variable immigration proved to be insignificant in every regression that was run, meaning that changes in immigration rates do not have a discernable impact on wage growth. Productivity and real minimum wage both proved to be significant, meaning that percent increases in both will result in a corresponding percent increase in wage growth.

Although regressions 4 and 5 cannot be used as conclusive evidence to support my theory that this relationship between short-term rate of unemployment and wage growth is the cause of the lack of expected inflation in recent years, I believe that the results of regressions 2 and 3 can be used as evidence that this may be the case. Taking 2017 as an example, total unemployment rate was 4.4%. The last time the annual average unemployment dropped below 4.4% was in 2000, when it was at 4%. In 2000, wage growth measured at 3.5%; in 2017, 1.2%. This lack of wage growth despite similar rates of total unemployment can be explained by the shifting composition of the unemployed; the 45% rate of short-term unemployment and 11.4% rate of long-term unemployment in 2000 and the 32.5% rate of short-term unemployment and the 24.2% rate of long-term unemployment in 2017.