Regulatory versus Informational Value of Bond Ratings: Hints from History…[*]

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Abstract

A multivariate analysis can be used in order to investigate the relationship between bond yields, ratings and standard control variables. In an attempt to evidence a possible impact of financial regulations using ratings, identical tests have been done on a number of cross-sections. Datasets for corporate (NYSE) bond issues allow a focus on two key events in the development of ratings driven financial regulation in the United States of America: the valuation of bank portfolios introduced in the 1930's and the net capital requirements for broker dealers introduced in the 1970's. The contribution of bond ratings in the explanation of the variability in bond yields appeared definitely stronger once regulations had been enacted (1937 and 1975).

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The financial turmoil following the United States (US) sub-prime crisis has brought credit rating agencies liability back into question. While the role and performance of this particular financial intermediary have been recurring issues, regulatory pressures towards a century old rating business had not truly materialized before the corporate scandals that came with the end of the equity « dotcom » bubble. European Union (EU) authorities opted for a self-regulation approach strongly relying on codifying business ethics. United States (US) Congress launched a process of hearings and reports that ended with the Credit Rating Agency Reform Act of 2006, which added to self-regulation the need to increase competition in the credit rating business and targeted a designation introduced in the 1970s by the Security and Exchange Commission (SEC).

This coming back to a 30 year old designation as a treatment against the assumed ills of the rating business should raise suspicion: can we really assess the economic role of credit rating agencies? Starting in the 1930s with a need to police banks' bond portfolio, US financial authorities began producing rules relying on bond ratings. The trend has then been an unchallenged widening of this use, which however truly started only at the beginning of the 1970s with a ruling on brokers' margin requirements. Globally, Japanese financial authorities started to rely on ratings in the early 1980s and then further international adoption came with the 1990s.

This public use of ratings means a major exogenous fact and a remaining question is: to what extent does it matter versus common explanations for the success of bond ratings as a business? In particular, the fact that financial regulation uses ratings may prove as a determinant of the relation between bond ratings and yields. This relation is a matter of interest because it enables one to judge on how ratings are recognized by investors. Were issuers not convinced of this relation for some reason, they would not be ready to pay for ratings. While usual explanations for investors' reliance on ratings are information specialization and information equalizing, the question is: did financial regulations using ratings impact this recognition?

One can take advantage of History by performing identical tests before and after the enactment of these regulations. This particular strategy was inaugurated by West (1973) about regulations enacted in the 1930s. A first contribution of this paper is to come back to this analysis by introducing a multivariate analysis on the same datasets. A second one is to apply a similar multivariate setting to first-hand datasets at the beginning of the 1970s. This introduces an investigation of a possible impact of regulations enacted by the SEC. In both case, what is documented is an increase of bond ratings "informational" value once the regulation had been enacted.

The rest of the paper is organized as follows. Section 1 gives background information on bond ratings as regulatory inputs. Section 2 reviews the existing literature on bond ratings and yields. Section 3 introduces the chosen empirical framework. Section 4 provides a tentative conclusion.

1. Background: ratings as financial regulation tools

An interesting feature of the bond markets is that some firms deal with the established business of rating bonds on the basis of their relative financial quality. These *bond ratings* are meant to proxy for the "expected reliability in meeting future financial requirements" and have become a quite shared measure of bond default risk.

The acceptance of bond rater's opinion by regulatory agencies is now so broad that a full account would need a paper. Historically, while bond ratings were born at the turn of the twentieth century, this acceptance came with the 1930s.

In 1930, the Federal Reserve began using bond ratings in their examination of the member banks' portfolios[1]. In 1931, the United States Treasury Department, through the Comptroller of the Currency, adopted credit ratings as proper measures of the quality of the national banks' bond accounts: bonds rated Baa/BBB (or an equivalent rating) or higher would be carried at cost; bonds with lower ratings (including defaulted bonds) would however require fractional write-offs[2]. During the following years, many State banking superintendents adopted the Comptroller's plan (see Harold (1938, pp. 27-28).

In 1935, Amendments to the Federal Banking Act specified that all national banks were subject to the orders of the Comptroller's Office as for the securities they might purchase for their own accounts. On February, 15th 1936, the Comptroller issued a ruling stating that "the purchase of investment securities in which the investment characteristics are distinctly and predominantly speculative, or investment in securities of a lower designated standard than those which are distinctly

[1]Harold (1938, 3p.25) mentions the use by several branches of the Federal Reserve of systems similar to the one introduced by Osterhus (1931). This member of the Federal Reserve Bank of New York introduced a system already in use for weighting a bank's entire portfolio based on credit ratings, so that the portfolio's "safety" or "desirability" could be expressed in a single number, referred to as a "desirability weighting."

[2] Mimeographed ruling issued by J.W. Pole, then Comptroller of the Currency, not dated, although other references indicated that the ruling was made on September 11, 1931 (see The Commercial and Financial Chronicle, 133, Sept. 12, 1931, 1672). This ruling received wide attention at the time (see Wall Street Journal Sept. 12, 1931, at 1, 5 and also Harold (1938, p.27) for J. Moody's comments).

and predominantly speculative, is prohibited" and adding in a footnote that "the terms applied herein may be found in recognized rating manuals" (see Harold, (1938 p. 30)).

This decision spurred confusion about what this footnote exactly implied and hostility about the use of bond ratings as tools to influence the structure of commercial banks portfolios. Actually, the Comptroller had then to state that ratings were not "the sole criterion, or even a necessary criterion, for judging whether or not a particular bond was eligible for purchase by a national bank"[3]. Nonetheless, controversies did not quiet down. The footnote was even deleted on July 1 1938… only to be restated in full force with the 1938 Agreement and subsequent regulations issued jointly by the U.S. Comptroller of the Currency, the Federal Deposit Insurance Corporation, the Board of Governors of the Federal Reserve System and the Executive Committee of the National Association of Supervisors of State Banks.

By virtue of this agreement, all American banking authorities stated that bonds in the first four rating categories (Group I) were to be given a privileged status by being valued at their purchase price or at par and by being therefore insulated from day-to-day price fluctuations[4]. From now on, regulators of bank investment would use privately issued opinions on bond quality as an input. For individual banks, this meant that informational requirements and uncertainties would be minimized for investments in the top three rating categories while lower rated or even unrated bonds would still be permitted but with an added burden of justification.

The use of bond ratings by US financial regulators was now clearly stated and since then the trend would be an unchallenged widening of this use, which however truly started only at the beginning of the 1970s. In 1951, the National Association of Insurance Commissioners began equating the term "investment grade bonds" with bonds having ratings of Baa or better. But the increase in regulatory dependence on credit ratings began in 1973 when, following the credit crises of the early 1970s, the SEC adopted Rule 15c3-1 on broker dealers. Since this time, there have been credit-rating dependent rules and regulations promulgated under the Securities Act of 1933, the Securities Exchange Act of 1934, the Investment Company Act of 1940, and various banking, insurance, pension, and real estate regulations. (see Cantor &Packer (1996, Table 2 p.32) and IMF (1999, Table A6.1 p.154) for a tentative listing).

