On the Economic Sources of Changes in Credit Ratings

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Abstract

In this thesis, the focus lies on the determinants of changes in credit ratings. Multiple regression is used to study the relation between credit ratings and a quantity of selected economic variables. The study is restricted to the US market and the ratings have been assigned by Moody's during the period 1999-2008. In line with previous studies, the short-term interest rate and corporate profits are important determinants of rating changes. The result shows that other important factors are the capacity utilization rate and the rate of inflation. Finally, evidence is found that the number of rating changes is procyclical. This leads to the conclusion that if banks use the standardized approach in BIS II, bank capital requirements will be adjusted more frequently when the economy is growing.

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1. Introduction

Substantial progress has been made on measuring credit risk. The lack of traditional approaches to predict significant and sudden increases in credit risk exposure has accelerated the emergence of new models. Besides the purpose of measuring credit risk more accurately, new models aim to evaluate credit risk from a portfolio perspective and examine how derivatives can be used to alter the risk exposure. Nevertheless, many of the better proposals in traditional approaches are indeed used in the new models. In credit risk management, rating systems belong to the traditional approaches. Since, ratings reflect companies' creditworthiness, they affect their possibilities of finding financing. Moreover, external ratings provided by credit rating agencies, such as Standard & Poor's, can be used in the calculation of bank capital requirements.

The value of external ratings has been questioned after the financial crisis in 2008. During the crisis, many former top-rated asset-backed securities (ABSs) either defaulted or were downgraded to a great extent. These events were followed by huge credit losses in banks and financial institutions all around the world. ABSs are usually traded in over-the-counter markets. The absence of supervised exchanges for these kinds of instruments, made it difficult to assess which banks that held huge amounts of bad debt. This uncertainty combined with high credit losses caused a temporarily stop in inter-bank lending. In view of the fact that ABSs, such as Collateralized Debt Obligations (CDOs), can have extraordinarily complex compositions, the superior credit rating evidently appealed to investors. Another attractive feature was the higher expected returns compared to other instruments in the same rating class. The credit rating agencies motivated their high credit ratings by referring to the diversification effect. Moreover, the assigned ratings were supported by highly advanced simulation models. Although globalisation has removed many barriers to investment across borders, the under-estimation of credit risk enabled large institutions to invest in these types of instruments. Typically, pension funds, insurance companies, and other large institutions have clear investment restrictions, which may prohibit them to invest in instruments with credit ratings below a specified limit.

In this thesis, the focus lies on the determinants of changes in external credit ratings. The purpose is to analyze which economic factors that might explain the variation in credit ratings by using multiple regression. Furthermore, the influence of each explanatory will be examined thoroughly. The study is restricted to the US market and the ratings have been assigned by Moody's during the period 1999-2008. The methodology is organized such that a suitable functional form of the regression models is estimated first, followed by an examination of the validity of the assumptions in the regression models. Appropriate measures will be taken in case of any violations. Subsequently, relevant economic hypothesis tests will be carried out on the parameters of the estimated models. The result from this study will be compared with earlier research so as to examine whether the conclusions coincide with the general opinion. The outline of the thesis is as follows: chapter 2 presents the theoretical framework, the 3rd chapter discusses the applied methods and presents the collected data, chapter 4 contains the empirical result and the concluding remarks are provided in chapter 5.

2. Theoretical framework

In this section, the relevant theory is provided. The chapter begins with an examination of rating systems, and continues with credit rating agencies. Finally, a review of the previous research is provided.

2.1 Rating systems

A rating system places a financial instrument or a borrower into different categories. If the rating refers to a borrower, the purpose is to reflect the creditworthiness of the borrower based on its ability to meet future repayments. The rating assigned to a financial instrument not only depends on the credit quality of the issuer, but also on collateral, options and other agreements that are specified in the financial contract. In general, rating systems place the object into high-quality or low-quality ratings. The vast majority of rating systems consider both qualitative and quantitative factors in dividing the rating classes. Examples of important factors are the history of borrowing and repayment, management quality, access to capital markets, market position, asset quality, extent of liabilities, and liquidity. Rating systems can be either internal or external. The internal systems are developed by banks, insurance companies and financial institutions, while external systems are provided by rating agencies such as Moody's and Standard & Poor's. Empirical research has showed that the internal ratings tend to coincide with external ratings. Carey (2001) has compared insurance companies' internal ratings with external ratings, and found that both systems agree in 76, 10

% of the cases and vary by one grade or less in 90, 50 % of the cases. Rating systems can be used in the calculation of required economic capital. Some other areas in which they are used are the determination of loss reserves, pricing of loans, construction of risk reports and the setting of credit limits. The new Basel Capital Accord (BIS II) has acknowledged the variation in commercial credit risk due to external credit ratings, covenants, collateral etc. Therefore, BIS II makes the calculation of capital requirements more sensitive to credit risk exposure. Capital requirements can be calculated in any of the recommended techniques. According to the standardized model in BIS II, each loan is given a certain risk weight based on the company's external credit rating.

2.2 Credit rating agencies

A credit rating agency rank different kinds of financial instruments, for instance, corporate bonds, government securities, and ABSs. Companies and sovereigns themselves are given ratings based on their ability to meet future obligations to investors (i.e. pay back coupons and nominal amounts). Moreover, credit rating agencies usually provides financial data, analysis and research. The leading institutions are Standard & Poor's (S&P), Moody's and Fitch. These companies have rated debt instruments since the beginning of the 1900s. The rating primarily affects the rate of return required by investors. Generally, improvements of the credit rating decreases the risk premium required by investors, whereas a decline leads to an increase. The ratings provided by credit rating agencies covers a large amount of outstanding instruments. According to Standard & Poor's (2009), *the total amount of outstanding debt rated by S&P globally is approximately US$32 trillion, in 100 countries.* Standard and Poor's rank a company from AAA (highest) to D (lowest) whereas Moody's uses a grade from Aaa (highest) to C (lowest). Ratings are reconsidered at certain intervals or when major events occur.

The credit rating agencies have recently been subject to a great deal of criticism. First, they have been criticized for having too close relationships with their clients' management. This close relationship might initiate a reluctance to downgrade a credit rating, even though this is indeed justified. Second, credit ratings have been criticised on the basis that they lag new systems in forecasting credit quality deteriorations and improvements. Third, the judgement of rating agencies have been questioned after the financial crisis in 2008 when it turned out that many former top-rated ABSs either defaulted or were downgraded to a great extent. Thus, the rating agencies clearly underestimated the risk, when they assigned the same rating to these instruments as to risk-free government bonds.

2.3 Previous research

Amato and Furfine (2004) have studied the influence of the state of the business cycle on credit ratings. Their purpose was to assess whether rating agencies are excessively procyclical in their assignment of ratings. They found little evidence of procyclicality. On the other hand, Amato and Furfine concluded that initial ratings and rating changes exhibit excess sensitivity to the business cycle. Koopman et al. (2009) used an intensity-based framework with the purpose of examining the relationship between macroeconomic fundamentals, cycles in defaults and rating activity. They found that the level of economic activity, bank lending conditions and financial market variables are important determinants of default and rating migration intensities. However, many macro fundamentals fall out when their model is improved by adding an unobserved dynamic component. The remaining important macro fundamentals are GDP-growth, the short term interest rate, default spreads and stock market volatilities. Taylor and Gonis (2009) investigated whether the credit quality of UK companies has deteriorated in recent years or if the credit rating agencies have become more stringent in the credit rating process. They applied an ordered probit analysis of 69 UK companies and found evidence that support both explanations. Moreover, among the significant explanatory variables were company size, long- and short-term solvency measures, profits, leverage ratios and cash flow. Mellios and Paget-Blanc (2006) have examined determinants of sovereign credit ratings. They used a principal component analysis with the purpose of identifying the significant explanatory variables. The result point out that sovereign ratings are most influenced by government income, per capita income, the rate of inflation, real exchange changes, and the history of default. Moreover, the study showed that the level of corruption influence economic development and the quality of the governance of a country. Cheng and Neamtiu (2009) have investigated whether and how rating agencies respond to pressure and investor criticism for their ratings' lack of timeliness in predicting bankruptcies. They found that credit rating agencies improve their rating timeliness, increase rating accuracy and reduce rating volatility. The authors suggest that when credit rating agencies' market power is threatened by the possibility of increased regulatory intervention and/or reputation concerns, they respond by improving their credit analysis. Han et al. (2009) have examined stock market reactions to corporate credit rating changes in 26 emerging market countries included in the Morgan Stanley Capital International Emerging Market Index. They used the ratings assigned by Moody's and Standard & Poor's and compared the effect of credit rating changes in two emerging stock markets, namely local markets and American Depository Receipts (ADRs) markets. The authors only found that ADR markets react significantly on changes in credit ratings. Furthermore, the ADR markets react significantly to rating upgrades as well as to rating downgrades. The authors concluded that investors react more strongly in ADR markets because of greater expected bankruptcy costs and foreign exchange risks of those firms listed in both ADR- and local markets.

