Unraveling the Economic Dynamics of the 2008 Financial Crisis: The Effects of GDP Growth, Interest Rates, and Unemployment on Default Rates

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Abstract:

This paper explores the complex interactions between the unemployment rate, GDP growth rate, mortgage default rate, and loan default rate during the subprime mortgage crisis in the United States. By analyzing the relationships between these key economic indicators, the study highlights the dynamics that led to the 2008 financial crisis. The study investigates how growing unemployment and a dramatic decline in GDP affected bad mortgages and the consequent explosion. By deeply researching historical information and financial theory, a precious understanding of the interconnections of these variables and their effects on the subprime crisis are provided.

Keywords: Default Rate, Financial Crisis, Mortgage, Loan

1. Introduction

"Financial Production and the Subprime Mortgage Crisis" investigates the association among economic innovations, including securitization and credit bubbles. By theoretically analyzing Minsky and Schumpeter, the core effect of financial innovation on the subprime crisis is pointed out. Economic innovations, including securitization, improved market liquidity, but concealed a decrease in loan quality. The procedure of securitization packages loans into economic goods for sale so that banks transfer risks away. Nevertheless, this advocated riskier lending, which finally resulted in the generation of a credit bubble. In the case of a burst bubble, the subprime crisis was triggered by massive defaults on these risky loans. There is a positive association between economic innovation and credit bubbles. Economic innovation made significant contributions to forming the credit bubble by growing market liquidity and driving the issuance of risky loans, resulting in the credit bubble [1].

"Understanding the Subprime Mortgage Crisis" investigates the association between loan quality and house price increase. According to the research, from 2001 to 2007, the quality of subprime loans continuously deteriorated. These loans were always offered to borrowers with poorer credit and on simpler terms. Nevertheless, growing home prices canceled issues with loan quality because they refinanced or sold their properties to enable borrowers to avoid default. When house prices started falling, loan quality deteriorated, bringing greatly grown defaults and a

collapsed market. According to studies, the market boom canceled the risk of a decrease in loan quality, causing an inevitable crisis. There is a negative correlation between two variables; growing house prices canceled a deterioration in loan quality, causing seemingly steady risky loans. When home prices stopped growing or falling, issues with loan quality were exposed, resulting in growing defaults and market collapse [2].

"The U.S. Subprime Mortgage Crisis: Issues Raised and Lessons Learned" explores the association between economic control and market collapse. It is pointed out that the major causes of the subprime crisis are improper economic regulation and market collapse. To be specific, economic regulators failed to usefully regulate the origination and securitization of risky loans, resulting in a flood of such loans in the market. Besides, risks were estimated by market participants wrongly, and a lot of investors failed to fully know the threats of subprime securities. It recommends improving economic control, transparency, and risk evaluation abilities to stop similar crises in the future. There is a positive correlation between two variables; improper economic supervision resulted in the propagation of high-risk loans, and the market failure aggravated the severity of the subprime crisis. The shortage of useful regulation methods and the wrong estimation of risks were the major causes of the subprime crisis [3].

Although there are wide studies, there has been a shortage of research paying attention to the roles of GDP growth, unemployment, and real interest rates in default rates during the subprime crisis. Hence, we aim at seizing this chance to comprehensively investigate these roles. For this purpose, we plan to analyze the associations among these variables by adopting a regression modeling method. During the subprime crisis, volatilities in GDP growth and unemployment rates significantly influenced default rates. GDP growth is typically regarded as an index of financial health, with high GDP growth usually accompanied by lower unemployment rates, showing financial vitality and growing job chances. Nevertheless, during the subprime crisis, the deceleration in GDP growth, real interest rates, and the growth in unemployment likely exerted great effects on default rates. To be specific, with the slowed economy and increased unemployment, borrowers' capacity to repay loans diminished, resulting in higher default rates. To research this association in an integrated way, a regression model will be built for the quantification of the influence of GDP growth, unemployment rate, and real interest rate on default rates.

The next part hereof will pay attention to data gathering, next to modeling in the third part. The outcomes and discussion will be presented in the fourth part. In the end, the paper will overview the outcomes and explore any restric-tions hereof.

2. Data Collection

With this model, we will decide the statistical significance of these variables (p-values), the ratio of variance in default rates interpreted by GDP growth and unemployment (R Square), and the strength and direction of these associations (parameters). Through investigating these elements, how macroeconomic situations affected borrower action during the subprime crisis can be deeply understood, potentially uncovering understandings that could inform future financial policies. Gathering data on GDP growth, unemployment rates, and default rates from credible origins during the period of the subprime crisis will be involved in our method. The correlations and causations between these variables are explored with regression analysis techniques. The outcomes from this analysis could offer a precious understanding of the dynamics of financial crises and assist policymakers in designing more useful interventions to relieve the influence of similar crises in the future.