This regulatory use of ratings has been mirrored first in Japan in the early 1980s and then in the European Union with the 1993 Capital Adequacy Directive implemented by 2000. Ratings as

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[3]Address by J. F. O'Connor before California Bankers Association, May 22 1936

[4]Book value for bonds of Group I (Aaa to Baa inclusive); current market value plus any unrealized 50 cent depreciation on them should be charged against net bank capital for Group II (Ba or below) (see Fed Reserve Bulletin, 24, 565, July 1938).

regulatory tools ratings have been promoted internationally through the advancement of the Basles II scheme for the global standardization of bank regulations (IMF (1999, Table A6.2 p.156) provides a global picture of this use of ratings). Following a global perspective, the adoption of ratings by economic agents has been all the more contemporaneous to their use by financial authorities. The picture is all the more blurred and then a rationale for coming back to US history is to look for a more paced sequence of events.

From publishers of opinions on creditworthiness, rating agencies ended up providing information as to the future treatment by financial regulation, a point on which F. Partnoy based a theory of rating agencies as "regulatory licenses providers" (see Partnoy (1999, p. 681)). Well before this generalizing effort, observers wondered about the potential impacts of this use of ratings by financial regulation. The most straightforward field of investigation is the relation between ratings and yields, which is introduced below.

2. Literature review

Bond ratings are ultimately valued because they are recognized as a shared measure of bond default risk by investors. It is then tempting to investigate their relationship with bond yields in order to elaborate on the pertinence of their use[5]. Bond yields can be *offering* yields at issuance on the primary market, *actual* yields as quoted on the second market or *realized* yields once the bond came to expire.

Looking at realized yields is an *ex post* analysis where a focus on the impact of US financial regulation has been quite common. Considering the experience of bond issues for 1900-1943, B. Hickman came to the conclusion that actual loss rates did not completely eliminate the *ex ante* higher yields accorded to bonds with lower ratings (see Hickman (1958, table 1 p10). This finding was then restudied and contested (see Fraine &Mills (1961)). It however remained a piece of evidence that could be interpreted as a claim for a more active trading of high yield debt securities (see, for example, Fitzpatrick &Severiens (1973)). Then, along with the rise of the high yield (or "junk") bond market came further investigations showing that investors in speculative bonds had been more than satisfactorily compensated for the default risk (see, for example, Altman &Namacher (1985) and Altman (1989)). Producing evidence on the overcompensation for default risk by high yield debt

[5] Bond prices are usually given as percentages of the original face value of the bond. In order to study the behavior of bond market agents, it has moreover been a convention to focus on the annual rates of return implied by these prices or *yields* as they are referred to.

securities would usually go along with noting that demand for these securities had been constrained by legal restrictions for a number of institutional investors.

Dealing with an *ex post* analysis however means a difficulty in sorting out the impact of a particular regulation. Such a difficulty has brought a focus on evidencing over-inflated yields for non investment grade issues as a straightforward impact of the 1930s regulation introduced in section 2. This focus is intuitive but should not mask the original difficulty. For example, the very findings of B. Hickman have been used in a study focusing on the passing of 1933 Securities Act (see Jarell (1981, pp. 650-660) in a follow-up study to the famous work of Stigler (1964) on the equity market).

Turning to an *ex ante* analysis means either looking at offering yields or at actual yields. To my knowledge, the literature does not discriminate on this point. It is then better introduced with the help of the following questions:

a) Are bond ratings relevant to explain bond yields?

b) Do bond yields react to a change in bond ratings?

Dealing with b) means introducing a temporal analysis and then requires continuous data from the second market[6]. Focusing on the other question involves a static cross examination of bond ratings, control variables and yields. This kind of analysis can be fed by data either on offering yields observed on the primary market or on actual yields computed from the prices on the second market[7].

Given a focus on a), a typical review of literature may be: West (1973), Liu &Thakor (1984), Ederington et al. (1987), Reiter &Ziebart (1991), Brister et al. (1994), Levingston et al. (2003). Levingston et al. (2003) provides details about the earlier studies that will not be introduced here (pp. 4-6). The authors then use a latent variable methodology and yields on new industrial bond issues to focus on whether bond ratings contain non-publicly available information.

West (1953) introduced the issue of Moody's rating in a classical study of corporate bond yields (Fisher 1959). In 1959, L. Fisher produced a study of using a log/log transformation of the common Ordinary Least Square (OLS) regression analysis. This study became classical and in 1973 R. West investigated the relationship between Moody's ratings and L. Fisher's regressions residuals. As opposed to a lack of pronounced relationship in 1927, 1932 and 1937, the behavior of residuals could be linked to the investment grade status in 1949 and 1953. The cross examination of bond

[6] A reader interested with b) (i-e "do Y react to a bond rating change?") may found a review of the relevant literature in Kliger &Sarig, (2000, 2 p. 2280).

[7] Note that while mixing studies using actual yields and offering yields has then been common, studies focusing on the impact of multiple ratings on yields at issuance have usually been set aside (see, for example., Liu & Moore (1987), Billingsley et al. (1985), Hsueh & Kidwell (1988), Thompson &Vaz (1990)).

ratings, control variables and yields, came to document an impact of the "first wave" of US financial regulation embodying bond ratings[8].

An interesting point is that most of the following studies dealt solely with the neutral position of evidencing *an informational* value of ratings. The focus is on testing the following null hypothesis:

(h_O) : "bond ratings do not have an explanatory power"

For example, Ederington et al. (1987) "explores the information content" of Moody's and S&P ratings beyond publicly available accounting variables by relating them to the yield to maturity. The authors used a non-linear lest square procedure on data concerning bonds traded on the NYSE on 02/28/1979 and 02/28/1981.

Overall, R West's result may be noted or commented, but the issue of sorting the investigated informational value from a regulatory value is not faced. To my knowledge, such a concern can only be found in Brister et al. (1994). On a given sample, authors proceed with several methodologies in order to evidence an inflation of non-investment grade bond yields above the one that could be expected by judging on default risk. Echoing the literature dealing with realized yields, Brister et al. (1994) has a focus on a straightforward reading of existing regulations and on producing an *ex post* piece of evidence (by outlining the over-inflation of yields with data on offering yields for 1982-1987). When R. West did share this focus on the investment grade distinction, the more convincing part of his work is that the very spacing of L. Fisher's regressions allowed him to contrast the relationship between yields and ratings before and after the enactment of regulations. Following this interpretation leads to formulate the following "meta-null hypothesis":

(H_O): "The explanatory power of ratings does not change with the passing of new regulation"

Departing from a focus on the over-inflation of non investment grade bond yields as an impact of US Financial regulation, the question is more the robustness of the relationship between ratings and yields to the passing of the relevant regulations. The following empirical analysis should be read with this overall concern in mind.

[8] See, supra, section 1 and Harold (1938, p. v): "Following the Comptroller of the Currency statement on 02/15/1936, it became common knowledge in bond circles that bond rated below that of "a business man investment "(BBB, Baa, B**, B1+) could almost never be sold to a bank."

3. Empirical analysis

A first objective of this empirical analysis is to provide a read-through of West (1973), which concluded to an impact of the 1938 regulation relying on the non-investment grade status (see section 1 and especially footnote 4). A second one is to provide a similar investigation for a possible impact of the 1975 regulation of broker dealers. First is introduced the data, an overall model is then motivated. The analysis proceeds with running two distinct declinations of this general model respectively on five cross sections surrounding the late 1930's enactment and on three cross sections surrounding the early 1970's enactment.