3. Econometric methods and Data

This section provides a general description of the applied method that is used to determine the economic factors of changes in credit ratings, and how the validity of the assumptions in the models is examined. Furthermore, the collected variables are described in detail. All computations are implemented using *Eviews*.

3.1 Linear regression

The starting point is to estimate the parameters of two separate linear regression models. The estimated parameters are obtained by ordinary least squares (OLS). In these regression models, Moody's rating drift and rating activity are used as dependent variables. These variables are regressed on a constant and number of explanatory factors. A more detailed description of the independent and dependent variables is provided in chapter 3.6. The approach of OLS is to minimize the sum of squared differences. In matrix form, the function to be minimized is

$$S(\dddot{\beta}) = (y - X\dddot{\beta})'(y - X\dddot{\beta}) \qquad (3.1)$$

where X is a (N x K) matrix, $\dddot{\beta}$ is a (K x 1) vector and y, the dependent variable, is a (N x 1) vector. The first step to find the least squares solution is to differentiate equation (3.1) with respect to $\dddot{\beta}$, and setting the result equal to zero. That is,

$$\frac{\partial S(\ddot{\beta})}{\partial \ddot{\beta}} = -2(X'y - X'X\ddot{\beta}) = 0 \qquad (3.2)$$

The OLS solution is then given by (see Verbeek, chapter 2, 2008)

$$b = (X'X)^{-1}X'y \qquad (3.3)$$

It is assumed that X'X is invertible. This implies that there exists no strict multicollinearity. The dependent variable, y, can be written as

$$y = Xb + e \qquad (3.4)$$

where b is the vector of estimated values of the true parameters and e is the vector of residuals with an expected value of zero. Hence, the predicted value for y is given by

$$\hat{y} = Xb \qquad (3.5)$$

There are several assumptions imposed on the linear regression model. If the Gauss-Markov conditions hold, the OLS estimator b has a number of desirable properties. Nevertheless, the OLS estimator still has several attractive properties even under weaker conditions. The first condition has already been mentioned. This implies that the expected value of the error terms is equal to zero. Second, the error terms have the same variance. Third, it is assumed that the error terms are not correlated. The final condition states that X and e are independent. If all mentioned assumptions hold, the OLS estimator is the best linear unbiased estimator (BLUE) of the true parameter values.

3.2 Statistical inference and Multicollinearity

The models' adequacy will be examined comprehensively by testing for specification errors, heteroskedasticity, autocorrelation, as well as to analyze the presence and severity of multicollinearity among the independent variables. When the correctly specified models have been found, hypothesis testing is going to point out which coefficients that are statistically significant. If the Gauss-Markov assumptions hold and the error terms are normally distributed, it is possible to develop a stable test for hypothesis regarding the true unknown population parameter. The Jarque-Bera (JB) test will be carried out in order to test for normality. Given that the Gauss-Markov assumptions hold and the error terms are normally distributed, the estimator b is normally distributed with the mean equal to the true population parameter, β. In addition, the covariance matrix is defined as

$$\sigma^2 (X'X)^{-1} \tag{3.6}$$

Based on this information, it follows that the test statistic in equation (3.7) is standard normal.

$$z = \frac{b_k - \beta_k}{\sigma \sqrt{c_{kk}}} \tag{3.7}$$

where σ is the unknown square root of the error variance and c_{kk} is defined as the (k, k) element in $(X'X)^{-1}$. The term σ can be replaced by its estimate s. It can be shown (see Gujarati, chapter 5, 2006) that the t-statistic in equation (3.8) follows the Student's t-distribution with N-K degrees of freedom

$$t_k = \frac{b_k - \beta_k}{s \sqrt{c_{kk}}} \tag{3.8}$$

The main difference between the normal- and t-distribution is that the t-distribution has fatter tails. However, the t-distribution approaches the normal as N-K gets larger. Using the result above, any hypothesis of interest can be tested. If a coefficient differs significant from zero, this implies that the independent variable has a statistically significant impact on the dependent variable.

Multicollinearity is the statistical occurrence in multiple regressions when the independent variables are highly correlated. In the presence of multicollinearity, the OLS estimators are still BLUE. However, the regression model is likely to produce OLS estimators with large variances and standard errors. As a consequence, constructed confidence intervals for population parameters tend to be wider, which increases the possibility of accepting the hypothesis that the population coefficient is equal to zero. One typical indication of multicollinearity is high R^2 values and few significant test statistics. Accordingly, multicollinearity makes it difficult to assess the individual influence of each independent variable to the obtained R^2. The variance inflation factor (VIF) together with auxiliary regressions will be used as diagnostic tools in an attempt to analyze the multicollinearity problem. The VIF is defined as

$$VIF = \frac{1}{1 - R_k^2} \tag{3.9}$$

where R_k^2 denotes the R^2 from an auxiliary regression upon the other independent variables. The VIF measures how much the variance of a specific coefficient is increased due to multicollinearity. For example, if the VIF of an independent variable takes the value 3, this means that the variance of the coefficient will be 3 times greater compared to the case when there is no correlation between this variable and the other independent variables. If multicollinearity is detected, a remedial measure may be the omission of collinear variables or the acquiring of new data.

3.3 Heteroskedasticity

If the error variance is not constant, we have the situation of heteroskedasticity. Given that the other assumptions in the linear regression model hold, the OLS estimators are still linear and unbiased. However, they are no longer efficient estimators, not even asymptotically. Thus, the variances of the OLS estimators are biased and the hypothesis tests based on F- and t-distributions becomes unreliable. White's test is carried out in order to detect any heteroskedasticity in the regression models. In this test, the squared residuals are regressed on a constant and on each independent variable, their cross products, and their squared values. For example, in a model with two independent variables we run the following auxiliary regression:

$$e_t^2 = B_1 + B_2 X_{2t} + B_3 X_{3t} + B_4 X_{2t} X_{3t} + B_5 X_{2t}^2 + B_6 X_{3t}^2 + \eta_t \tag{3.10}$$

where X_2 and X_3 represent the independent variables and the term η_t is the residual term. Moreover, additional powers of the independent variables might be included in regression

(3.10). The obtained R^2 value from regression (3.10) together with the number of observations (=N) are used to calculate the test statistic. Under the null hypothesis of no heteroskedasticity, the test statistic

$$NR^2 \sim \chi^2_{k-1} \qquad (3.11)$$

is asymptotically Chi-distributed with degrees of freedom equal to the number of independent variables in the auxiliary regression, excluding the intercept. If heteroskedasticity is found, the method of weighted least squares (WLS) can be carried out as a remedial measure given that the true variances of the regression coefficients are known. Nevertheless, the true error variance is hardly ever known. Other more appropriate measures are to re-specify the model or to use White's heteroskedasticity-corrected standard errors.

