A Hierarchical Regression Analysis of Patent Data: Investigating the Relationship between   
Patent Citations Received and Various Patent Data Variables

Malcolm S. Townes

Saint Louis University

**Introduction**

This study continues the investigation of how technology transfer success can be defined and measured that I began on Assignment 01 for SOC 6100 in the Fall 2018 semester. Specifically, I conducted a hierarchical regression analysis to test an incremental model change of estimated regression lines. Again, I used patents as a proxy for units of technology. For the dependent variable (DV), I used the number of citations a given U.S. patent receives from other U.S. patents (CRECEIVE) as a measure of technology transfer.

**Data and Methods**

Based on the results of the previous analysis, I made several modifications to the model. I removed the following variables because of high multicollinearity with other variables: APPYEAR, BCKGTLAG, FWDAPLAG, SELFCTLB, and SECDLWBD. Additionally, I used a log transformation on the original DV (CRECEIVE) because the data for this variable was very skewed to the right (i.e., positively skewed) based on a visual inspection of a histogram for the data. The transformed DV is logCRECEIVE, which is what I used in the hierarchical regression analysis.

Finally, I created a product term called CLAIMSORIGINAL using the CLAIMS variable and ORIGINAL variable to test for possible interaction between these two variables. I suspected that the relationship between the DV and the CLAIMS variable varies as a function of the ORIGINAL variable. I surmised that the higher the originality of a technology as represented by a patent, the more interest that it may receive from other innovators and thus the more likely that the patent will be cited in the patents of other innovators. If there is a CLAIMS by ORIGINAL interaction, then these two variables do not operated independently of one another in their influence on the DV and therefore cannot be considered in isolation of one another.

To create the logCRECEIVE and CLAIMSORIGINAL variable, I used RStudio. I imported the cleaned data subset from Assignment 01 and used the mutate function to calculate values of logCRECEIVE as the logarithm of the CRECEIVE variable. I also used the mutate function to calculate values of CLAIMSORIGNAL as the product of the CLAIMS and ORIGINAL variables. I then saved this modified data subset as a .csv file.

**Analysis**

I analyzed this data using IBM SPSS Statistics 25. I verified that the correct data type and data variable type was applied to each variable in the variable view tab. I assigned the logCRECEIVE as the dependent variable. I used the Analyze > Regression > Linear function to conduct a hierarchical regression analysis. The options I selected included model fit, R square change, part and partial correlations, and collinearity diagnostics for the regression statistics; estimates, a confidence level of 95 percent, and covariance matrix for the regression coefficients; and Durbin-Watson, casewise diagnostics for outliers beyond 3 standard deviations for the residuals.

For each model I used the enter method. The first model in the hierarchical regression analysis included the CLAIMS, CMADE, GENERAL, GYEAR, ORIGINAL, and RATIOCIT variables as independent variables (IVs). The claims of a patent define the scope of the subject that it asserts to be novel, nonobvious, and useful. I theorized that the more claims that are included in a patent (CLAIMS) the more opportunities it has to be cited another patents. I suspected that the number of citations made by a patent (CMADE) would indicate its relevance to the field of interest and thus the more citations made the higher the likelihood it will be relevant to other technologies in the field. I surmised that the more general the nature of a patent (GENERAL) the more likely it is to be relevant to a wide variety of fields. I expected the older a patent was (GYEAR) the less likely it was to be relevant to other technologies because of half-life effects. Based on the results of my previous analysis, I suspected that patents that rate high on originality (ORIGINAL) would probably not be relevant to technologies because they likely make use of new paradigms that are incompatible with the popular approaches to innovation within a field at that point in time. I included the ratio of citations made by all patents granted since 1963 to the total number of citations made by a particular patent (RATIOCIT) in the model because I theorized that this is an indication of overall technology transfer activity. The greater the overall level of technology transfer activity, the more likely that any given patent will be cited by other patents.

In addition to the IVs included in the first model, the second model included the SECDUPBD, SELFCTUB, and CLAIMSORIGINAL variables to test whether the addition of these variables improved the fit of the regression model. The SECDUPBD and SELFCTUB variables account for the number of citations received and made by a patent, respectively, to other patents with the same assignee (typically an organization). I anticipated there is an incentive for an organization to leverage technologies assigned to it as much as possible, thus increasing the chances of technology transfer within the organization and thus the number of citations a patent receives. As I indicated above, I included the CLAIMSORIGINAL product term because I suspected interaction effects between the CLAIMS variable and the ORIGINAL variable.