3.1 Data

In order to deal with 1930's regulation, building datasets starts by computing data from the Appendix of L. Fisher's PhD dissertation thesis (see Fisher (1959, appendix D p.66)). These original datasets are several samples of yields spread ("risk premium") per issuer according to prices on NYSE outstanding bond issues on December 31st. They are given with financial ratios concerning the issuer. Replicating R. West's work, these datasets have been matched with relevant issues of Moody's manuals.

In order to deal with 1970's regulation, the starting point has been data communications by S&P and Moody's according to their archiving of US corporate bond rating histories. These datasets range from the end of the 1960s to the beginning of the 1970s. Datasets for bond ratings outstanding on Dec 31 for the years 1971, 1973 and 1975 are subsets of these files[9].

For the computation of yields, information on the bond issue bearing the rating is needed (name, coupon, maturity, etc.). In the case of the Moody's communication, such information is

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[9] See, *supra*, section 1, where the 1930's regulation have introduced extensively. For the 1970's, I refer here to the regulation of broker-dealers by Rule 15c3-1, which set forth certain "haircut" requirements. A "haircut" is the percentage of a financial asset's market value a broker-dealer is required to deduct for the purpose of calculating its net capital requirement. Rule 15c3-1 required a different "haircut" based on the credit ratings assigned to the asset. This ruling was more than yet another use of ratings in regulation since for the first time it included the creation of a Nationally Recognized Statistical Rating Organization status. See the 1975 Net Capital Rule (Rule 15c3-1, 17 C.F.R. § 240.15c3-1, setting new net capital requirements for broker-dealers).
At the end of 1971, the "second wave" has not yet started; at the end of 1973, the enactment of Rule 15c3–1 by the SEC is pending (See Notice of Revision Proposed Amendments to Rule 15c3-1 under the Securities Exchange Act of 1934, Release No. 34-10, 525, 1973 SEC LEXIS 2309 (Nov. 29, 1973): "The Commission to a limited extent has also recognized the usefulness of the nationally recognized statistical rating organizations as a basis for establishing a dividing line for securities with a greater or lesser degree of market volatility."); at the end of 1975, the rule is on for 6 months (See Adoption of Amendments to Rule 15c3–1 and Adoption of Alternative Net Capital Requirement for Certain Brokers and Dealers, Release No. 34–11497 (June 26, 1975), 40 FR 29795 (July 16, 1975)).

missing and then gained by merging the dataset with the Mergent Fixed Income Securities Database (FISD) database[10]. Once this common dataset of outstanding ratings has been built, it is merged with the Compustat North America Industrial Annually database in order to get information on the issuing company.

Fisher (1959) used actual yields and then bond prices on the second market, are required[11]. They have been hand-computed following the New York Stock Exchange (NYSE) quotations as reported by the Bank and Quotation Report (see Annex A for details on this point).

Lastly, the outcome of this merging process is a sample of bond ratings, prices, etc., *per bond issue* and then can sometime produce a couple of observations identical according to the gathered information. These observations are thus computed in order to build an average yield spread given a rating for the issuer[12].

The final outputs can be considered as randomly selected samples for each year[13]. The table below displays the respective populations per rating categories.

TABLE 1 – Sample size and rating categories								
RATING	1927	1932	1937	1949	1953	1971	1973	1975
Aaa/ AAA	10	3	4	1	2	10	11	15
Aa/ AA	9	4	5	12	16	25	32	32
A/ A	15	4	8	15	29	52	56	80
Baa/ BBB	18	14	27	16	21	15	14	18
Ba/ BB	14	10	19	13	8	3	4	3
B/ B	--	10	10	2	4	4	6	5
Caa	--	--	2	--	--	--	--	--
Total (N)	66	45	75	59	80	109	121	153

-- : unrelevant

[10] Given this added merging and also that the Moody's communication is by far more numerous, I focus on Moody's ratings *that do not duplicate the S&P ratings*. My rationale for doing so is that I am not interested in multiple/split ratings issues, which is of course a limitation of the following results.

[11] This is not a problem for an investigation focusing on the offering yield (i-e the yield offered when the bond was issued on the primary bond market). The offering price and sometime the offering yield is reported in any dataset describing bond issues (e.g. Mergent FISD).

[12] This computation is done regardless of the agency that produced the rating. For example, if one company has two outstanding bond issues each one bearing the same rating but one from Moodys and the other from S&P, a single observation is created.(weighted average based on the respective outstanding amounts). The outstanding amounts on Dec 31 are found in the relevant issues of the Moodys Industrial and Public Utilities manuals. The computation is not done and observations remain distinct in case of (a) a different level of security or (b) a difference between SP and Moodys ratings (a split rating, the account of which is very rare because of the merging decision described in footnote 9).

[13] Merging statistics are available upon request to the author.

3.2 Model

Let us start with the assumption that the yield (Y) on a bond issue (i) will be a function of: 1) the rate of return of riskless debt, 2) issue "other" characteristics defined as whether the bond prospectus mentions several provisions or restrictions, 3) the probability of default of (i) [14].

A first step is to raise the issue of ratings' relevance and then the overall specification is:

$Y_i = f(C_i, R_i, X_i, YREF_i, u_i)$

where, Y_i : yield to maturity on the issue i
C_i : issuer's creditworthiness
R_i : bond rating of the issue i
X_i : issue i other characteristics
$YREF_i$: yield on the chosen risk free issue
u_i : random error

A second step is to change the target variable in order to focus on the spread between the yield on the issue i and the yield on the chosen risk free issue[15]. Hence a new variable is defined as follows:

$AYSprd_i = Y_i - YREF_i$

The new overall specification is then:

$AYSprd_i = f(C_i, R_i, X_i, u_i)$

3.2.1 Variable selection

A balance has to be stricken between a full account of ratings determinants (see Chan&Jegadesh (2001), Appendix p. 23) and a final set that has to be easily computable for an average investor. It should moreover be noted that the exercise of replicating bond ratings may not end up with an acknowledged default probability prediction model when, again, it is desirable that the set of control variables be viewed as a potential standard for the typical investor.

[14] See, for example, Merton (1974, p. 449). This assumption is standard but may be considered simplistic… for instance, Fisher (1959) raises the issue of marketability; while Ederington et al. (1987, p.218) or Elton et al. (2001, p. 247) raise the one of taxation.

[15] The computed yield spread is *relative* as opposed to the common *absolute* yield spread used by L Fisher ($ABSYSpread_i = Y_i - YREF_i$). Lamy &Thompson (1988) show how the relative yield spread appears to be a more stable measure considering changes in interest rates. The basis of $YREF_i$ is the yield of US Treasury bond according to the CRSP monthly Treasury database (for detail on the computation see annex A). These issues are of course not perfectly exempt from risk but it is extensively common to consider their yield as a pure rate.

3.2.2.1 On default risk (C_i)

With these requirements in mind, a first step can be to focus on financial ratios, for example broken down by i) liquidity, ii) profitability and iii) capital structure (see, for example, Tang (2006, appendix B p. 48).