The interactions between core financial variables during the subprime mortgage crisis are examined (2005-2012). Integrated datasets covering the rate of unemployment, GDP growth rate, mortgage default rate, loan default rate, and interest rate were gathered from credible sources. This gathering of structured information is designed to offer an understanding of the financial variables' interactions that resulted in the 2008 economic crisis.

The subprime mortgage crisis of 2008 resulted in great disruptions in the global economy. Knowing the interplay between different financial indexes during this period is important for policymakers and scholars. This research pays attention to the associations between the rate of unemployment, GDP growth rate, mortgage default rate, loan default rate, and interest rate. These interactions were analyzed in an integrated way by gathering information from 2005 to 2012.

The datasets were acquired from credible origins to guarantee the precision and relevance of the analysis. The primary variables examined include:

Rate of Unemployment: This variable stands for the percentage of the unemployed in the labor force. Data was acquired from Statista and includes annually recorded rates of unemployment for the United States.

GDP Growth Rate: GDP growth rate data was acquired from Statista. This data is modified for inflation to precisely show financial increase tendencies in the United States annually.

Rate of Mortgage Default: The Federal Reserve Bank of St. Louis offered data on mortgage default rates. Monthly

percentages of mortgages in default are included in this data set, which were averaged to generate annual information. Discrimination between prime and subprime mortgages was conducted where applicable.

Rate of Loan Default: Data on loan default rates were offered by the Federal Reserve Bank of St. Louis, including various loan kinds beyond mortgages. The annual percent of loans that were not repaid is included in this data set.

Rate of Interest: Long-term trends offered interest rate data. The annual interest rates were included in this data set, typically defined as a percent of the loan outstanding.

Model 1: Loan Default Rate [4-7]
- Dependent Variable: Loan Default Rate (%)
- Independent Variables: Rate of Unemployment (%), GDP Growth Rate Before One Year (%), Interest Rate (%)

Table 1 shows the regression analysis of the loan default rate, rate of unemployment, GDP growth rate before one year, and the interest rate.

Table 1. Regression Analysis of Loan Default Rate

Regression Statistics	
Multiple R	0.992413926
R Square	0.984885401
Adjusted R Square	0.973549451
Standard Error	0.364742279
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	3	34.67538275	11.55846092	86.88159674	0.000426182
Residual	4	0.532147721	0.13303693		
Total	7	35.20753047			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.406604861	1.155342878	-0.351934364	0.742645805	-3.614350939	2.801141216	-3.614350939	2.801141216
Unemployment Rate	0.697544427	0.149443934	4.667599484	0.009535361	0.282621549	1.112467305	0.282621549	1.112467305
Interest Rate	-0.185756447	0.116977718	-1.587964362	0.187489183	-0.510538658	0.139025765	-0.510538658	0.139025765
GDP Growht Rate Before 1 year	-0.189500348	0.10092539	-1.877628093	0.133647091	-0.469714153	0.090713458	-0.469714153	0.090713458

Model 2: Mortgage Default Rate [5,7,8]
- Dependent Variable: Mortgage Default Rate (%)
- Independent Variables: Rate of Unemployment (%), GDP Growth Rate Before One Year (%), Interest Rate (%)

Table 2 shows the regression analysis of mortgage default rate, rate of unemployment, GDP growth rate before one year and the interest rate.

Table 2. Regression Analysis of Mortgage Default Rate

Regression Statistics	
Multiple R	0.866492757
R Square	0.750809697
Adjusted R Square	0.56391697
Standard Error	0.661865918
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	3	5.279572567	1.759857522	4.017329669	0.106254798

Residual	4	1.752265975	0.438066494					
Total	7	7.031838542						

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	8.642674547	2.096499689	4.122430637	0.014583521	2.821858249	14.46349085	2.821858249	14.46349085
Unemployment Rate	-0.432943517	0.271182838	-1.59650043	0.185612793	-1.18586778	0.319980745	-1.18586778	0.319980745
Interest Rate	0.076208843	0.212269235	0.359019728	0.737729332	-0.513145035	0.665562721	-0.513145035	0.665562721
GDP Growht Rate Before 1 year	-0.169935134	0.18314048	-0.927894992	0.405983391	-0.678414622	0.338544354	-0.678414622	0.338544354

The data gathering and analysis comprehensively demonstrate the interplay between the rate of unemployment, GDP growth rate, mortgage default rate, loan default rate, and rate of interest during the subprime mortgage crisis. Through investigating these associations, the research is designed to focus on the financial dynamics that made contributions to the 2008 economic crisis, providing precious understandings for future financial policy and study. This structured method for data gathering and analysis guarantees that the research is based on credible data, driving a comprehensive examination.