**Results and Findings**

Table 1 below shows the results of the hierarchical regression analysis of the patent data. The complete output file for the analysis is shown in Appendix A.

Table 1. Results of hierarchical regression analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Unstandardized | | | | Standardized | | | |
| Variable | **Model 1** |  | **Model 2** |  | **Model 1** |  | **Model 2** |  |
| Constant | 330.669 | \* | 331.411 | \* | 0.000 | \* | 0.000 | \* |
| CLAIMS | 0.005 | \* | 0.008 | \* | 0.077 | \* | 0.127 | \* |
| CMADE | 0.001 |  | 0.001 |  | 0.021 |  | 0.022 |  |
| GENERAL | 1.744 | \* | 1.752 | \* | 0.569 | \* | 0.572 | \* |
| GYEAR | -0.166 | \* | -0.166 | \* | -0.221 | \* | -0.222 | \* |
| ORIGINAL | -0.301 | \* | -0.195 | \* | -0.104 | \* | -0.067 | \* |
| RATIOCIT | 0.555 | \* | 0.557 | \* | 0.081 | \* | 0.082 | \* |
| SECDUPBD |  |  | 0.053 |  |  |  | 0.023 |  |
| SELFCTUB |  |  | -0.033 |  |  |  | -0.010 |  |
| CLAIMSORIGINAL |  |  | -0.007 |  |  |  | -0.073 |  |
|  |  |  |  |  |  |  |  |  |
| Adj. R2 | 0.436 |  | 0.437 |  | 0.436 |  | 0.437 |  |
| Adj. R2 change | 0.436 |  | 0.001 |  | 0.436 |  | 0.001 |  |
| F | 215.741 | \* | 144.442 | \* | 215.741 | \* | 144.442 | \* |
| F change | 215.741 | \* | 1.474 |  | 215.741 | \* | 1.474 |  |

\* p<0.05

The multiple regression model using logCRECEIVE as the DV and CLAIMS, CMADE, GENERAL, GYEAR, ORIGINAL, RATIOCIT as IVs (Model 1) showed a good model fit (F=215.741, p<0.05) indicating that at least one of the IVs was significant. The adjusted R2 for the model was 0.436 indicating that the IVs in the model explained 43.6 percent of the DV.

The multiple regression model using logCRECEIVE as the DV and the IVs from Model 1 plus SECDUPBD, SELFCTUB, and CLAIMSORIGINAL as additional IVs (Model 2) also showed a good model fit (F=144.442, p<0.05). However, the addition of the SECDUPBD, SELFCTUB, and CLAIMSORIGINAL variables did not incrementally improve the model to any significant extent. The adjusted R2 for Model 2 was 0.437 indicating the IVs in the model explained 43.7 percent of the DV. None of the additional variables included in Model 2 were significant (p>0.05 for all three variables).

Appendix A. IBM Statistics SPSS 25 Output

GET FILE='D:\SOC6100\Assignments\Assignment02\Results\Townes\_SOC6100\_Assignment02\_Data.sav'.

DATASET NAME DataSet1 WINDOW=FRONT.

REGRESSION

/DESCRIPTIVES MEAN STDDEV CORR SIG N

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) BCOV R ANOVA COLLIN TOL CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT logCRECEIVE

/METHOD=ENTER CLAIMS CMADE GENERAL GYEAR ORIGINAL RATIOCIT

/METHOD=ENTER CLAIMSORIGINAL SECDUPBD SELFCTUB

/RESIDUALS DURBIN

/CASEWISE PLOT(ZRESID) OUTLIERS(3).