3.4 Serial correlation

In time-series data, serial correlation implies that the error terms are correlated. The reason for this may be data manipulation or model specification error. The consequences of serial correlation are very similar to the case of heteroskedasticity. If the error terms are correlated, the OLS estimators are still linear and unbiased, but they are no longer efficient. As a result, the standard t- and F-tests are unreliable. Furthermore, the computed R^2 might be unreliable for the reason that the error variance is a biased estimator of its true value. There are several tests of serial- or autocorrelation. Some examples are the Durbin-Watson d test, the runs test, the iterative Cochrane-Orcutt method, and the Breusch-Godfrey LM test; see Verbeek (2008, Chapter 4) for illustrative examples. Moreover, a simple graphical examination of the OLS residuals may provide valuable information about the likelihood of serial correlation. The Breusch-Godfrey LM test will be employed so as to test for serial correlation. This is an asymptotic test based upon the R^2 of an auxiliary regression together with the selected quantity of lagged residuals. If K and F denote the number of lagged residuals and independent variables, the auxiliary regression model is defined as

$$e_t = B_1 + B_2 X_{2t} + ... + B_F X_{Ft} + a_1 e_{t-1} + ... + a_K e_{t-k} + \varepsilon_t \qquad (3.12)$$

If the R^2 from regression (3.12) is multiplied with the number of observations, the obtained test statistic is Chi-distributed under the null hypothesis of no serial correlation. If serial correlation is found, the model will be corrected with appropriate measures. Generalized least squares (GLS) estimation may be one remedial measure. Another common approach is to re-estimate the model while adjusting its standard errors. The standard errors that are consistent with both autocorrelation and heteroskedasticity are called the Newey-West (1987) standard errors. According to this approach, the estimated covariance matrix is given by

$$\hat{V}(b) = \left(\sum_{t=1}^{T} x_t x_t^{'} \right)^{-1} TS^* \left(\sum_{t=1}^{T} x_t x_t^{'} \right)^{-1} \tag{3.13}$$

where

$$S^* = \frac{1}{T} \sum_{t=1}^{T} e_t^2 x_t x_t^{'} + \frac{1}{T} \sum_{j=1}^{H-1} w_j \sum_{s=j+1}^{T} e_s e_{s-j} (x_s x_{s-j}^{'} + x_{s-j} x_s^{'}) \tag{3.14}$$

with $w_j = 1 - j/H$. Note that in the above example H denote the lag length. The Newey-West standard errors are computed from equation (3.13). In the presence of autocorrelation and/or heteroskedasticity, standard tests from a linear model with Newey-West standard errors are said to be asymptotically valid.

3.5 Stability test

To test for possible specification errors, the RESET test will be employed. According to Ramsey (1969), under the null hypothesis, nonlinear functions of equation (3.5) should not help in explaining the dependent variable. The RESET test is performed by running regression (3.4) once more and adding nonlinear powers of equation (3.5). If Q is equal to the number of powers, the functional form of the auxiliary regression is defined as

$$y_t = x_t^{'}b + k_2\hat{y}_t^2 + k_3\hat{y}_t^3 + ... + k_Q\hat{y}_t^Q + \eta_t \tag{3.15}$$

where k stands for the coefficient for the power of $\hat{Y}_t$, and η_t is the residual from the model. The R^2 obtained from model (3.4) together with the R^2 from regression (3.15) are used to produce an F-statistic. This can be used to test the hypothesis that all coefficients for the power of $\hat{Y}_t$ are equal to zero. The hypothesis that the model is correctly specified is accepted if the F-statistic is not statistically significant.

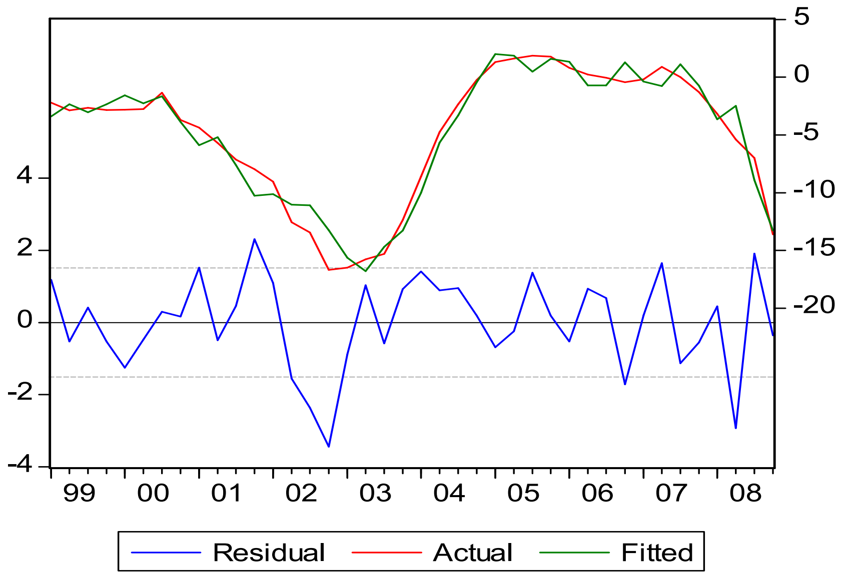
3.6 Data

The data employed is quarterly and are taken from *Thomson DataStream*. The sample period ranges from the first quarter in 1999 to the last quarter in 2008. The descriptive statistics and the corresponding abbreviation for each collected variable are provided in table 16 and 17, respectively. The study is restricted to the US market and the obtained corporate ratings have been assigned by Moody's. For rating changes, Moody's rating activity and rating drift are used. The rating activity is defined as the number of issuer rating changes, divided with all rated issuers, whereas the rating drift is defined as the difference between the upgrades and the downgrades, divided with the number of rated issuers. The rating drift might be interpreted as the overall change in creditworthiness, where positive values indicate an improvement. Conversely, negative values imply deterioration in creditworthiness. The rating activity, on the other hand, is an intensity measure of the number of rating changes. The data set of independent variables consists of the 3-month treasury bill rate, the growth in the gross domestic product (GDP) and the producer price index (PPI), aggregate corporate net cash flows, aggregate corporate profits, the unemployment rate, the national bureau's (NBER) business cycle, the capacity utilization rate, the CEO confidence index, and a trade weighted value of the US dollar against major currencies. Economic theory suggests that the short-term interest rate is negatively related to upgrades, because the higher the interest rate, the more expensive it is for companies to borrow new capital. The growth in PPI (inflation) is closely connected with the short-term interest rate for the reason that high rates of inflation advocate for an increase in the short-term interest rate. Therefore, it is expected that the rate of inflation is negatively related to upgrades. Since, the GDP measures the market value of all final goods and services produced in the economy, it is considered as a measure of the country's economic performance. Therefore, it is expected that GDP growth is positively related to upgrades. As suggested in economic theory, corporate profits and improvements in creditworthiness are positively correlated. Corporate net cash flow is another measure of a company's financial health. Accordingly, it is expected that cash flow is positively correlated with upgrade movements, and negatively with downgrades. Both cash flow and profits are measured in billions of dollars. It is commonly argued that an increasing rate of unemployment is associated with lower levels of disposable income and higher costs on society. In view of the fact that a higher rate of unemployment reduces the demand for products and services, there should be a positive relationship between downgrades and the rate of unemployment. The NBER business cycle is a dummy variable equal to 1 if the economy is in recession and 0 if the economy is in expansion mode. According to NBER (2003), *a recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Between trough and peak, the economy is in an expansion.* Intuitively, economic recession ought to be positively related to downgrades, while expansion is positively related to upgrades. The capacity utilization rate is defined as the ratio of actual output to the potential output. Thus, it is interpreted as an overall efficiency measure of the economy. Since, the capacity utilization rate is linked to total demand, it is believed that the capacity utilization rate is positively related to upgrades. The CEO confidence index is a regular survey of Chief Executive Officers (CEOs) in the United States. Approximately 100 CEOs are interview each occasion and they come from a variety of industries. The index reflects their views on issues such as industry concerns, the economic outlook, and future business plans. It ranges from 0 to 100, where values of 50 or higher indicate that the CEOs are more positive than negative in their views on the business conditions. It is expected that an optimistic view on the business conditions is positively related to upgrades. The trade-weighted value of the US dollar against major currencies is an index with base period value of 100 on March, 1973. A decrease in the value of the US dollar makes US goods cheaper in the global market, followed by an increase in total demand. Hence, it is expected that the currency index is negatively related to upgrades.