3. Results and Analysis

The coefficient of our regression analysis indicates the association between dependent and independent variables.

For Model 1, which takes into account the loan default rate as its dependent variable, a positive association between the rate of unemployment and the rate of loan default can be concluded, which represents that unemployed individuals are more likely to default. The recession might cause this during the subprime mortgage crisis. As the economy entered a recession, triggered largely by the bursting of the housing bubble and the financial turmoil it caused, unemployment rates began to rise, leading to increased defaults and foreclosures. Oppositely, a negative association was discovered between the interest rate and the loan default rate, as well as between the GDP growth rate from the previous year and the loan default rate. During the subprime crisis, many borrowers were tempted to accept subprime loans at low interest rates and repurchase them at high rates. When interest rates increase, borrowers often face larger monthly payments than many borrowers can afford. As a result, mortgage losses and foreclosures have risen among financially fragile, high-risk borrowers. Higher GDP growth rates one year prior generally corresponded with better economic conditions: lower unemployment, higher household incomes, and greater financial stability for borrowers, which, as a result, leads to a low loan default rate.

The relationship of dependent and independent variables in Model 2 can be obtained similarly. The dependent variable in Model 2 is the mortgage default rate. Unlike the conclusion obtained in Model 1, the mortgage default rate has a positive relationship with the interest rate. When interest rates rose, borrowers with adjustable-rate mortgages faced increased monthly payments. This was particularly challenging for subprime borrowers who may have stretched financially to afford their homes even at the initial teaser rates; many borrowers needed help to make the increased payments. This led to a surge in mortgage defaults among subprime borrowers, who were already more vulnerable due to their lower credit ratings and higher debt-to-income ratios. However, the association between the unemployment rate, GDP growth rate before one year, and the mortgage default rate is negative. As the subprime crisis occurred, rising unemployment and weaker economic growth exacerbated financial pressures on households. Increased defaults led to declining home prices, further intensifying financial distress for homeowners, leading to more defaults. This negative feedback loop contributed to the severity of the crisis and its broader economic ramifications.

For loans, the regression analysis provides an understanding of the association between the dependent variable and the independent variables, which include the unemployment rate, interest rate, and GDP growth rate from the previous year. Below is a summary of the key regression statistics from the output.

Multiple R is 0.992413926. This value indicates a very high correlation between the observed and predicted values of the dependent variable.

R Square is 0.984885401. The R Square value suggests that about 98.49% of the variability in the dependent variable can be interpreted by the independent variables in the model, indicating the fit of the model to the data very well.

Adjusted R Square is 0.973549451. The Adjusted R Square accounts for the number of predictors in the model and provides a more accurate measure of the goodness of fit. An Adjusted R Square of 0.973549451 confirms that the model is robust and a great portion of the variation in the dependent variable is collectively interpreted by the independent variables.

The standard Error is 0.364742279. The standard error of the estimate indicates the typical distance that the ob-

served values fall from the regression line. A lower standard error signifies a better fit.

The high F-Value and low P-Value suggest that the regression model is of statistical significance, indicating that the independent variables collectively have a great relationship with the dependent variable.

The intercept coefficient is -0.406604861, standing for the estimated value of the dependent variable in case of zero independent variables. The high P-value of 0.742645805 suggests that the intercept is not of statistical significance. The coefficient for the unemployment rate is 0.697544427, with a P-value of 0.009533561. This suggests a statistically significant positive association between the unemployment rate and the dependent variable. For every unit growth in the unemployment rate, the dependent variable grows by about 0.6975 units, holding all other variables constant.

The coefficient for the interest rate is -0.185756447, with a P-value of 0.187489183. Although the relationship is negative, it is not statistically significant at the 0.05 level. This suggests that changes in the interest rate may not strongly influence the dependent variable.

The coefficient for the GDP growth rate is -0.189500348, with a P-value of 0.133647091. This negative relationship is also not of statistical significance. This suggests that the GDP growth rate from the previous year does not have a statistically significant impact on the dependent variable in this model.

All in all, the regression analysis displays that the overall model is of statistical significance, as indicated by the high F-value and low P-value. According to the R Square and Adjusted R Square values, the model interprets a very high ratio of the change in the dependent variable. Among the independent variables, the rate of unemployment is the only one that displays a statistically significant association with the dependent variable, indicating that a growth in the rate of unemployment results in a great growth in the dependent variable. The rate of interest and GDP growth rate before one year, although displaying negative coefficients, do not statistically greatly influence the dependent variable based on this analysis. These outcomes offer a precious understanding of the dynamics between macroeconomic variables and the dependent financial index, which can be effective for policymakers and financial analysts in knowing and predicting financial tendencies.