**Regression**

|  |  |  |
| --- | --- | --- |
| **Notes** | | |
| Output Created | | 10-OCT-2018 20:23:46 |
| Comments | |  |
| Input | Data | D:\SOC6100\Assignments\Assignment02\Results\Townes\_SOC6100\_Assignment02\_Data.sav |
| Active Dataset | DataSet1 |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 2000 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as missing. |
| Cases Used | Statistics are based on cases with no missing values for any variable used. |
| Syntax | | REGRESSION  /DESCRIPTIVES MEAN STDDEV CORR SIG N  /MISSING LISTWISE  /STATISTICS COEFF OUTS CI(95) BCOV R ANOVA COLLIN TOL CHANGE ZPP  /CRITERIA=PIN(.05) POUT(.10)  /NOORIGIN  /DEPENDENT logCRECEIVE  /METHOD=ENTER CLAIMS CMADE GENERAL GYEAR ORIGINAL RATIOCIT  /METHOD=ENTER CLAIMSORIGINAL SECDUPBD SELFCTUB  /RESIDUALS DURBIN  /CASEWISE PLOT(ZRESID) OUTLIERS(3). |
| Resources | Processor Time | 00:00:00.03 |
| Elapsed Time | 00:00:00.06 |
| Memory Required | 9024 bytes |
| Additional Memory Required for Residual Plots | 0 bytes |

[DataSet1] D:\SOC6100\Assignments\Assignment02\Results\Townes\_SOC6100\_Assignment02\_Data.sav

|  |  |  |  |
| --- | --- | --- | --- |
| **Descriptive Statistics** | | | |
|  | Mean | Std. Deviation | N |
| logCRECEIVE | .803931581920302 | .804113290481782 | 1667 |
| CLAIMS | 15.52 | 12.480 | 1667 |
| CMADE | 10.76 | 13.775 | 1667 |
| GENERAL | .201574 | .2624779 | 1667 |
| GYEAR | 1996.28 | 1.073 | 1667 |
| ORIGINAL | .396933 | .2769866 | 1667 |
| RATIOCIT | .955843 | .1180271 | 1667 |
| CLAIMSORIGINAL | 6.525935 | 8.5131005 | 1667 |
| SECDUPBD | .20 | .342 | 1667 |
| SELFCTUB | .14 | .231 | 1667 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | | |
|  | | logCRECEIVE | CLAIMS | CMADE | GENERAL | GYEAR |
| Pearson Correlation | logCRECEIVE | 1.000 | .100 | .018 | .612 | -.350 |
| CLAIMS | .100 | 1.000 | .167 | .063 | .030 |
| CMADE | .018 | .167 | 1.000 | .067 | .072 |
| GENERAL | .612 | .063 | .067 | 1.000 | -.242 |
| GYEAR | -.350 | .030 | .072 | -.242 | 1.000 |
| ORIGINAL | .018 | .106 | .288 | .191 | .017 |
| RATIOCIT | .077 | .012 | -.104 | .031 | .080 |
| CLAIMSORIGINAL | .077 | .750 | .286 | .161 | .029 |
| SECDUPBD | -.015 | .006 | .013 | -.058 | .040 |
| SELFCTUB | -.006 | -.007 | -.056 | -.024 | -.012 |
| Sig. (1-tailed) | logCRECEIVE | . | .000 | .232 | .000 | .000 |
| CLAIMS | .000 | . | .000 | .005 | .114 |
| CMADE | .232 | .000 | . | .003 | .002 |
| GENERAL | .000 | .005 | .003 | . | .000 |
| GYEAR | .000 | .114 | .002 | .000 | . |
| ORIGINAL | .233 | .000 | .000 | .000 | .239 |
| RATIOCIT | .001 | .317 | .000 | .105 | .001 |
| CLAIMSORIGINAL | .001 | .000 | .000 | .000 | .118 |
| SECDUPBD | .270 | .401 | .303 | .009 | .051 |
| SELFCTUB | .400 | .385 | .012 | .168 | .312 |
| N | logCRECEIVE | 1667 | 1667 | 1667 | 1667 | 1667 |
| CLAIMS | 1667 | 1667 | 1667 | 1667 | 1667 |
| CMADE | 1667 | 1667 | 1667 | 1667 | 1667 |
| GENERAL | 1667 | 1667 | 1667 | 1667 | 1667 |
| GYEAR | 1667 | 1667 | 1667 | 1667 | 1667 |
| ORIGINAL | 1667 | 1667 | 1667 | 1667 | 1667 |
| RATIOCIT | 1667 | 1667 | 1667 | 1667 | 1667 |
| CLAIMSORIGINAL | 1667 | 1667 | 1667 | 1667 | 1667 |
| SECDUPBD | 1667 | 1667 | 1667 | 1667 | 1667 |
| SELFCTUB | 1667 | 1667 | 1667 | 1667 | 1667 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | |
|  | | ORIGINAL | RATIOCIT | CLAIMSORIGINAL | SECDUPBD |
| Pearson Correlation | logCRECEIVE | .018 | .077 | .077 | -.015 |
| CLAIMS | .106 | .012 | .750 | .006 |
| CMADE | .288 | -.104 | .286 | .013 |
| GENERAL | .191 | .031 | .161 | -.058 |
| GYEAR | .017 | .080 | .029 | .040 |
| ORIGINAL | 1.000 | .028 | .580 | -.025 |
| RATIOCIT | .028 | 1.000 | .027 | .032 |
| CLAIMSORIGINAL | .580 | .027 | 1.000 | -.013 |
| SECDUPBD | -.025 | .032 | -.013 | 1.000 |
| SELFCTUB | -.055 | .060 | -.045 | .198 |
| Sig. (1-tailed) | logCRECEIVE | .233 | .001 | .001 | .270 |
| CLAIMS | .000 | .317 | .000 | .401 |
| CMADE | .000 | .000 | .000 | .303 |
| GENERAL | .000 | .105 | .000 | .009 |
| GYEAR | .239 | .001 | .118 | .051 |
| ORIGINAL | . | .123 | .000 | .155 |
| RATIOCIT | .123 | . | .138 | .096 |
| CLAIMSORIGINAL | .000 | .138 | . | .304 |
| SECDUPBD | .155 | .096 | .304 | . |
| SELFCTUB | .012 | .008 | .032 | .000 |
| N | logCRECEIVE | 1667 | 1667 | 1667 | 1667 |
| CLAIMS | 1667 | 1667 | 1667 | 1667 |
| CMADE | 1667 | 1667 | 1667 | 1667 |
| GENERAL | 1667 | 1667 | 1667 | 1667 |
| GYEAR | 1667 | 1667 | 1667 | 1667 |
| ORIGINAL | 1667 | 1667 | 1667 | 1667 |
| RATIOCIT | 1667 | 1667 | 1667 | 1667 |
| CLAIMSORIGINAL | 1667 | 1667 | 1667 | 1667 |
| SECDUPBD | 1667 | 1667 | 1667 | 1667 |
| SELFCTUB | 1667 | 1667 | 1667 | 1667 |