The next step is to pick a number of these ratios. An example is: i) liquidity: the volume of bond outstanding[16], ii) profitability: the 9 years net income variation coefficient[17] and iii) capital structure: the ratio of equity market value on par value of debt. These variables and a proxy for financial reliability constitute the Fisher (1959) model.

With the building of new datasets on early 1970s came the opportunity to go beyond a straight use of the Fisher (1959) model. All that is needed is a model fitting in the gridline introduced above. For instance, previous studies may be interpreted as pointing out the choice of: i) liquidity: firm size, ii) profitability: interest coverage or operating margin and return on assets, iii) any measure of leverage (see Livingston et al. (2003, p. 17 and table 1 p. 39)).

The present study will somewhat depart from the above framework. If one looks for a standard way to analyze default risk, the success and common use of the Z score models must be outlined (Altman (1968) introduced these models while Altman (2000) provides an extended introduction to them). To my knowledge, while it has been quite common to plot Z scores against ratings, only Brister et al. (1994) imported them in a cross examination of ratings and yields. They replicated a Z score methodology in order to use the computed scores as default risk proxies. This meant a two stepped process starting with a Multi Discriminant Analysis, which goes along with several hypotheses and computational complexity. Rather than focusing on the output of Z score models, the input, that is the very variables constituting the model, are an interesting set of predictors for credit risk. Including them as control variables for the present investigation follows Altman &Rijken (2005) using them in an ordinal logit regression to build a rating prediction model.

I further follow Altman &Rijken (2005) by supplementing the common Z score determinants with a variable accounting for the number of years since a company was first rated by a company. This kind of variable is quite common in investigations of ratings determinants but remain somewhat unpresent in the typical cross examination of yields and ratings. To put it in a nutshell, my set of predictors accounting for credit risk is the “agency ratings prediction model” as introduced by Altman &Rijken (2005).

[16] Original purpose of the volume of bond outstanding was to account for marketability but it ended up as a proxy for liquidity.

[17] Variation coefficient = standard deviation / arithmetic mean

3.2.2.2 On other issue characteristics (X_i)

Turning to issue characteristics other than default risk can be a rather difficult task since the bond prospectus may include numerous features. Their relevance for the bond pricing process is moreover left open to discussion. A cautious strategy can then be to gather a sample of bond issues with similar features and hence focus on ratings and default risk variables (see Livingston et al. (2003, 2 p. 22)). In a similar manner, Fisher (1959) took care of these characteristics during the computation of yield spread.

Information on the subordination and security level of bond issues could be gathered while building the datasets for 1970s. The model then includes two dummies variables: SUB coding for subordination and SEC coding for security. It should however be noted that there is no account of other common features such as the presence of a call and/or the one of a sinking fund.

Last but not least, Fisher (1959) focused on industrials. Gathering data on early 1970s gave the opportunity to get a broader view. Original datasets covered corporate bond issues and then mixed industrials and utilities issues. Industrials and utilities are usually considered as two different realms. Instead of splitting the datasets, what is proposed here is the other option of including a dummy variable coding for public utilities (UTILITY) to the model.

3.2.3 Model specification

The previous remarks lead to two General Linear Model estimations built on the following overall specification:

$AYSprd_i = f\ ((LIQUx_i, PROFx_i, LEVx_i, R_i, X_i, u_i)$

where, $AYSprd_i$: Absolute yield spread on the issue i
$LIQUx_i$: Liquidity proxy "x" for the issuer
$PROFx_i$: Profitability proxy "x" for the issuer
$LEVx_i$: Leverage proxy "x" for the issuer
R_i : bond rating of the issue i
X_i : issue i other characteristics
u_i : random error

Information about the chosen proxies is given by the table below:

	Name	Definition	Source
		TABLE 2 – Variables definitions and sources	
Numerical	AYSprd	Absolute Yield spread	Fisher (1959, appendix D p.66) Bank and Quotation record CRSP Monthly Treasury fixed term indices CRSP Fama risk free rate
	PROFa	9 years variation coefficient of net income after all charges and taxes	Fisher (1959, appendix D p.66, x1)
	PROFb	Retained earnings / Total assets	Compustat Industrials Annually (data 36 / data 6)
	PROFc	Earnings before interest and taxes / Total assets	Compustat Industrials Annually ((data 170 + data 15) / data 6)
	LEVa	Market value of equity / par value of debt	Fisher (1959, appendix D p.66, x3)
	LEVb	Market value of equity / book value of total liabilities	Compustat Industrials Annually (data 24 * data 25) / data 181
	LIQUIa	Bond outstanding volume	Fisher (1959, appendix D p.66, x4)
	LIQUIb	Book value of total liabilities / US equity market capitalization	Compustat Industrials Annually (data 181) CRSP database
	LIQUIc	Working capital / Total assets	Compustat Industrials Annually (data 179 / data 6)
	SOLV	Period of solvency since creation or last default episode	Fisher (1959, appendix D p.66, x2)
Categorical	AGE	Years since a firm was first rated by an agency*	S&P and Moody's communications
	RATING	Moody's and/or S&P's ratings	Moody's manuals S&P and Moody's communications
	SUB	Dummy for subordination	S&P dataset and Mergent FISD
	SEC	Dummy for security	S&P dataset and Mergent FISD

* The upper limit is set to 10 (see Altman &Rijken 2005 note 4 p. 38)

For datasets intended to deal with 1930's regulation enactment, this is a multivariate estimation of Fisher (1959) with a categorical variable following the rating scale. After logging all numerical variables to ensure comparability with Fisher (1959) and West (1973), this leads to the following equation:

(1) $\text{Log}(\text{AYSprd}_i) = f(\text{Log}(\text{PROFa}_i), \text{Log}(\text{SOLV}_i), \text{Log}(\text{LEVa}_i), \text{Log}(\text{LIQUIa}_i), \text{RATING}_i, u_i)$

where, u_i: random error

For datasets intended to deal with 1970's regulation enactment, the multivariate estimation is based on the Altman&Rijken (2005) rating prediction model. The equation tested is:

(2) $\text{Log}(\text{AYSprd}_i) = f(\text{Log}(\text{LIQUIb}_i), 1+\text{Ln}(\text{LEVb}_i), \text{LIQUIc}_i, \text{Ln}(1-\text{PROFb}_i), 1-\text{PROFc}_i, \text{AGE}_i, \text{RATING}_i, \text{SUB}_i, \text{SEC}_i, \text{UTILITY}_i, u_i)$

where, u_i: random error

3.3 *Results*

For each year, the table below provides a summary of the final outputs which may be found in Annex B. When residuals did exhibit non-constant variance, a weighted analysis has been found helpful[18].