4. Result

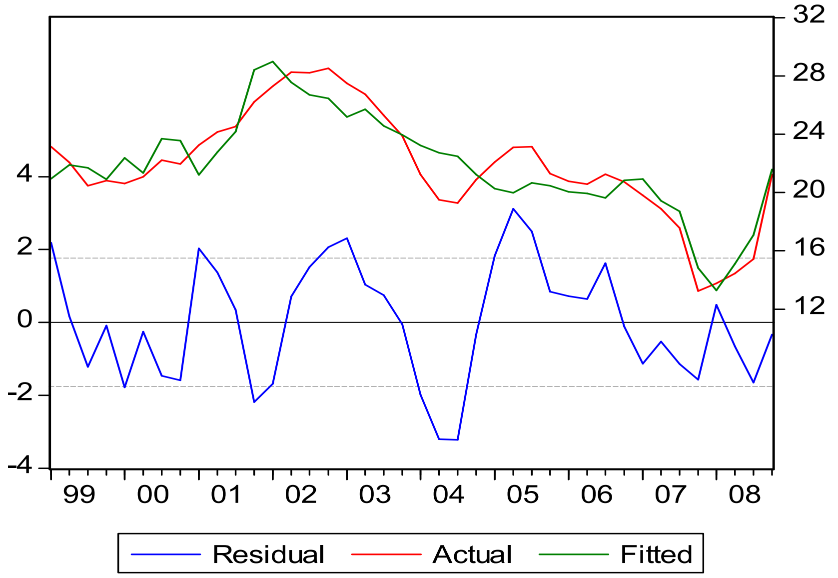
To begin with, Moody's rating drift and rating activity have been regressed on a constant and all 10 independent variables. The results are given in table 1 and 2. As we can see, the R^2 is fairly high whereas most t-ratios are insignificant. In table 1, every independent variable, including the intercept, is insignificant at the 5 % level. This might indicate a presence of severe multicollinearity among the independent variables. The pair wise correlation matrix for all included variables is presented in table 17. It appears that several correlations are remarkably high, with a number of values exceeding 0, 8. In some cases, there is a more or less perfect correlation. The variables that are particularly highly correlated are the unemployment rate and the 3-month bill rate, aggregate profits and the exchange-rate measure, along with aggregate profits and aggregate cash flows. In order to analyze the severity of multicollinearity, each independent variable has been regressed on a constant and the remaining independent variables. Moreover, the obtained values of the R^2 have been used to calculate the VIF. The results are presented in table 3. As the table shows, six regressions have R^2 values in excess 0,9; the F-test shows that every R^2 is statistically significant at the 5 % level, suggesting that some independent variables are highly collinear with other independent variables. The multicollinearity problem is confirmed by the large variance inflations factors. The variables that exhibit especially high VIF values are the capacity utilization rate, the short-term interest rate, aggregate cash flows, aggregate profits, the unemployment rate, and the exchange-rate measure. Typically, a VIF value greater than 10 is an indication of severe multicollinearity. For that reason, it may be desirable to modify the regression models in order to reduce the multicollinearity problem. The proposed solution has been to omit an appropriate number of variables. The variables that have been excluded are the unemployment rate, aggregate cash flows, and the exchange-rate measure. The auxiliary regressions without these variables are presented in table 4. Undoubtedly, the exclusion of three independent variables significantly decreased the variance inflation factors. Moreover, the obtained F-values are lower, but still significant at the 5 % level. The new models, based on the 7 remaining independent variables, are presented in table 5 and 6. As expected, the obtained value of the R^2 has decreased somewhat in both models. However, several independent variables are significant at the 5 % level. The RESET tests of model 3 and 4 are presented in table 7 and 8. As we can see, the computed F-values are equal to 22, 02 and 0, 44. It can be seen that the p-value of obtaining an F-value of as much as 0, 44 or greater is 64, 57 %. Hence, the hypothesis that all coefficients for the power of $\hat{Y}_t$ are equal to zero is accepted at the 5 % level. In table 7, the F-statistic is significant at the 5 % level. The conclusion we draw from this is that model 4 is correctly specified, whereas model 3 is misspecified. An alternative model of the rating drift is presented in table 9. In this model, the absolute values of aggregate profits and the short-term interest rate have been replaced by their respective log values. Furthermore, cross products and squared independent variables have been included in the regression equation. Evidently, nonlinear functions are significant and suggest that nonlinearities are important in explaining changes in the rating drift. The RESET test of model 5 can be found in table 10. The F-value has taken a value of 1, 73 and the corresponding p-value is equal to 19, 65 %. The conclusion is that model 5 is correctly specified, based on the RESET test.

Figure 1: Graphical illustration of model 5



Note: Actual- and fitted values together with the residuals are plotted for model 5, during the sample period 1999Q1-2008Q4

Figure 2: Graphical illustration of model 4



Note: Actual- and fitted values together with the residuals are plotted for model 4, during the sample period 1999Q1-2008Q4

The obtained values of the R^2 in model 4 and 5 are fairly high. The independent variables in model 5 explain approximately 95 % of the variance in the rating drift, whereas the independent variables in model 4 are able to explain 82, 12 % of the variance in the rating activity. Obviously, the estimated regression lines fit the actual observations well. This can be seen from figure 1 and 2, which plots the actual- and fitted values from model 4 and 5. Moreover, the residuals from model 4 and 5 are plotted alongside with the fitted- and actual values. From the regressions we see that the intercept term in both models is significant at the 5 % level. In model 5, the effect of the log value of the short-term interest rate, the rate of inflation, and the log value of aggregate profits are statistically significant at the 5 % level. The slope coefficient of the log value of the interest rate has taken the value 17, 26. This means that if the interest rate increases by 1 %, on the average, the rating drift increases by 0, 1726 units. The slope coefficient of the log value of aggregate profits is equal to 29, 51. Hence, if aggregate profits increases by 1 %, on average, the rating drift increases by 0, 2951 units. The increase in PPI (inflation) has a negative effect on the rating drift. Holding other variables constant, as the PPI goes up by one percentage point, on average, the rating drift goes down by 1, 46. The F-statistic in table 9 has taken the value of 47, 56, which is significant at the 5 % level. Therefore, there is evidence in favour of the hypothesis that the independent variables collectively have a significant effect on the rating drift. In model 4, the effect of the capacity utilization rate, the short-term interest rate, the NBER business cycle, and aggregate profits are statistically significant at the 5 % level. The slope coefficient of the short-term interest rate has taken the value 0, 96. This implies that if the bill rate increases by 1 %, ceteris paribus, the rating activity will increase by approximately 0, 96 units. The value of the coefficient of aggregate profits is equal to -0, 0034, meaning that if aggregate profits increases with 1 billion dollars, the rating activity declines by approximately 0, 0034 units. The NBER business cycle coefficient of -4, 03 imply that if the economy is in recession, the rating activity is about 4, 03 units lower. The coefficient of the capacity utilization rate has taken the value -1, 17. Accordingly, if the capacity utilization rate increases with 1 unit, ceteris paribus, the rating activity decreases with approximately 1, 17 units. The histogram of the residuals in model 4 and 5 are presented in figure 3 and 4. Moreover, the figures provide the JB test statistics and their corresponding p-values. The histograms indicate that there is no reason to reject the hypothesis that the residuals in model 5 and 4 are normally distributed. The JB statistics takes the values 3, 01 and 1, 00. Thus, the hypothesis of normality is accepted in both cases at the 5 % significance level.