|  |  |  |
| --- | --- | --- |
| **Correlations** | | |
|  | | SELFCTUB |
| Pearson Correlation | logCRECEIVE | -.006 |
| CLAIMS | -.007 |
| CMADE | -.056 |
| GENERAL | -.024 |
| GYEAR | -.012 |
| ORIGINAL | -.055 |
| RATIOCIT | .060 |
| CLAIMSORIGINAL | -.045 |
| SECDUPBD | .198 |
| SELFCTUB | 1.000 |
| Sig. (1-tailed) | logCRECEIVE | .400 |
| CLAIMS | .385 |
| CMADE | .012 |
| GENERAL | .168 |
| GYEAR | .312 |
| ORIGINAL | .012 |
| RATIOCIT | .008 |
| CLAIMSORIGINAL | .032 |
| SECDUPBD | .000 |
| SELFCTUB | . |
| N | logCRECEIVE | 1667 |
| CLAIMS | 1667 |
| CMADE | 1667 |
| GENERAL | 1667 |
| GYEAR | 1667 |
| ORIGINAL | 1667 |
| RATIOCIT | 1667 |
| CLAIMSORIGINAL | 1667 |
| SECDUPBD | 1667 |
| SELFCTUB | 1667 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables Entered/Removeda** | | | |
| Model | Variables Entered | Variables Removed | Method |
| 1 | RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINALb | . | Enter |
| 2 | SECDUPBD, SELFCTUB, CLAIMSORIGINALb | . | Enter |

|  |
| --- |
| a. Dependent Variable: logCRECEIVE |
| b. All requested variables entered. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryc** | | | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | |
| R Square Change | F Change | df1 |
| 1 | .662a | .438 | .436 | .603832813033063 | .438 | 215.741 | 6 |
| 2 | .663b | .440 | .437 | .603574533062267 | .001 | 1.474 | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Model Summaryc** | | | |
| Model | Change Statistics | | |
| df2 | Sig. F Change |  |
| 1 | 1660 | .000 |  |
| 2 | 1657 | .220 | 1.991 |