TABLE 3 – Accounting for the variability in absolute yield spread								
	F statistics and *p* values in brackets							
VARIABLE	1927	1932	1937	1949	1953	1971	1973	1975
- Log (PROFa)	6.36 (0.014)	7.98 (0.008)	8.18 (0.006)	7.48 (0.009)	0.06 (0.808)			
Ln (1 - PROFb)						7.54 (0.007)	5.97 (0.016)	1.63 (0.203)
1- PROFc						0.33 (0.568)	1.31 (0.256)	2.13 (0.147)
Log (SOLV)	1.32 (0.255)	0.06 (0.803)	0.26 (0.614)	3.49 (0.068)	8.11 (0.006)			
Log (LEVa)	28.58 (0.000)	3.06 (0.086)	69.53 (0.000)	15.47 (0.000)	22.22 (0.000)			
1 + Ln (LEVb)						2.02 (0.159)	31.98 (0.000)	13.21 (0.000)
Log (LIQUIa)	7.00 (0.010)	2.50 (0.123)	17.94 (0.000)	15.90 (0.000)	8.23 (0.000)			
Log (LIQUIb)						13.19 (0.000)	44.24 (0.000)	9.56 (0.002)
LIQUIc						0.34 (0.564)	0.07 (0.797)	0.67 (0.414)
AGE						27.53 (0.000)	4.87 (0.000)	1.30 (0.245)
RATING	4.68 (0.002)	5.80 (0.001)	13.51 (0.000)	8.21 (0.000)	11.49 (0.000)	8.17 (0.000)	3.50 (0.006)	10.99 (0.000)
SUB						0.11 (0.737)	0.53 (0.469)	0.09 (0.768)
SEC						0.35 (0.557)	5.15 (0.025)	0.01 (0.924)
UTILITY						4.76 (0.032)	1.90 (0.171)	2.00 (0.160)
Standard error	0.311	0.698	0.677	0.653	0.829	0.467	0.613	1.072
R^2	79.85%	87.76%	91.89%	84.63%	81.08%	78.42%	81.96%	81.79%
Adjusted R^2	77.03%	84.61%	90.62%	81.80%	78.64%	74.39%	78.13%	78.71%

[18] Details about this analysis are available upon request to the author. This analysis was not needed for 1927. Note also that this analysis gives the opportunity to control for omitted variable. For 1971, 1973 and 1975, a dummy coding for split ratings on a bond issue has been created and is used at this step of analysis (see note 12).

Due to a reliance on weights, the displayed R^2 measures are not straightforward goodness of fit measures as in the standard Ordinary Least Squares analysis[19]. With this disclaimer in mind, they indicate fair results with about 75% or more of the variability in the "risk premium" explained. For tests involving the Fisher (1959) model, the overall performance increases to reach a peak in 1937 and then decreases so that the level in 1953 is similar to the one in 1927. For tests involving the Altman &Rijken (2005) model, the performance rises from 1973 to similar levels for 1973 and 1975.

The respective *F* statistics and related *p* values provides information on how the predictors in the model are related to the variability in the target variable. The introduction of the RATING variable in the multivariate analysis has put to a test the explanatory power of the predictors in the Fisher (1959) model. The common 5% level of significance is reached only four times by log(equity/debt), three times by log(bond volume outstanding) and log(earnings variation coefficient), and only once by log(period of solvency). In contrast, an explanatory power of the RATING variable has been validated for the 5 years[20]. Turning to the analysis with the Altman &Rijken (2005) model, only two variables did show up as significant predictors for every investigated year: Log(LIQUIb) and RATING. Then, AGE, 1+ln(LEVb) and ln(1-(PROFb)) proved significant for two years. The dummies SEC and UTILITY reached statistical significance only once [21].

The estimated coefficients for the numerical variables can be found in the outputs in Annex B. Their equivalent for categorical variables can also be found there (least squares means for the target variable given all predictors equal to their mean value). An overall interpretation of the respective factors is however difficult due to a changing set of significant variables.

Judging by the *F* statistics, for every investigated year one has to reject the null hypothesis and admit: (h_a) = "ratings have an explanatory power". Following this interpretation, the fact that this informational value proved quite stable in comparison to the other predictors of each model can be noted. But for a categorical variable to be fully pertinent "an explanatory power" may not be enough. Since the model does not include interactions, the significance of RATING is further assessed with

[19] The reported value are not $R^2 = 1 -$ (Residual Sum of Square/Total Sum of Square) but approximations defined by $R^2 = (pF) / (pF + n - p - 1)$.

[20] R. West apparently did try to include ratings with the help of dummies and run a multivariate analysis similar to this one (see West (1973, note 22 p.165)). Facing a perturbation in the estimation of coefficients for predictors, he chose to build an alternative two-stepped analysis. Not finding an explanatory power and a stability similar to the one exhibited by Fisher (1959) should however not settle the case for a multivariate analysis.

[21] UTILITY is significant only once but very close to be so the other years. There is then a case for the used constant switch between utilities and industrials when analyzing the selected datasets. This worked better than splitting the dataset. The last option of using interaction effects remains open.

the help of Tukey multiple comparison tests, which control for the fact that a categorical variable may reach statistical significance by chance. On the next page, Table 4 gives a summary of the produced results[22].

After picking one category as a reference, the relevance of sorting this category from the next ones is tested. The process is iterative: first is tested the relevance of the first one (here: Aaa/ AAA) against all other categories, then the relevance of the second one (Aa/ AA) against remaining categories, and so on. The first result is that, overall, the rating scale is often poorly validated.

What is tested is the significance of the rating categories given all other variables in the model though… given that the model of Fisher (1959) was quite successful in explaining "risk premium", this result is not that surprising. An interesting point is that, as soon as 1927, the only category to exhibit statistical significance is the first of the non-investment grades (Ba). Well before the passing of any financial regulation, one may conclude to an investment grade effect then validated for the 5 years. But, if the main concern is the added value of ratings, the core result is how the pertinence of the scale reached a climax in 1937.

Pointing to this year alone differs from West (1973). The two stepped analysis exhibited over-inflated yields for non-investment grade issues in 1949 and in 1953 as opposed to the previous years. Note also that pointing to 1937 means drawing attention to the widely debated 1936 initial ruling by the US Comptroller instead of focusing on the 1938 joint restatement including all US banking authorities (see, *supra*, section 1).

In 1971 and 1973, most rating categories also fail to prove as statistically significant. Again, the relevance of bond ratings is tested given the level of all other variables in the model and then given a fair appraisal of credit risk and other features. It should moreover be added that small samples are not well suited to study the significance of rating categories. As opposed to the previous setting, there is no sign of a particular relevance for the first of non-investment grades (Ba/BB) in 1971. The only category to evidence statistical pertinence is one rank below (B/B) and this is also found in 1973. Once more, the main result is however that most of the rating scale proved significant beyond the 5% level only in 1975.

[22] Detailed reports are available upon request to the author.