For mortgage, the association between the dependent variable and three independent variables is investigated by the regression analysis: the rate of unemployment, rate of interest, and GDP growth rate from the previous year. The regression statistics, ANOVA outcomes, and coefficients offer an understanding of the model's efficiency and the significance of every variable.

The Multiple R-value of 0.866492757 indicates a strong correlation between the observed and estimated values of the dependent variable. An R Square of 0.750809697 suggests that about 75.08% of the variance in the dependent variable can be interpreted by the model. The Adjusted R Square, which accounts for the number of predictors, is 0.56391697, suggesting a moderate fit.

The estimate shows the standard error of 0.661865918, which reflects the mean distance that the observed values fall from the regression line. This value indicates that while the model has several predictive powers, there is still a fair amount of unexplained variability.

The ANOVA outcomes display an F-value of 4.017329669 with a Significance F of 0.106254798. The F-value suggests the total significance of the model. Although the F-value is reasonably high, the Significance F exceeds the common threshold of 0.05, suggesting that the overall model is not of statistical significance at the 5% level. This indicates that, collectively, the independent variables may not provide a reliable prediction of the dependent variable.

The intercept is of statistical significance with a P-value of 0.014583521, suggesting that in the case of all zero independent variables, the expected value of the dependent variable is significant.

The coefficient for the unemployment rate is negative, indicating an inverse relationship with the dependent variable. However, the P-value of 0.185612793 indicates that this association is not of statistical significance. Therefore, changes in the unemployment rate may not reliably influence the dependent variable in this model.

The positive coefficient for the interest rate suggests a direct association with the dependent variable, but the P-value of 0.737729332 indicates that this association is not of statistical significance. Thus, it appears that the interest rate does not significantly influence the dependent variable.

The coefficient for the GDP growth rate from the previous year is also negative, suggesting an inverse association with the dependent variable. The P-value of 0.405983391 indicates that this association is not of statistical significance, meaning that past GDP growth rates do not significantly influence the dependent variable in the current model.

All in all, the regression analysis reveals that while the model interprets a great portion of the variance in the dependent variable (as indicated by the R Square value), the overall model is not of statistical significance at the 5% level. Among the independent variables, none of them are statistically significant predictors of the dependent variable. This implies that the unemployment rate, interest rate, and GDP growth rate from the previous year do not significantly influence the dependent variable in this context.

Further research with a larger dataset or additional variables might be necessary to improve the model's predictive power and to identify significant predictors of the dependent variable.

4. Conclusion

The coefficient for the unemployment rate is 0.6975, with a p-value less than 0.05, indicating a great positive correlation between the unemployment rate and loan volume. This indicates that under the background of the subprime crisis, a growth in the rate of unemployment may result in a larger need for loans. During the crisis, people might depend more on loans to cover living expenses because of high unemployment. The rate of interest has a coefficient of -0.1858, but with a p-value larger than 0.05, suggesting no great association with loan volume. Although rates of interest might influence loan needs, more key elements, including market confidence and lending policies of economic organizations during the crisis, could overshadow their effect. The coefficient for the previous year's GDP growth rate is -0.1895, but with a p-value larger than 0.05, suggesting no great correlation with loan volume. Market fluctuation and variations in credit policies during the subprime crisis might obscure the influence of financial increases on loan volume.

By contrary, the rate of unemployment has a coefficient of -0.4329, but with a p-value larger than 0.05, suggesting no great statistical correlation with mortgage volume. This might indicate that, although there was a high rate of unemployment as a financial problem during the subprime crisis, other key elements, including credit market liquidity and economic organizations' lending policies, could mask its direct influence on mortgage volume. The rate of interest has a coefficient of 0.0762, but with a p-value larger than 0.05, displaying no great correlation with mortgage volume. This conforms to the past analysis, indicating that during the subprime crisis, variations in rates of interest did not exert direct or significant influences on mortgage demand. The coefficient for the previous year's GDP growth rate is -0.1699, but with a p-value larger than 0.05, suggesting no great correlation with mortgage volume. The previous year's economic growth might not usefully forecast present mortgage needs because of great market volatility and uncertain factors during the crisis.

To sum up, during the subprime crisis, loan volume was greatly correlated with the rate of unemployment instead of interest rates or the past year's GDP growth rate. By contrary, mortgage volume displayed no great correlation with any of these macroeconomic variables, likely because of the overshadowing roles of market situations and lending policies.

4.1 . Implications for Policy and Future Research

Understanding the dynamics between these macroeconomic variables provides valuable insights for policymakers and economic analysts. The study emphasizes the need for robust economic policies and effective financial regulation to mitigate the impact of future crises. Further studies could dig for extra variables or adopt more integrated datasets to improve the insights into these complicated interactions.

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