|  |
| --- |
| a. Predictors: (Constant), RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINAL |
| b. Predictors: (Constant), RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINAL, SECDUPBD, SELFCTUB, CLAIMSORIGINAL |
| c. Dependent Variable: logCRECEIVE |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 471.973 | 6 | 78.662 | 215.741 | .000b |
| Residual | 605.259 | 1660 | .365 |  |  |
| Total | 1077.233 | 1666 |  |  |  |
| 2 | Regression | 473.584 | 9 | 52.620 | 144.442 | .000c |
| Residual | 603.649 | 1657 | .364 |  |  |
| Total | 1077.233 | 1666 |  |  |  |

|  |
| --- |
| a. Dependent Variable: logCRECEIVE |
| b. Predictors: (Constant), RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINAL |
| c. Predictors: (Constant), RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINAL, SECDUPBD, SELFCTUB, CLAIMSORIGINAL |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| B | Std. Error | Beta |
| 1 | (Constant) | 330.699 | 28.660 |  | 11.539 | .000 |
| CLAIMS | .005 | .001 | .077 | 4.096 | .000 |
| CMADE | .001 | .001 | .021 | 1.079 | .281 |
| GENERAL | 1.744 | .059 | .569 | 29.316 | .000 |
| GYEAR | -.166 | .014 | -.221 | -11.536 | .000 |
| ORIGINAL | -.301 | .057 | -.104 | -5.285 | .000 |
| RATIOCIT | .555 | .127 | .081 | 4.371 | .000 |
| 2 | (Constant) | 331.411 | 28.663 |  | 11.562 | .000 |
| CLAIMS | .008 | .002 | .127 | 3.623 | .000 |
| CMADE | .001 | .001 | .022 | 1.135 | .257 |
| GENERAL | 1.752 | .060 | .572 | 29.392 | .000 |
| GYEAR | -.166 | .014 | -.222 | -11.562 | .000 |
| ORIGINAL | -.195 | .084 | -.067 | -2.326 | .020 |
| RATIOCIT | .557 | .127 | .082 | 4.378 | .000 |
| CLAIMSORIGINAL | -.007 | .004 | -.073 | -1.703 | .089 |
| SECDUPBD | .053 | .044 | .023 | 1.204 | .229 |
| SELFCTUB | -.033 | .066 | -.010 | -.510 | .610 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | |
| Model | | 95.0% Confidence Interval for B | | Correlations | | |
| Lower Bound | Upper Bound | Zero-order | Partial | Part |
| 1 | (Constant) | 274.485 | 386.914 |  |  |  |
| CLAIMS | .003 | .007 | .100 | .100 | .075 |
| CMADE | -.001 | .003 | .018 | .026 | .020 |
| GENERAL | 1.627 | 1.861 | .612 | .584 | .539 |
| GYEAR | -.194 | -.138 | -.350 | -.272 | -.212 |
| ORIGINAL | -.412 | -.189 | .018 | -.129 | -.097 |
| RATIOCIT | .306 | .804 | .077 | .107 | .080 |
| 2 | (Constant) | 275.191 | 387.631 |  |  |  |
| CLAIMS | .004 | .013 | .100 | .089 | .067 |
| CMADE | -.001 | .004 | .018 | .028 | .021 |
| GENERAL | 1.635 | 1.868 | .612 | .585 | .541 |
| GYEAR | -.194 | -.138 | -.350 | -.273 | -.213 |
| ORIGINAL | -.360 | -.031 | .018 | -.057 | -.043 |
| RATIOCIT | .307 | .806 | .077 | .107 | .081 |
| CLAIMSORIGINAL | -.015 | .001 | .077 | -.042 | -.031 |
| SECDUPBD | -.034 | .140 | -.015 | .030 | .022 |
| SELFCTUB | -.162 | .095 | -.006 | -.013 | -.009 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Coefficientsa** | | | |
| Model | | Collinearity Statistics | |
| Tolerance | VIF |
| 1 | (Constant) |  |  |
| CLAIMS | .965 | 1.036 |
| CMADE | .879 | 1.137 |
| GENERAL | .898 | 1.114 |
| GYEAR | .922 | 1.085 |
| ORIGINAL | .881 | 1.135 |
| RATIOCIT | .975 | 1.026 |
| 2 | (Constant) |  |  |
| CLAIMS | .275 | 3.643 |
| CMADE | .875 | 1.143 |
| GENERAL | .894 | 1.119 |
| GYEAR | .921 | 1.086 |
| ORIGINAL | .405 | 2.470 |
| RATIOCIT | .971 | 1.030 |
| CLAIMSORIGINAL | .183 | 5.458 |
| SECDUPBD | .956 | 1.046 |
| SELFCTUB | .953 | 1.050 |