Figure 3: Histogram and normality test (Model 5)

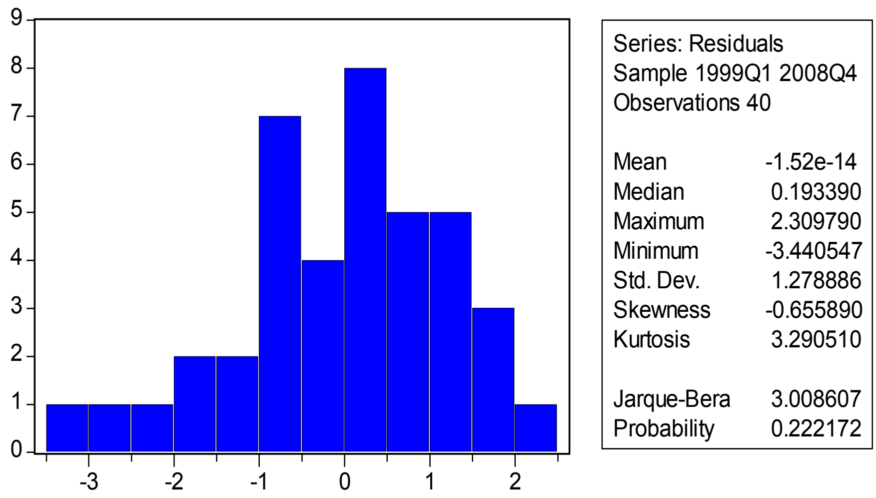
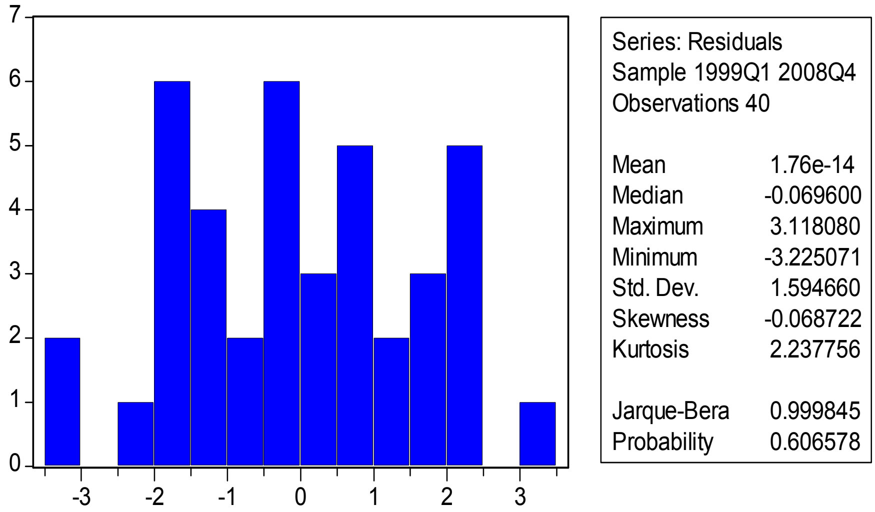


Figure 4: Histogram and normality test (Model 4)



The White test has been carried out in order to test for heteroskedasticity. The result is presented in table 11 and 12, respectively. As we can see, the test statistics takes the values of 21, 30 and 32, 99. Hence, the test statistics are not significant at the 5 % level and we accept the hypothesis that there is no heteroskedasticity in any of the models.

Figure 5: Residuals against lagged residual from model 4

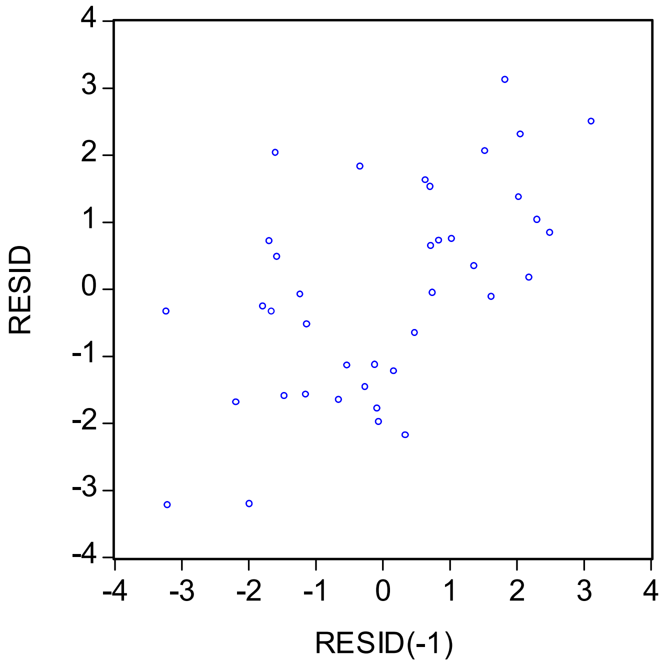
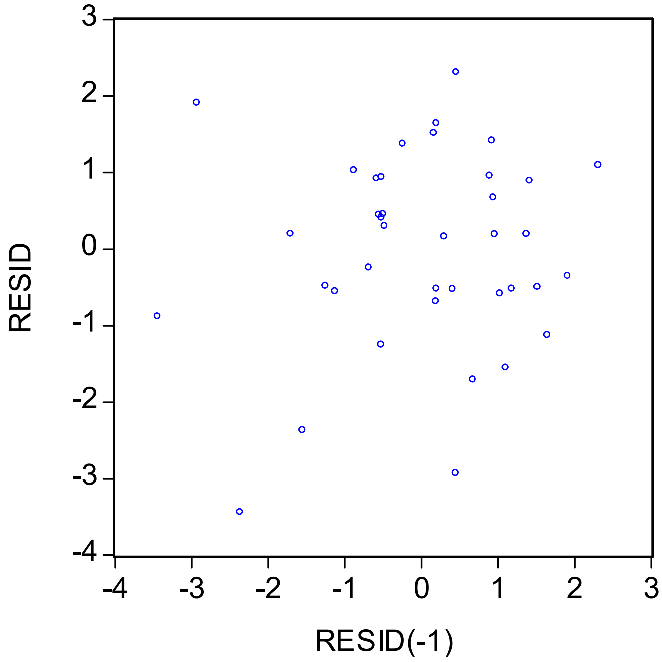


Figure 6: Residuals against lagged residual from model 5



The residuals have been plotted against the lagged residual (lagged by 1), as shown in figure 5 and 6, which depicts the residuals from model 4 and 5. An examination of figure 5 shows that the residuals seem to exhibit positive autocorrelation while figure 6 shows no systematic pattern among the residuals. Hence, the graphical plotting of the residuals suggests that model 4 suffers from serial correlation. The result of the Breusch-Godfrey serial correlation LM tests can be found in table 13 and 14. The LM test for model 5 produces a test statistic of 1, 27, which implies that the hypothesis of no serial correlation should be accepted. For model 4, the test statistic of 16, 10 clearly imply that the null hypothesis should be rejected against the alternative of serial correlation. As the test strongly indicates the presence of serial correlation, it seems appropriate to use OLS while computing corrected Newey-West standard errors. Recall that these standard errors also allow for heteroskedasticity. The result is presented in table 15. Qualitatively, the conclusions do not change. As before, the capacity utilization rate, the short-term interest rate, the business cycle and aggregate profits are significant at the 5 % level. The standard errors of the significant coefficients have taken the values of 0, 26, 0, 37, 1, 55 and 0,001. In model 4, the equivalent standard errors were equal to 0, 26, 0, 36, 1, 04 and 0, 001. Comparing model 4 with model 6, we see that the standard errors are slightly lower in model 6.

5. Conclusions

The main purpose of this thesis was to analyze credit ratings over time and search for the determinants of changes in credit ratings. Using the rating drift and the rating activity of US corporations from Moody's over the period 1999-2008, the influence of a quantity of economic factors was examined with multiple regression. In line with previous studies, the short-term interest rate and corporate profits are important determinants of rating changes. These two economic variables are significant in explaining both the number of rating changes as well as the direction in overall creditworthiness. Other important candidates are the rate of inflation, the capacity utilization rate, and the state of the business cycle. Since, the rating activity is lower in recessions, it seems that there is indeed procyclicality in the number of rating changes.

The estimated coefficients for all of the significant variables had the expected signs, except for the coefficient of the short-term interest rate. The result pointed out that the short-term interest rate has a positive relationship to the rating drift in addition to the rating activity. Hence, a higher interest rate is good for rating upgrades and is associated with a higher intensity in the number of rating changes. Generally, we would expect that the higher the interest rate, the more expensive it is for companies to borrow new capital. The result might have two reasons. First, the positive sign may come about due to sampling error. An alternative explanation is that the short-term interest rate is positively related to aggregate profits. Another interesting finding is that the CEO confidence index was insignificant in each model. Therefore, corporate leaders' subjective opinions about the economic conditions do not have a significant impact on rating changes.

