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On the efficiency of the Corporate Bond Market and the Rating Agencies: Evidence from the Israeli Bond Market

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Abstract

In this research I have used bonds data from the Israeli financial market, in order to establish to what extent the Israeli credit market is efficiently rated by both existing rating agencies ("Maalot" and "Midrug"). Results show that the bond market does refer to ratings as a measurement of risk, however, further investigating have proven that it was not the entire risk involved in the investment process. The results of this research suggests that a better rating process should be adopted perhaps by adding a third investor-paid rating agency that would separate the unhealthy linkage between the issuer of the bond and the rating agency, enabling the rating process to be more objective and trustfully by investors to capture all related risks.

JEL classification numbers: G14, G20, G15, D4
Keywords: Bonds, Efficiency, Rating agencies, Yields

1 Introduction

Credit rating agencies have an important role on the credit markets in enhancing the efficiency of those markets. Therefore, it is important that those agencies will provide an accurate rating that over time will earn investors credibility. The rating should capture all various risks involving in the ability of the borrowing firm to return funds to investors according to the pre- agreed terms. Risks should include industry and business types of risks and also the initiating firm's individual risks such as financial stability, liquidity, leverages and bankruptcy prospects.

When an investor evaluates corporate bonds, he/she examines the bonds properties including its duration, future returns timing, covenants and collaterals a side to the rating that was given by the different rating agencies. He/she should be able to grasp all the

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aspects of risk-return involving that investment opportunity and quantify the demanded yield to maturity (YTM).
Assuming that the rating agency can be trusted to be able to capture bonds full risk, in an efficient corporate bond market one can expect that two different corporate bonds with the same duration and the same rating should be traded with the same YTM.
An inherent known problem with the rating process is the fact that most rating agencies are paid by the issuer of the bond creating pressure on the rating agency to inflate their rating. Bolton, Freixas, and Shapiro(2012) and Camanho, Deb, and Liu (2010) have showed that rating agencies that face tougher competition are more likely to issue inflated rating. The tendency to inflated rating is associated with more complex securities (Mathis, McAndrews, and Rochet (2009)) or when ratings are issued during a boom period (Bar-Issac and Shapiro (2012)). Becker and Milbourn (2011) showed that competition among rating agencies during 1995-2006 is positively correlated to the credit ratings of firms. They interpret this result as evidence that increased competition leads to rating inflation in corporate bond markets due to potential conflicts of interest among rating agencies. Bongaerts, Cremers, and Goetzmann (2012) showed that the inflated rating phenomena increases when issuer shop for around for favorable rating.
Xia (2012) has examined the quality of the rating process performed by competitors' agencies when an investor-paid rating agency (Egan- Jones rating company) has entered the market. He finds that ratings were shifted downwards and that they better reflect market risks. In the Israel credit markets two rating agencies operates. 1. "Maalot" which is a subsidiary of S&P and 2. "Midrug" which is a subsidiary of Moody's international[2]. Those two agencies operate according to the issuer payment model. At the moment there is no rating agency that is paid by investors although major institutional investors have come to realize that one is needed and may act accordingly in the near future.

2 Background Literature Review

The roll of the rating agencies is to improve efficiency in the credit market reducing information gaps between investors and issuers in that market. Debt rating is commonly used in performance pricing agreements, where interest rates vary according to the firm's performance (Asquith et al.(2005), Doyle (2004)). Moreover, in some countries regulations enable institutional investors to hold bonds that are rated as investment- grade by certified agency (Cantor and Packer (1995)). In 2010 the Israeli government has adopted "Hodeck"[3] committee recommendation in order to improve institutional investment in corporate bond. One of the most important recommendations was an automatic interest rate increase in case of rating downgrading of the bond. In The U.S the government adopted procedures that recognize the ability of the rating agency to produce an accurate risk measurement. That recognition has valuated as most important by researchers such as Hunt (2002) and Borrus (2002) to produce a reliable ratings. The question to what extent regulations of the rating agencies market is necessary has been presented for example by Djankov et al.(2002). That literature debates the necessity to limit the amount of rating agencies that operates in a specific credit market. Limiting the

[2]These local rating agencies use their parent rating systems."Maalot" uses the S&P scale: AAA, AA, A etc. While "Midrug "uses Moddy's scale: Aaa,Aa1, Aa2 etc.
[3]David Hodeck was the head of that committee.

amount of rating agencies may support their profit bottom line and may reduce pressure that might be inquired by issuers. On the other hand, limiting the amount of rating agencies can lead to reduced sensitivity of the agencies to investor's needs. Watts (1977) points out, that rating agencies tends to be more conservative because the costs from losses due to overvaluation are greater than the foregone gains due to undervaluation, i.e., downgrades are more important than upgrades. He also argued in a later paper (Watts (2003)) that rating agencies will incorporate bad news sooner than good news concerning the firm's ability to support their bonds obligations.