TABLE 4 – Significance of rating categories

*** = *p* value < 5%, ** = *p* value < 10%, * = *p* value < 15%
-- : unrelevant

1927	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B
Aaa/ AAA	--	--	--	--	--	--
Aa/ AA		--	--	--	--	--
A/ A			--	--	--	--
Baa/ BBB	***			--	--	--
Ba/ BB	***	***	***		--	--
B/ B	--	--	--	--	--	--

1932	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B
Aaa/ AAA	--	--	--	--	--	--
Aa/ AA		--	--	--	--	--
A/ A			--	--	--	--
Baa/ BBB	**	***		--	--	--
Ba/ BB	***	***	***	***	--	--
B/ B	***	***	***	*		--

1937	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B
Aaa/ AAA	--	--	--	--	--	--
Aa/ AA		--	--	--	--	--
A/ A	***	***	--	--	--	--
Baa/ BBB	***	***	**	--	--	--
Ba/ BB	***	***	***	***	--	--
B/ B	***	***	***	***		--
Caa/ CCC	***	***	***	***		

1949	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B
Aaa/ AAA	--	--	--	--	--	--
Aa/ AA		--	--	--	--	--
A/ A			--	--	--	--
Baa/ BBB				--	--	--
Ba/ BB	***	***	***	***	--	--
B/ B	**					--

1953	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B
Aaa/ AAA	--	--	--	--	--	--
Aa/ AA		--	--	--	--	--
A/ A			--	--	--	--
Baa/ BBB		***	***	--	--	--
Ba/ BB	***	***	***	***	--	--
B/ B	***	***	***	***		--

1971	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB
Aaa/ AAA	--	--	--	--	--
Aa/ AA		--	--	--	--
A/ A	**		--	--	--
Baa/ BBB				--	--
Ba/ BB					--
B/ B	***	***	***	***	

1973	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB
Aaa/ AAA	--	--	--	--	--
Aa/ AA		--	--	--	--
A/ A			--	--	--
Baa/ BBB				--	--
Ba/ BB					--
B/ B	***	***	***	*	

1975	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB
Aaa/ AAA	--	--	--	--	--
Aa/ AA	***	--	--	--	--
A/ A	***	***	--	--	--
Baa/ BBB	***	***	***	--	--
Ba/ BB	***	***	***	**	--
B/ B					*

4. Concluding remarks: can the sitting of the 800 pound gorilla be evidenced?

"[T]he weight of government regulators on private institutions can be enormous. Eight hundred pound gorillas should be careful where they sit."

T. J. McGuire, Moody's Investors Service, writing to the SEC[23]

When West (1973) exhibits an over-inflation of non investment grade yields in 1949 and 1953, it is indeed tempting to conclude to a lasting and straightforward effect of the 1938 regulation of bank investment. This means a piece of evidence pointing to how the public use of ratings may have altered how investors value bonds. Starting from a concern for an impact of US financial regulation using bond ratings, should a focus on an unexplained premium in the yields of non-investment grade bonds be acknowledged?

First, even if this focus is unquestioned, its mere evidencing would not be enough. One has at least to raise the issue of other developments that could have challenged such a straightforward effect (for instance, Glenn (1976) argues that proponents of such a regulatory induced premium need to investigate why arbitrage by unconstrained investors has not taken place). Secondly, one may argue that an attention to the overall significance of the ratings may also be welcome. Another straightforward effect of the ruling could be an increase in the reliance on bond ratings for the pricing of all bond issues. Lastly, if one truly intends to focus on the impact of US financial regulation embodying rating, the present framework may be restrictive. For example, Harold identifies this first "practical effect" on non-investment grade yields but also mentions "more far reaching effects" (such as the development of other more yielding avenues of investment like real estate mortgage, see Harold (1938, pp. 33-34)).

Picking on the second comment, the present paper aims at looking at the overall pertinence of ratings for investors in the 1930's and 1970's. Specifically, what is introduced is a discussion of existing results on the structural relation between ratings and yields. When the relevance of ratings is evidenced, it has usually been interpreted as a proof of their informational value. This paper intends to test whether these results are robust to the presence or not of US financial regulation using ratings.

This test shows that the explanatory power of ratings did change over the selected years. A further result is that this change is a striking improvement in 1937 and in 1975 as compared to the respective other years. This leads to a new question: why do yields gravitate more around ratings in these two years? or what may have caused an increased reliance on ratings for these particular years?

[23] "Ratings in Regulation: A Petition to the Gorillas", Delivered to the SEC 5th Annual International Institute for Securities Market Development (04/28/1995, p.17)

While there seem to be a case for pointing respectively to the 1936 US Comptroller ruling on bank investment and to the 1975 SEC rule on broker dealers, the question does remain open. In particular, such a case would highly benefit from an investigation focusing on the dynamics of the relationship between ratings and yields.

Annex A – The computation of yield spreads

The first step is to compute bond prices as of Dec 31 starting with the quotation as reported by the Bank and Quotation Report issue for the following January. The methodology below follows Fisher (1959, appendix A p.52).

The standard way is to get the last sale price on 12/31 and the first sale price on following business day and then compute their arithmetic mean. If this arithmetic mean is inside the closing Bid &Ask spread on Dec 31 then it is taken as price. Otherwise, what is taken as price is the Bid or the Ask quote that is the nearest to this arithmetic mean. Then there are of course cases when this standard way cannot be performed:

- If only one sale price is found, when it comes on Dec. 31, what is taken as price is the arithmetic mean of this price with the following bid quote, because the latter brings new info; when it comes on the opening day of January, it is taken as price because it usually resolves the Bid &Ask spread on Dec. 31.
- If only 1 Bid &Ask spread is found, the arithmetic mean is taken as price
- If only 2 bids quotations are found, their arithmetic mean is taken as price
- If only 1 bid quotation is found, it is taken as price
- If only 1 or 2 ask quotations are found, the data is rejected

The second step is to compound yields to maturity based on these prices, which is quite straightforward.

The third step is to gather yields that are to be considered as risk free[24]. This is done thanks to the CRSP Monthly Treasury fixed term indices on Dec 31st, complemented with the CRSP Monthly Treasury Fama risk free rates (for 1 month and 90 days maturities). In order to match every yield on a bond issue to a comparable risk free rate according to maturity, I use these yields to build a risk free rate curve given the years to maturity. That YREF curve is built with the help of a regression equation based on these first observations, which is given in the table below[25].

Year	Curve equation	R^2
1971	$YREF = 0.001\ YTM^3 - 0.0463\ YTM^2 + 0.584\ YTM + 3.5614$	0.9673
1973	$YREF = 0.0001\ YTM^4 - 0.0048\ YTM^3 + 0.076\ YTM^2 - 0.4719\ YTM + 7.5278$	0.8962
1975	$YREF = 0.5136\ LN(YTM) + 6.2369$	0.9633

[24] As stated before, the fourth and last step is to compute a relative yield spread: $RYSpread_i = (Y_i - YREF_i)/YREF_i$

[25] Regressions are found to work well but not trusted enough to be followed for out of sample prediction… for maturities above 30 year, I take the conservative view of setting YREF to the value of the 30 year fixed term indice.