The findings may have implications for policymakers. According to the standardized model in BIS II, banks will base their capital requirements on external credit ratings. If the number of changes in credit ratings is procyclical, bank capital requirements will be adjusted more frequently when the economy is growing.

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7. Appendix

Table 1: Linear regression results (Model 1)

Dependent Variable: USMDRATD				
Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-0.636083	1.107420	-0.574383	0.5701
PPI	-0.318100	0.468706	-0.678678	0.5027
USCAPUTLQ	1.043783	0.909399	1.147772	0.2604
USCEOCNFR	0.054194	0.069604	0.778607	0.4425
USGBILL3	-0.435725	1.342830	-0.324482	0.7479
USMFNWA	0.015313	0.017464	0.876862	0.3878
USNBERBCR	0.358594	2.130963	0.168278	0.8675
USPROFTSB	-0.000221	0.012638	-0.017451	0.9862
USUNTOTQ	-4.515100	2.768435	-1.630921	0.1137
USXTW	0.041476	0.232749	0.178199	0.8598
C	-86.17682	99.34308	-0.867467	0.3928
R-squared	0.808658	F-statistic		12.25610
Adjusted R-squared	0.742678	Prob(F-statistic)		0.000000

Note: Sample period: 1999Q1-2008Q4

Table 2: Linear regression results (Model 2)

Dependent Variable: USMDRATA				
Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-0.410358	0.601421	-0.682314	0.5005
PPI	-0.011661	0.254546	-0.045812	0.9638
USCAPUTLQ	0.290113	0.493879	0.587417	0.5615
USCEOCNFR	0.006655	0.037801	0.176051	0.8615
USGBILL3	0.204005	0.729268	0.279740	0.7817
USMFNWA	0.009848	0.009484	1.038366	0.3077
USNBERBCR	-2.410243	1.157289	-2.082662	0.0462
USPROFTSB	-0.002484	0.006863	-0.361937	0.7200

Table 2 (continued)

USUNTOTQ	2.959053	1.503489	1.968124	0.0587
USXTW	0.348114	0.126402	2.754015	0.0101
C	-55.99951	53.95150	-1.037960	0.3079
R-squared	0.872596	F-statistic		19.86225
Adjusted R-squared	0.828664	Prob(F-statistic)		0.000000

Note: Sample period: 1999Q1-2008Q4

Table 3: Auxiliary Regressions, 10 explanatory variables

Dependent variable	Value of R^2	Value of F	Is F significant*	VIF
GDP	0,5446	3,99	Yes	2,20
PPI	0,4323	2,54	Yes	1,76
USCAPUTLQ	0,9661	94,87	Yes	29,46
USCEOCNFR	0,6052	5,11	Yes	2,53
USGBILL3	0,9632	87,33	Yes	27,20
USMFNWA	0,9812	173,87	Yes	53,16
USNBERBCR	0,7149	8,36	Yes	3,51
USPROFTSB	0,9890	299,10	Yes	90,73
USUNTOTQ	0,9509	64,52	Yes	20,36
USXTW	0,9713	112,70	Yes	34,81

Note: * Significant at the 5 % level

Table 4: Auxiliary Regressions, 7 explanatory variables

Dependent variable	Value of R^2	Value of F	Is F significant*	VIF
GDP	0,5090	5,70	Yes	2,04
PPI	0,3698	3,23	Yes	1,59
USCEOCNFR	0,5472	6,65	Yes	2,21
USGBILL3	0,8148	24,20	Yes	5,40
USNBERBCR	0,5484	6,68	Yes	2,21
USPROFTSB	0,3713	3,25	Yes	1,59
USCAPUTLQ	0,8398	28,83	Yes	6,24

Note: * Significant at the 5 % level

Table 5: Linear regression results (Model 3)

Dependent Variable: USMDRATD

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-86.83977	31.57965	-2.749865	0.0097
GDP	-0.010804	1.101592	-0.009808	0.9922
PPI	-0.233272	0.459512	-0.507651	0.6152
USCAPUTLQ	0.820794	0.432354	1.898432	0.0667
USCEOCNFR	0.095461	0.067133	1.421963	0.1647
USGBILL3	1.442219	0.617969	2.333804	0.0260
USNBERBCR	2.231675	1.748679	1.276206	0.2111
USPROFTSB	0.006476	0.001728	3.746574	0.0007
R-squared	0.774756	F-statistic		15.72398
Adjusted R-squared	0.725483	Prob(F-statistic)		0.000000

Note: Sample period: 1999Q1-2008Q4

Table 6: Linear regression results (Model 4)

Dependent Variable: USMDRATA

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	113.7803	18.69997	6.084517	0.0000
USCAPUTLQ	-1.166844	0.256019	-4.557641	0.0001
GDP	-0.523995	0.652310	-0.803291	0.4277
PPI	-0.160096	0.272101	-0.588368	0.5604
USCEOCNFR	0.041655	0.039753	1.047858	0.3026
USGBILL3	0.959473	0.365932	2.621996	0.0133
USNBERBCR	-4.032523	1.035484	-3.894335	0.0005
USPROFTSB	-0.003386	0.001023	-3.307997	0.0023
R-squared	0.821696	F-statistic		21.06695
Adjusted R-squared	0.782692	Prob(F-statistic)		0.000000

Note: Sample period: 1999Q1-2008Q4

Table 7: Ramsey's RESET test (model 3)

F-statistic	22.01840	Probability	0.000001
Log likelihood ratio	36.13459	Probability	0.000000

Dependent Variable: USMDRATD

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	241.7856	55.80176	4.332938	0.0002
GDP	-0.147951	0.725438	-0.203947	0.8398
PPI	-0.319089	0.302383	-1.055249	0.2997
USCAPUTLQ	-2.872928	0.647380	-4.437775	0.0001
USCEOCNFR	-0.054156	0.058829	-0.920555	0.3646
USGBILL3	-0.296200	0.483980	-0.612007	0.5451
USNBERBCR	-4.270310	1.727582	-2.471843	0.0193
USPROFTSB	-0.002272	0.001744	-1.302458	0.2027
FITTED^2	-0.524613	0.084037	-6.242632	0.0000
FITTED^3	-0.024097	0.004568	-5.275533	0.0000

R-squared	0.908730	F-statistic	33.18837
Adjusted R-squared	0.881349	Prob(F-statistic)	0.000000

Table 8: Ramsey's RESET test (model 4)

F-statistic	0.443842	Probability	0.645712
Log likelihood ratio	1.166405	Probability	0.558108

Dependent Variable: USMDRATA

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-28.50817	758.7490	-0.037573	0.9703
USCAPUTLQ	0.336696	8.245268	0.040835	0.9677
GDP	0.354436	3.943911	0.089869	0.9290
PPI	0.139494	1.128298	0.123633	0.9024
USCEOCNFR	-0.030464	0.301095	-0.101177	0.9201
USGBILL3	-0.336772	6.688208	-0.050353	0.9602
USNBERBCR	1.574077	28.77567	0.054702	0.9567
USPROFTSB	0.001544	0.024851	0.062147	0.9509
FITTED^2	0.086971	0.342659	0.253812	0.8014
FITTED^3	-0.001654	0.005343	-0.309514	0.7591

R-squared	0.826820	F-statistic	15.91448
Adjusted R-squared	0.774866	Prob(F-statistic)	0.000000

Table 9: Linear regression results (Model 5)

Dependent Variable: USMDRATD				
Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-221.7592	20.71807	-10.70366	0.0000
USCAPUTLQ	0.054077	0.305547	0.176985	0.8608
GDP	-0.289702	0.616036	-0.470267	0.6418
LOG(USGBILL3)	17.25666	1.807061	9.549571	0.0000
USCEOCNFR	0.080428	0.044230	1.818374	0.0797
PPI	-1.463189	0.430838	-3.396149	0.0021
LOG(USPROFTSB)	29.50559	4.422668	6.671446	0.0000
USNBERBCR	0.926055	1.130807	0.818932	0.4197
USGBILL3*USPROFTSB	-0.004485	0.000764	-5.868033	0.0000
PPI*USNBERBCR	-1.437749	0.667216	-2.154847	0.0399
PPI^2	0.554258	0.175105	3.165283	0.0037
USGBILL3^2	0.159098	0.103448	1.537958	0.1353
R-squared	0.949202	F-statistic		47.56371
Adjusted R-squared	0.929245	Prob(F-statistic)		0.000000