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| --- |
| a. Dependent Variable: logCRECEIVE |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Excluded Variablesa** | | | | | | | |
| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics | |
| Tolerance | VIF |
| 1 | CLAIMSORIGINAL | -.073b | -1.702 | .089 | -.042 | .183 | 5.454 |
| SECDUPBD | .021b | 1.140 | .254 | .028 | .994 | 1.006 |
| SELFCTUB | -.004b | -.234 | .815 | -.006 | .992 | 1.009 |

|  |  |  |
| --- | --- | --- |
| **Excluded Variablesa** | | |
| Model | | Collinearity Statistics |
| Minimum Tolerance |
| 1 | CLAIMSORIGINAL | .183 |
| SECDUPBD | .879 |
| SELFCTUB | .878 |

|  |
| --- |
| a. Dependent Variable: logCRECEIVE |
| b. Predictors in the Model: (Constant), RATIOCIT, CLAIMS, GENERAL, CMADE, GYEAR, ORIGINAL |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficient Correlationsa** | | | | | | | |
| Model | | | RATIOCIT | CLAIMS | GENERAL | CMADE | GYEAR |
| 1 | Correlations | RATIOCIT | 1.000 | -.022 | -.050 | .127 | -.098 |
| CLAIMS | -.022 | 1.000 | -.047 | -.142 | -.027 |
| GENERAL | -.050 | -.047 | 1.000 | -.031 | .256 |
| CMADE | .127 | -.142 | -.031 | 1.000 | -.083 |
| GYEAR | -.098 | -.027 | .256 | -.083 | 1.000 |
| ORIGINAL | -.050 | -.050 | -.179 | -.270 | -.036 |
| Covariances | RATIOCIT | .016 | -3.372E-6 | .000 | 1.842E-5 | .000 |
| CLAIMS | -3.372E-6 | 1.456E-6 | -3.392E-6 | -1.965E-7 | -4.738E-7 |
| GENERAL | .000 | -3.392E-6 | .004 | -2.085E-6 | .000 |
| CMADE | 1.842E-5 | -1.965E-7 | -2.085E-6 | 1.312E-6 | -1.358E-6 |
| GYEAR | .000 | -4.738E-7 | .000 | -1.358E-6 | .000 |
| ORIGINAL | .000 | -3.459E-6 | -.001 | -1.758E-5 | -2.969E-5 |
| 2 | Correlations | RATIOCIT | 1.000 | .003 | -.052 | .126 | -.098 |
| CLAIMS | .003 | 1.000 | .014 | -.025 | -.010 |
| GENERAL | -.052 | .014 | 1.000 | -.028 | .255 |
| CMADE | .126 | -.025 | -.028 | 1.000 | -.081 |
| GYEAR | -.098 | -.010 | .255 | -.081 | 1.000 |
| ORIGINAL | -.023 | .603 | -.086 | -.138 | -.020 |
| SECDUPBD | -.023 | -.006 | .045 | -.030 | -.027 |
| SELFCTUB | -.053 | -.023 | .008 | .037 | .022 |
| CLAIMSORIGINAL | -.017 | -.846 | -.046 | -.059 | -.006 |
| Covariances | RATIOCIT | .016 | 7.629E-7 | .000 | 1.836E-5 | .000 |
| CLAIMS | 7.629E-7 | 5.115E-6 | 1.853E-6 | -6.583E-8 | -3.202E-7 |
| GENERAL | .000 | 1.853E-6 | .004 | -1.945E-6 | .000 |
| CMADE | 1.836E-5 | -6.583E-8 | -1.945E-6 | 1.318E-6 | -1.329E-6 |
| GYEAR | .000 | -3.202E-7 | .000 | -1.329E-6 | .000 |
| ORIGINAL | .000 | .000 | .000 | -1.331E-5 | -2.452E-5 |
| SECDUPBD | .000 | -6.508E-7 | .000 | -1.502E-6 | -1.690E-5 |
| SELFCTUB | .000 | -3.441E-6 | 3.128E-5 | 2.748E-6 | 2.100E-5 |
| CLAIMSORIGINAL | -8.638E-6 | -7.764E-6 | -1.117E-5 | -2.766E-7 | -3.220E-7 |