Annex B – Statistical Reports

1927

General Linear Model: LOGAYSprd versus Moodys

Factor	Type	Levels	Values
Moodys	fixed	5	1, 2, 3, 4, 5

Analysis of Variance for logYSprd, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
-log(x1)	1	7.4865	0.6142	0.6142	6.36	0.014
log(x2)	1	0.2076	0.1276	0.1276	1.32	0.255
log(x3)	1	9.0112	2.7595	2.7595	28.58	0.000
log(x4)	1	3.3032	0.6762	0.6762	7.00	0.010
Moodys	4	1.8074	1.8074	0.4518	4.68	0.002
Error	57	5.5036	5.5036	0.0966		
Total	65	27.3194				

S = 0.310732   R-Sq = 79.85%   R-Sq(adj) = 77.03%

Term	Coef	SE Coef	T	P
Constant	1.0325	0.2833	3.64	0.001
-log(x1)	-0.12711	0.05040	-2.52	0.014
log(x2)	-0.07365	0.06407	-1.15	0.255
log(x3)	-0.28846	0.05396	-5.35	0.000
log(x4)	-0.09920	0.03749	-2.65	0.010

Means for Covariates

Covariate	Mean	StDev
-log(x1)	0.2180	0.9104
log(x2)	3.1297	0.7008
log(x3)	1.0849	1.1459
log(x4)	2.3412	1.3324

Least Squares Means for logYSprd

Moodys	Mean	SE Mean
1	-0.1494	0.14242
2	0.1428	0.11166
3	0.1274	0.08174
4	0.3908	0.07790
5	0.6341	0.10476

1932

General Linear Model: LOGAYSprd versus Moodys

Factor	Type	Levels	Values
Moodys	fixed	6	1; 2; 3; 4; 5; 6

Analysis of Variance for LOGYSpread, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
-LOGx1	1	49,919	3,884	3,884	7,98	0,008
LOGx2	1	11,633	0,031	0,031	0,06	0,803
LOGx3	1	17,419	1,489	1,489	3,06	0,089
LOGx4	1	29,131	1,218	1,218	2,50	0,123
Moodys	5	14,124	14,124	2,825	5,80	0,001
Error	35	17,045	17,045	0,487		
Total	44	139,272				

S = 0,697848   R-Sq = 87,76%   R-Sq(adj) = 84,61%

Term	Coef	SE Coef	T	P
Constant	1,4907	0,3436	4,34	0,000
-LOGx1	-0,2845	0,1007	-2,82	0,008
LOGx2	0,01927	0,07657	0,25	0,803
LOGx3	-0,16446	0,09407	-1,75	0,089
LOGx4	-0,11416	0,07220	-1,58	0,123

Means for Covariates

Covariate	Mean	StDev
-LOGx1	0,0821	0,8408
LOGx2	3,1526	0,7943
LOGx3	-0,1201	1,1934
LOGx4	1,9858	1,2362

Least Squares Means for LOGYSpread

Moodys	Mean	SE Mean
1	0,1876	0,4899
2	0,7080	0,2327
3	1,1235	0,2030
4	1,5608	0,1076
5	2,2925	0,1910
6	2,0542	0,1523

1937

General Linear Model: LOGAYSprd versus Moodys

Factor	Type	Levels	Values
Moodys	fixed	7	1; 2; 3; 4; 5; 6; 7

Analysis of Variance for LOGYSPRD, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
-LOGx1	1	24,428	3,750	3,750	8,18	0,006
LOGx2	1	137,275	0,118	0,118	0,26	0,614
LOGx3	1	84,000	31,856	31,856	69,53	0,000
LOGx4	1	49,240	8,219	8,219	17,94	0,000
Moodys	6	37,139	37,139	6,190	13,51	0,000
Error	64	29,322	29,322	0,458		
Total	74	361,403				

S = 0,676869   R-Sq = 91,89%   R-Sq(adj) = 90,62%

Term	Coef	SE Coef	T	P
Constant	1,0703	0,1588	6,74	0,000
-LOGx1	-0,10773	0,03766	-2,86	0,006
LOGx2	-0,02565	0,05054	-0,51	0,614
LOGx3	-0,40116	0,04811	-8,34	0,000
LOGx4	-0,13517	0,03191	-4,24	0,000

Means for Covariates

Covariate	Mean	StDev
-LOGx1	-0,4417	1,1472
LOGx2	2,9083	0,9392
LOGx3	0,6407	0,9215
LOGx4	1,7097	1,5215

Least Squares Means for LOGYSPRD

Moodys	Mean	SE Mean
1	-0,6450	0,21366
2	-0,5266	0,20969
3	0,3841	0,13202
4	0,7917	0,06296
5	1,2222	0,08398
6	1,2052	0,12286
7	1,4549	0,16951

1949

General Linear Model: LOGAYSprd versus Moodys

Factor	Type	Levels	Values
Moodys	fixed	6	1; 2; 3; 4; 5; 6

Analysis of Variance for LOGYSPRD, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
-LOGx1	1	13,715	3,188	3,188	7,48	0,009
LOGx2	1	11,557	1,488	1,488	3,49	0,068
LOGx3	1	31,561	6,592	6,592	15,47	0,000
LOGx4	1	40,644	6,779	6,779	15,90	0,000
Moodys	5	17,489	17,489	3,498	8,21	0,000
Error	49	20,884	20,884	0,426		
Total	58	135,849				

S = 0,652842   R-Sq = 84,63%   R-Sq(adj) = 81,80%

Term	Coef	SE Coef	T	P
Constant	1,2757	0,3211	3,97	0,000
-LOGx1	-0,26511	0,09693	-2,74	0,009
LOGx2	-0,13665	0,07313	-1,87	0,068
LOGx3	-0,31225	0,07940	-3,93	0,000
LOGx4	-0,17139	0,04298	-3,99	0,000

Means for Covariates

Covariate	Mean	StDev
-LOGx1	0,8934	0,4985
LOGx2	3,5379	0,7582
LOGx3	0,9090	0,7375
LOGx4	2,3203	1,3375

Least Squares Means for LOGYSPRD

Moodys	Mean	SE Mean
1	-0,8699	0,26174
2	-0,4435	0,11293
3	-0,4770	0,08799
4	-0,1967	0,08698
5	0,3971	0,11174
6	0,8333	0,56782

1953

General Linear Model: LOGAYSprd versus Moodys

Factor	Type	Levels	Values
Moodys	fixed	6	1; 2; 3; 4; 5; 6

Analysis of Variance for LOGYSPRD, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
-LOGx1	1	50,090	0,041	0,041	0,06	0,808
LOGx2	1	16,701	5,583	5,583	8,11	0,006
LOGx3	1	37,130	15,285	15,285	22,22	0,000
LOGx4	1	62,914	5,659	5,659	8,23	0,005
Moodys	5	39,522	39,522	7,904	11,49	0,000
Error	70	48,162	48,162	0,688		
Total	79	254,521				

S = 0,829478   R-Sq = 81,08%   R-Sq(adj) = 78,64%

Term	Coef	SE Coef	T	P
Constant	1,1820	0,2777	4,26	0,000
-LOGx1	0,02376	0,09745	0,24	0,808
LOGx2	-0,20350	0,07144	-2,85	0,006
LOGx3	-0,34871	0,07398	-4,71	0,000
LOGx4	-0,12753	0,04447	-2,87	0,005

Means for Covariates

Covariate	Mean	StDev
-LOGx1	0,9035	0,5167
LOGx2	3,6747	0,6614
LOGx3	0,9624	0,6643
LOGx4	2,5076	1,4207

Least Squares Means for LOGYSPRD

Moodys	Mean	SE Mean
1	-0,7849	0,39033
2	-0,9659	0,20123
3	-0,6260	0,09142
4	-0,0243	0,06889
5	0,5555	0,13605
6	0,6472	0,20099

1971

General Linear Model: LogAYSprd versus RATING, AGE, SUB, SEC, UTILITY

Factor	Type	Levels	Values
RATING	fixed	6	1, 2, 3, 4, 5, 6
AGE	random	5	1, 2, 4, 5, 10
SUB	fixed	2	0, 1
SEC	fixed	2	0, 1
UTILITY	fixed	2	0, 1