Note: Sample period: 1999Q1-2008Q4

Table 10: Ramsey's RESET test (model 5)

F-statistic	1.733409	Probability		0.196481
Log likelihood ratio	5.006731	Probability		0.081809
Dependent Variable: USMDRATD				
Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-122.7016	59.87269	-2.049376	0.0506
USCAPUTLQ	0.019157	0.326226	0.058723	0.9536
GDP	-0.279039	0.602751	-0.462942	0.6473
LOG(USGBILL3)	9.305322	4.680785	1.987983	0.0574
USCEOCNFR	0.045304	0.047071	0.962457	0.3447
PPI	-0.828913	0.540793	-1.532774	0.1374
LOG(USPROFTSB)	16.45073	8.296082	1.982952	0.0580
USNBERBCR	-0.132579	1.243474	-0.106620	0.9159
USGBILL3*USPROFTSB	-0.002308	0.001391	-1.659178	0.1091
PPI*USNBERBCR	-0.855509	0.730481	-1.171159	0.2522
PPI^2	0.296671	0.221881	1.337075	0.1928

Table 10 (continued)

USGBILL3^2	0.056389	0.115202	0.489479	0.6286
FITTED^2	-0.063271	0.049517	-1.277764	0.2126
FITTED^3	-0.002067	0.002279	-0.906788	0.3728
R-squared	0.955178	F-statistic		42.62125
Adjusted R-squared	0.932767	Prob(F-statistic)		0.000000

Table 11: Auxiliary regression White test (Model 5)

F-statistic	1.082409	Probability	0.433063
Obs*R-squared	21.30298	Probability	0.379496

Dependent Variable: The squared residuals from model 5 (RESID^2)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1591.605	1273.250	-1.250033	0.2265
USCAPUTLQ	-24.50587	32.18653	-0.761370	0.4558
USCAPUTLQ^2	0.147085	0.204570	0.718996	0.4809
GDP	-0.295225	2.987016	-0.098836	0.9223
GDP^2	-0.501294	1.666984	-0.300719	0.7669
LOG(USGBILL3)	-4.753163	10.89122	-0.436421	0.6674
(LOG(USGBILL3))^2	-34.16232	21.77724	-1.568717	0.1332
USCEOCNFR	0.041344	0.592219	0.069813	0.9451
USCEOCNFR^2	-0.002018	0.005336	-0.378074	0.7096
PPI	-0.291428	1.132389	-0.257357	0.7997
PPI^2	-1.380038	0.903241	-1.527873	0.1430
LOG(USPROFTSB)	736.0982	476.8008	1.543828	0.1391
(LOG(USPROFTSB))^2	-52.00426	33.82954	-1.537244	0.1407
USNBERBCR	4.767476	5.730421	0.831959	0.4158
USGBILL3*USPROFTSB	0.005893	0.008791	0.670397	0.5107
(USGBILL3*USPROFTSB)^2	-5.00E-07	6.16E-07	-0.812075	0.4268
PPI*USNBERBCR	-2.176597	2.585457	-0.841861	0.4103
(PPI*USNBERBCR)^2	0.080907	1.497886	0.054014	0.9575
(PPI^2)^2	0.250662	0.190288	1.317278	0.2034
USGBILL3^2	5.449899	3.330535	1.636343	0.1182
(USGBILL3^2)^2	-0.058656	0.035976	-1.630391	0.1195
R-squared	0.532574	Adjusted R-squared		0.040548

Table 12: Auxiliary regression White test (Model 4)

F-statistic	0.691589	Probability	0.766794
Obs*R-squared	32.98591	Probability	0.517174

Dependent Variable: The squared residuals from model 4 (RESID^2*)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7637.747	12101.69	0.631131	0.5557
USCAPUTLQ	-199.1698	312.8532	-0.636624	0.5524
USCAPUTLQ^2	1.302828	1.972116	0.660624	0.5381
USCAPUTLQ*GDP	10.94274	6.073263	1.801790	0.1315
USCAPUTLQ*PPI	0.649141	3.690360	0.175902	0.8673
USCAPUTLQ*USCEOCNFR	-0.035968	0.314063	-0.114525	0.9133
USCAPUTLQ*USGBILL3	1.285258	3.684709	0.348809	0.7414
USCAPUTLQ*USNBERBCR	11.88389	12.13819	0.979049	0.3725
USCAPUTLQ*USPROFTSB	-0.018103	0.013016	-1.390861	0.2230
GDP	-839.8483	455.6005	-1.843388	0.1246
GDP^2	-17.89860	9.950065	-1.798842	0.1320
GDP*PPI	3.367314	8.664436	0.388636	0.7135
GDP*USCEOCNFR	1.220463	0.706978	1.726309	0.1449
GDP*USGBILL3	-14.39066	8.153895	-1.764882	0.1379
GDP*USNBERBCR	-8.305218	17.91251	-0.463655	0.6624
GDP*USPROFTSB	-0.015468	0.010134	-1.526364	0.1874
PPI	-14.44914	258.3842	-0.055921	0.9576
PPI^2	-1.450199	3.406001	-0.425778	0.6880
PPI*USCEOCNFR	-0.593943	0.414271	-1.433705	0.2111
PPI*USGBILL3	-3.289852	5.306051	-0.620019	0.5624
PPI*USNBERBCR	-25.18277	16.71707	-1.506411	0.1923
PPI*USPROFTSB	0.006683	0.007474	0.894150	0.4122
USCEOCNFR	-0.821733	17.11631	-0.048009	0.9636
USCEOCNFR^2	0.008101	0.050067	0.161803	0.8778
USCEOCNFR*USGBILL3	0.309086	0.828622	0.373012	0.7244
USCEOCNFR*USNBERBCR	1.752552	2.477472	0.707395	0.5109
USCEOCNFR*USPROFTSB	0.000841	0.001386	0.607315	0.5702
USGBILL3	-94.26370	298.5307	-0.315759	0.7649
USGBILL3^2	-0.220250	2.683213	-0.082084	0.9378
USGBILL3*USNBERBCR	12.96862	23.92281	0.542103	0.6110
USGBILL3*USPROFTSB	-0.010334	0.008890	-1.162424	0.2975
USNBERBCR	-1015.481	903.2560	-1.124245	0.3120
USNBERBCR*USPROFTSB	-0.009082	0.039556	-0.229592	0.8275
USPROFTSB	1.433121	0.951880	1.505570	0.1925
USPROFTSB^2	2.27E-05	7.66E-05	0.296358	0.7789

R-squared	0.824648	Adjusted R-squared	-0.367748

Table 13: Breusch-Godfrey Serial Correlation LM Test (Model 5)

F-statistic	0.425872	Probability	0.657674
Obs*R-squared	1.268811	Probability	0.530251

Dependent Variable: The residuals from model 5 (RESID)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.796242	23.06551	0.121230	0.9044
USCAPUTLQ	0.048867	0.323927	0.150858	0.8813
GDP	-0.235853	0.680529	-0.346573	0.7317
LOG(USGBILL3)	-0.426438	2.336608	-0.182503	0.8566
USCEOCNFR	-0.007870	0.053931	-0.145928	0.8851
PPI	0.118937	0.528978	0.224844	0.8239
LOG(USPROFTSB)	-0.857883	4.939808	-0.173667	0.8635
USNBERBCR	-0.152390	1.188887	-0.128179	0.8990
USGBILL3*USPROFTSB	0.000139	0.000856	0.161858	0.8727
PPI*USNBERBCR	0.070629	0.686965	0.102812	0.9189
PPI^2	-0.039791	0.195095	-0.203955	0.8400
USGBILL3^2	-0.014365	0.107133	-0.134084	0.8944
RESID(-1)	0.218314	0.271126	0.805212	0.4280
RESID(-2)	-0.102293	0.280258	-0.364997	0.7181