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| **Coefficient Correlationsa** | | | | | | |
| Model | | | ORIGINAL | SECDUPBD | SELFCTUB | CLAIMSORIGINAL |
| 1 | Correlations | RATIOCIT | -.050 |  |  |  |
| CLAIMS | -.050 |  |  |  |
| GENERAL | -.179 |  |  |  |
| CMADE | -.270 |  |  |  |
| GYEAR | -.036 |  |  |  |
| ORIGINAL | 1.000 |  |  |  |
| Covariances | RATIOCIT | .000 |  |  |  |
| CLAIMS | -3.459E-6 |  |  |  |
| GENERAL | -.001 |  |  |  |
| CMADE | -1.758E-5 |  |  |  |
| GYEAR | -2.969E-5 |  |  |  |
| ORIGINAL | .003 |  |  |  |
| 2 | Correlations | RATIOCIT | -.023 | -.023 | -.053 | -.017 |
| CLAIMS | .603 | -.006 | -.023 | -.846 |
| GENERAL | -.086 | .045 | .008 | -.046 |
| CMADE | -.138 | -.030 | .037 | -.059 |
| GYEAR | -.020 | -.027 | .022 | -.006 |
| ORIGINAL | 1.000 | .007 | .006 | -.735 |
| SECDUPBD | .007 | 1.000 | -.196 | .004 |
| SELFCTUB | .006 | -.196 | 1.000 | .026 |
| CLAIMSORIGINAL | -.735 | .004 | .026 | 1.000 |
| Covariances | RATIOCIT | .000 | .000 | .000 | -8.638E-6 |
| CLAIMS | .000 | -6.508E-7 | -3.441E-6 | -7.764E-6 |
| GENERAL | .000 | .000 | 3.128E-5 | -1.117E-5 |
| CMADE | -1.331E-5 | -1.502E-6 | 2.748E-6 | -2.766E-7 |
| GYEAR | -2.452E-5 | -1.690E-5 | 2.100E-5 | -3.220E-7 |
| ORIGINAL | .007 | 2.728E-5 | 3.425E-5 | .000 |
| SECDUPBD | 2.728E-5 | .002 | -.001 | 7.006E-7 |
| SELFCTUB | 3.425E-5 | -.001 | .004 | 6.794E-6 |
| CLAIMSORIGINAL | .000 | 7.006E-7 | 6.794E-6 | 1.647E-5 |

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| a. Dependent Variable: logCRECEIVE |

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| **Collinearity Diagnosticsa** | | | | | | | |
| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | |
| (Constant) | CLAIMS | CMADE | GENERAL |
| 1 | 1 | 5.307 | 1.000 | .00 | .01 | .01 | .01 |
| 2 | .590 | 3.000 | .00 | .01 | .34 | .59 |
| 3 | .527 | 3.174 | .00 | .03 | .49 | .29 |
| 4 | .331 | 4.004 | .00 | .87 | .00 | .03 |
| 5 | .236 | 4.745 | .00 | .08 | .13 | .02 |
| 6 | .010 | 23.218 | .00 | .00 | .02 | .00 |
| 7 | 1.331E-7 | 6314.809 | 1.00 | .00 | .01 | .07 |
| 2 | 1 | 6.410 | 1.000 | .00 | .00 | .01 | .01 |
| 2 | .995 | 2.538 | .00 | .00 | .03 | .01 |
| 3 | .660 | 3.116 | .00 | .01 | .05 | .36 |
| 4 | .591 | 3.292 | .00 | .01 | .03 | .06 |
| 5 | .527 | 3.489 | .00 | .02 | .55 | .12 |
| 6 | .476 | 3.668 | .00 | .00 | .23 | .33 |
| 7 | .287 | 4.723 | .00 | .11 | .08 | .04 |
| 8 | .044 | 12.051 | .00 | .83 | .00 | .00 |
| 9 | .010 | 25.677 | .00 | .01 | .02 | .00 |
| 10 | 1.329E-7 | 6943.382 | 1.00 | .00 | .01 | .07 |