Analysis of Variance for LogAYSprd, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Log(LIQUIb)	1	16.6295	2.8734	2.8734	13.19	0.000
1+ln(LEVb)	1	3.9742	0.4396	0.4396	2.02	0.159
LIQUIc	1	0.1880	0.0732	0.0732	0.34	0.564
ln(1-PROFb)	1	8.6220	1.6424	1.6424	7.54	0.007
1-PROFc	1	3.2963	0.0716	0.0716	0.33	0.568
RATING	5	9.9184	8.8947	1.7789	8.17	0.000
AGE	4	27.2769	23.9881	5.9970	27.53	0.000
SUB	1	0.2622	0.0247	0.0247	0.11	0.737
SEC	1	0.8310	0.0758	0.0758	0.35	0.557
UTILITY	1	1.0367	1.0367	1.0367	4.76	0.032
Error	91	19.8249	19.8249	0.2179		
Total	108	91.8601				

S = 0.466750   R-Sq = 78.42%   R-Sq(adj) = 74.39%

Term	Coef	SE Coef	T	P
Constant	-3.9072	0.7075	-5.52	0.000
Log(LIQUIb)	-0.21911	0.06033	-3.63	0.000
1+ln(LEVb)	-0.07790	0.05484	-1.42	0.159
LIQUIc	0.1234	0.2129	0.58	0.564
ln(1-PROFb)	0.4895	0.1783	2.75	0.007
1-PROFc	-0.4097	0.7145	-0.57	0.568

Means for Covariates

Covariate	Mean	StDev
Log(LIQUIb)	-3.320	0.50330
1+ln(LEVb)	1.351	0.74125
LIQUIc	0.212	0.16645
ln(1-PROFb)	-0.390	0.21226
1-PROFc	0.894	0.04905

Least Squares Means for LogAYSprd

RATING	Mean
1	-4.230
2	-3.844
3	-3.794
4	-3.865
5	-3.828
6	-3.335

AGE	Mean
1	-3.656
2	-3.468
4	-3.712
5	-3.386
10	-4.228

UTILITY	Mean
0	-3.679
1	-3.953

SUB	Mean
0	-3.797
1	-3.835

SEC	Mean
0	-3.778
1	-3.854

1973

General Linear Model: LOGAYSprd versus RATING, AGE, SUB, SEC, UTILITY

Factor	Type	Levels	Values
RATING	fixed	6	1, 2, 3, 4, 5, 6
AGE	random	9	1, 2, 3, 4, 5, 6, 7, 8, 10
SUB	fixed	2	0, 1
SEC	fixed	2	0, 1
UTILITY	fixed	2	0, 1

Analysis of Variance for LOGAYSprd, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
LOGLIQUIb	1	59.6028	16.6686	16.6686	44.24	0.000
1+ln(LEVb)	1	56.6362	12.0495	12.0495	31.98	0.000
LIQUIc	1	5.2176	0.0251	0.0251	0.07	0.797
ln(1-PROFb)	1	8.7119	2.2500	2.2500	5.97	0.016
1-PROFc	1	5.9996	0.4920	0.4920	1.31	0.256
RATING	5	15.9772	6.5995	1.3199	3.50	0.006
AGE	8	13.9759	14.6781	1.8348	4.87	0.000
SUB	1	0.0963	0.1986	0.1986	0.53	0.469
SEC	1	2.5243	1.9415	1.9415	5.15	0.025
UTILITY	1	0.7160	0.7160	0.7160	1.90	0.171
Error	99	37.3012	37.3012	0.3768		
Total	120	206.7588				

S = 0.613824   R-Sq = 81.96%   R-Sq(adj) = 78.13%

Term	Coef	SE Coef	T	P
Constant	-6.3355	0.8133	-7.79	0.000
LOGLIQUIb	-0.42230	0.06349	-6.65	0.000
1+ln(LEVb)	-0.23483	0.04153	-5.66	0.000
LIQUIc	0.0781	0.3024	0.26	0.797
ln(1-PROFb)	0.4977	0.2037	2.44	0.016
1-PROFc	0.8919	0.7805	1.14	0.256

Means for Covariates

Covariate	Mean	StDev
LOGLIQUIb	-3.236	0.49855
1+ln(LEVb)	0.835	0.92187
LIQUIc	0.207	0.15830
ln(1-PROFb)	-0.384	0.22321
1-PROFc	0.885	0.06499

Least Squares Means for LOGAYSprd

RATING	Mean
1	-4.930
2	-4.835
3	-4.715
4	-4.605
5	-4.131
6	-4.088

AGE	
1	-4.915
2	-4.602
3	-4.290
4	-4.597
5	-4.415
6	-4.965
7	-4.452
8	-4.253
10	-4.467

UTILITY	Mean
0	-4.475
1	-4.626
SUB	
0	-4.434
1	-4.667
SEC	
0	-4.460
1	-4.641

1975

General Linear Model: LogAYSprd versus RATING, AGE, SUB, SEC, UTILITY

Factor	Type	Levels	Values
RATING	fixed	6	1, 2, 3, 4, 5, 6
AGE	random	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
SUB	fixed	2	0, 1
SEC	fixed	2	0, 1
UTILITY	fixed	2	0, 1

Analysis of Variance for LogAYSprd, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Log(LIQUIb)	1	70.537	11.002	11.002	9.56	0.002
1+ln(LEVb)	1	472.181	15.206	15.206	13.21	0.000
LIQUIc	1	12.139	0.772	0.772	0.67	0.414
ln(1-(PROFb))	1	23.526	1.881	1.881	1.63	0.203
1-PROFc	1	13.161	2.455	2.455	2.13	0.147
RATING	5	66.351	63.255	12.651	10.99	0.000
AGE	9	11.659	13.433	1.493	1.30	0.245
SUB	1	0.140	0.101	0.101	0.09	0.768
SEC	1	0.003	0.010	0.010	0.01	0.924
UTILITY	1	2.300	2.300	2.300	2.00	0.160
Error	130	149.629	149.629	1.151		
Total	152	821.626				

S = 1.07284   R-Sq = 81.79%   R-Sq(adj) = 78.71%

Term	Coef	SE Coef	T	P
Constant	-5.6319	0.8040	-7.00	0.000
Log(LIQUIb)	-0.25151	0.08135	-3.09	0.002
1+ln(LEVb)	-0.18475	0.05083	-3.63	0.000
LIQUIc	0.2149	0.2624	0.82	0.414
ln(1-(PROFb)	0.2898	0.2267	1.28	0.203
1-PROFc	1.1952	0.8183	1.46	0.147

Means for Covariates

Covariate	Mean	StDev
Log(LIQUIb)	-3.131	0.50708
1+ln(LEVb)	0.814	0.83558
LIQUIc	0.235	0.15952
ln(1-(PROFb))	-0.387	0.21639
1-PROFc	0.884	0.05359

Least Squares Means for LogAYSprd

RATING	Mean
1	-4.749
2	-4.435
3	-4.147
4	-3.704
5	-3.090
6	-3.878

AGE	
1	-3.956
2	-4.030
3	-4.316
4	-4.057
5	-3.852
6	-3.756
7	-3.645
8	-4.212

UTILITY	
0	-4.080
1	-3.921
SUB	
0	-3.960
1	-4.041
SEC	
0	-3.995
1	-4.006

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