R-squared	0.031720	F-statistic	0.065519
Adjusted R-squared	-0.452420	Prob(F-statistic)	0.999996

Table 14: Breusch-Godfrey Serial Correlation LM Test (Model 4)

F-statistic	10.10599	Probability	0.000441
Obs*R-squared	16.10132	Probability	0.000319

Dependent Variable: The residuals from model 4 (RESID)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.071168	15.27944	-0.135553	0.8931
USCAPUTLQ	0.039559	0.209308	0.189000	0.8514
GDP	0.243663	0.529858	0.459865	0.6489
PPI	-0.046008	0.217645	-0.211390	0.8340
USCEOCNFR	-0.013742	0.031913	-0.430591	0.6698
USGBILL3	-0.106622	0.296428	-0.359689	0.7216
USNBERBCR	0.025843	0.830624	0.031113	0.9754
USPROFTSB	-8.38E-05	0.000832	-0.100764	0.9204
RESID(-1)	0.771417	0.173752	4.439772	0.0001
RESID(-2)	-0.346350	0.182283	-1.900070	0.0671

R-squared	0.402533	F-statistic	2.245776
Adjusted R-squared	0.223293	Prob(F-statistic)	0.046752

Table 15: Linear regression results (Model 6), Newey-West HAC Standard Errors & Covariance

Dependent Variable: USMDRATA

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	113.7803	20.34535	5.592446	0.0000
USCAPUTLQ	-1.166844	0.258187	-4.519378	0.0001
GDP	-0.523995	0.488333	-1.073029	0.2913
PPI	-0.160096	0.244471	-0.654864	0.5172
USCEOCNFR	0.041655	0.054221	0.768253	0.4480
USGBILL3	0.959473	0.365748	2.623318	0.0132
USNBERBCR	-4.032523	1.552603	-2.597265	0.0141
USPROFTSB	-0.003386	0.001041	-3.251497	0.0027

R-squared	0.821696	Mean dependent var	21.86600
Adjusted R-squared	0.782692	S.D. dependent var	3.776482
S.E. of regression	1.760457	Akaike info criterion	4.145880
Sum squared resid	99.17468	Schwarz criterion	4.483656
Log likelihood	-74.91761	F-statistic	21.06695
Durbin-Watson stat	0.823240	Prob(F-statistic)	0.000000

Notes: Lag truncation= 3, Sample period: 1999Q1-2008Q4

Table 16: Summary statistics for the dependent and independent variables, 1999-2008

The collected variables are the increase in the producer price index (ppi), the growth in GDP (gdp), aggregate corporate net cash flows (usmfnwa), aggregate corporate profits with IVA & CCADS (usproftsb), the unemployment rate (usuntotq), the NBER business cycle (usnberbcr), the 3-month treasury bill rate (usgbill3), the capacity utilization rate (uscaputlq), the ceo confidence index (usceocnfr), a trade-weighted value of the US dollar against major currencies (usxtw), Moody's rating drift (usmdratd), and Moody's rating activity (usmdrata).

	GDP	PPI	USCAPUTLQ	USCEOCNFR	USGBILL3	USMDRATA	USMDRATD	USMFNWA	USNBERBCR	USPROFTSB	USUNTOTQ	USXTW
Mean	0.555977	0.711879	78.71573	51.62500	3.111250	21.86600	-4.911000	1134.363	0.200000	1178.260	5.030000	90.89225
Median	0.638703	0.796836	79.93450	52.00000	3.180000	21.28500	-2.855000	1121.400	0.000000	1130.250	4.900000	87.91500
Maximum	1.821262	2.456561	82.47000	73.00000	6.210000	28.52000	1.850000	1405.700	1.000000	1713.800	6.900000	111.3900
Minimum	-1.624774	-5.090312	73.74800	24.00000	0.110000	13.26000	-16.69000	858.5000	0.000000	714.5000	3.900000	70.88000
Std. Dev.	0.616734	1.305088	2.750978	10.53854	1.790085	3.776482	5.674239	192.4281	0.405096	347.3862	0.751136	11.68359
Skewness	-0.738222	-2.206721	-0.404071	-0.233494	0.093939	-0.268511	-0.785722	-0.080967	1.500000	0.236638	0.306160	0.098594
Kurtosis	5.591600	10.98788	1.753340	3.015920	1.621872	3.018276	2.392587	1.495093	3.250000	1.423430	2.243478	1.824000
Jarque-Bera	14.82713	138.8078	3.678754	0.363886	3.224226	0.481210	4.730648	3.818279	15.10417	4.515941	1.578769	2.369764
Probability	0.000603	0.000000	0.158916	0.833649	0.199466	0.786152	0.093919	0.148208	0.000525	0.104562	0.454124	0.305782
Sum	22.23907	28.47518	3148.629	2065.000	124.4500	874.6400	-196.4400	45374.50	8.000000	47130.40	201.2000	3635.690
Sum Sq. Dev.	14.83405	66.42690	295.1472	4331.375	124.9718	556.2108	1255.682	1444114.	6.400000	4706410.	22.00400	5323.747
Observations	40	40	40	40	40	40	40	40	40	40	40	40

Table 17: Pairwise correlation matrix for the dependent and independent variables, 1999-2008

	GDP	PPI	USCAPUTLQ	USCEOCNFR	USGBILL3	USMDRATA	USMDRATD	USMFNWA	USNBERBCR	USPROFTSB	USUNTOTQ	USXTW
GDP	1	0.382143986	0.31466323144	0.46590225825	0.21301315310	0.03186926621	0.17907240483	-0.0661963706	-0.5638256464	-0.0357061317	-0.2434195563	0.02527980525
PPI	0.3821439	1	0.40812133087	0.19475636371	0.19257417663	-0.3737419167	0.31563033248	0.13923059625	-0.0581494182	0.23822500647	-0.2890598734	-0.2905596269
USCAPUTLQ	0.31466323144	0.408121330	1	-0.2075363142	0.83546460200	-0.5600228882	0.81400970480	0.08306913976	-0.1895404497	0.31583198372	-0.8197560666	-0.3357607103
USCEOCNF R	0.46590225825	0.1947563637	-0.207536314	1	-0.2599337086	0.3957617245	-0.1739461215	-0.0289000408	-0.5285423512	-0.1391969452	0.24504464794	0.16714801652
USGBILL3	0.21301315310	0.1925741766	0.83546460200	-0.2599337086	1	-0.2087022720	0.694149729	-0.1956995030	-0.2503440033	0.00821249565	-0.9401441066	0.11754364149
USMDRATA	0.03186926621	-0.3737419167	-0.560022888	0.39576172451	-0.2087022720	1	-0.5794530520	-0.4738911411	-0.4161329034	-0.6314147395	0.27830579617	0.76745823461
USMDRATD	0.17907240483	0.31563033248	0.81400970480	-0.1739461215	0.69414972998	-0.5794530520	1	0.33670843735	-0.0933897764	0.49910761754	-0.6922321601	-0.4020964550
USMFNWA	-0.0661963706	0.13923059625	0.08306913976	-0.0289000408	-0.1956995030	-0.4738911411	0.33670843735	1	0.06302382601	0.95884653605	0.26822470951	-0.8357879610
USNBERBCR	-0.563825646	-0.0581494182	-0.1895404497	-0.5285423512	-0.2503440033	-0.4161329034	-0.0933897764	0.06302382601	1	0.06694650858	0.10617682633	-0.1860271365
USPROFTSB	-0.035706131	0.23822500647	0.31583198372	-0.1391969452	0.00821249565	-0.6314147395	0.49910761754	0.95884653605	0.06694650858	1	0.06638945324	-0.9027176176
USUNTOTQ	-0.243419556	-0.289059873	-0.819756066	0.24504464794	-0.9401441066	0.2783057961	-0.6922321601	0.26822470951	0.10617682633	0.06638945324	1	-0.1486510372
USXTW	0.025279805	-0.2905596269	-0.335760710	0.16714801652	0.11754364149	0.76745823461	-0.4020964550	-0.8357879610	-0.1860271365	-0.9027176176	-0.1486510372	1