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| **Collinearity Diagnosticsa** | | | | | | | |
| Model | Dimension | Variance Proportions | | | | | |
| GYEAR | ORIGINAL | RATIOCIT | CLAIMSORIGINAL | SECDUPBD | SELFCTUB |
| 1 | 1 | .00 | .01 | .00 |  |  |  |
| 2 | .00 | .00 | .00 |  |  |  |
| 3 | .00 | .00 | .00 |  |  |  |
| 4 | .00 | .12 | .00 |  |  |  |
| 5 | .00 | .87 | .00 |  |  |  |
| 6 | .00 | .00 | .98 |  |  |  |
| 7 | 1.00 | .00 | .01 |  |  |  |
| 2 | 1 | .00 | .00 | .00 | .00 | .01 | .01 |
| 2 | .00 | .00 | .00 | .02 | .23 | .26 |
| 3 | .00 | .00 | .00 | .02 | .26 | .02 |
| 4 | .00 | .00 | .00 | .02 | .32 | .54 |
| 5 | .00 | .00 | .00 | .03 | .13 | .02 |
| 6 | .00 | .00 | .00 | .01 | .06 | .15 |
| 7 | .00 | .28 | .00 | .01 | .00 | .00 |
| 8 | .00 | .70 | .02 | .88 | .00 | .00 |
| 9 | .00 | .01 | .97 | .01 | .00 | .00 |
| 10 | 1.00 | .00 | .01 | .00 | .00 | .00 |

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| a. Dependent Variable: logCRECEIVE |

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| **Casewise Diagnosticsa** | | | | |
| Case Number | Std. Residual | logCRECEIVE | Predicted Value | Residual |
| 202 | 3.893 | 3.737669618283370 | 1.388148576505667 | 2.349521041777704 |
| 230 | 4.030 | 4.718498871295090 | 2.285905306556838 | 2.432593564738252 |
| 243 | 3.429 | 3.135494215929150 | 1.065928600534789 | 2.069565615394361 |
| 269 | 3.349 | 2.639057329615260 | .617947331006890 | 2.021109998608371 |
| 446 | 3.445 | 3.218875824868200 | 1.139558356212943 | 2.079317468655257 |
| 457 | 4.013 | 3.433987204485150 | 1.011865850748473 | 2.422121353736677 |
| 832 | 3.125 | 2.639057329615260 | .752986076687250 | 1.886071252928010 |
| 859 | 3.563 | 2.564949357461540 | .414341646752613 | 2.150607710708927 |
| 1058 | 3.116 | 1.945910149055310 | .065267694600394 | 1.880642454454916 |
| 1063 | 4.049 | 3.637586159726390 | 1.193910852275735 | 2.443675307450655 |
| 1116 | 3.836 | 3.091042453358320 | .775945771776405 | 2.315096681581915 |
| 1220 | 3.299 | 3.496507561466480 | 1.505310400540486 | 1.991197160925994 |
| 1379 | 3.098 | 2.484906649788000 | .615250002856623 | 1.869656646931377 |
| 1680 | 3.725 | 3.258096538021480 | 1.009941980234544 | 2.248154557786936 |
| 1744 | 3.100 | 2.772588722239780 | .901372162285195 | 1.871216559954585 |

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| a. Dependent Variable: logCRECEIVE |

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| **Residuals Statisticsa** | | | | | |
|  | Minimum | Maximum | Mean | Std. Deviation | N |
| Predicted Value | -.220429137349129 | 2.285905361175537 | .803931581920265 | .533164126838409 | 1667 |
| Residual | -1.385528206825256 | 2.443675279617310 | .000000000000043 | .601942021944027 | 1667 |
| Std. Predicted Value | -1.921 | 2.780 | .000 | 1.000 | 1667 |
| Std. Residual | -2.296 | 4.049 | .000 | .997 | 1667 |

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| a. Dependent Variable: logCRECEIVE |