Rating changes and their influence on the financial markets have been extensively studied and documented. Weinstein (1997) indicates that over 50% of rating changes result from reviews accompanying new debt issue. Kaplan and Urwitz (1979) supports the claim that rating agencies react to information which is already publicly available. Pinches and Singleton (1978) found that the information contained in bond rating changes is impounded into the stock price up to one year in advance of the rating change. Beaver et al.(2006) and Griffin and Sanvicente (1982) found a significant negative price response for downgrades using monthly stock return data. Other researchers such as Grier and Katz (1976) have documented the effect of rating changes on bonds prices and yields. On the other hand, other researchers such as Wakeman (1978) found no evidence of a price response to rating changes.

The Israeli bond market suffers from many firms financial defaults that force them to negotiate with creditors for a new contractual agreement that can reduce their initial obligations[4]. In such a risky financial environment an efficient rating process that would be enable to measure risk correctly and objectively is necessary. Moreover, such a troubled bond market is very interesting from academic point of view. Unfortunately, not many academic researchers have explored that market characteristics. Huberman and Schwert (1985) have studied whether announcement of Israeli CPI (Consumer Price Index) contains information that is not already reflected in bond prices. They concluded that bond prices reflect about 85% of the new information about inflation. Kandel et al. (1996) have tested the hypothesis that real rate of interest is independent of inflation expectations. They found that nominal interest rates in Israel include inflation risk premium that is positively related to inflation uncertainty. To the best of my knowledge no academic research has previously attempted to examine the efficiency of the Israeli bond market with regard to its rating agencies.

3 Data, Modeling and Results

In order to be able to compare the different bonds I used only attached to inflation bond with no convertibility feature. Ignoring non-attached to inflation bonds and convertible bonds remaining total of 436 attached to inflation different corporate bond. I also eliminated from my sample 121 unrated bonds that leaves me with total of 315 bonds series that are rated by one or both rating agencies. I have decided to exclude from my sample bond with duration which is less than one year. This was done because first, the rating of such a short term bond is less important than longer bonds since rating should capture in most cases longer term risks. Second, less than one year to maturity bonds

[4]Bank if Israel report 2012.

yields are annualized and therefore can distort my results. Eventually I ended with 276 bonds in my sample.
First I constructed the following regression model that tries to predict the bond yield to maturity (YTM) using each of the rating agencies ratings and the duration of the bond:

$$ytm = \beta_0 + \beta_1 D + \beta_2 Rating_a * Dummy_a + \beta_3 Rating_b * Dummy_b \quad (1)$$

Where: $ytm =$ the corporate bond yield to maturity, $D =$ the bond's duration, $Rating_a =$ the rating by "Maalot" rating agency and $Rating_b =$ the By "Midrug" agency. $Dummy =$ Dummy variables (0,1) for each of the rating agencies.
Second, I used Wald test to examine the significance of the difference between the impact of each of the two rating agencies on the bond's yield when:

$$H_0 : \beta_2 - \beta_3 = 0$$

$$H_1 : \beta_2 - \beta_3 \neq 0$$

Table 1: Regressions results

	D	D	$Rating_a$	$Rating_b$	R^2	F	N	Wald $\beta_2 - \beta_3$
1	D>=1	-0.13 (-0.42)	1.32** (10.7)	0.80** (5.9)	0.34	47.2	276	0.52** (9.1)
2	D>2	0.019 (0.07)	1.05** (10.7)	0.92** (8.3)	0.47	58.9	200	0.13 (0.96)
3	D>3	0.30** (2.6)	0.23** (5.1)	0.45** (8.5)	0.37	28.36	146	-0.22** (12.8)
4	D>4	0.35** (2.3)	0.32** (5.3)	0.57** (8.9)	0.49	28.7	93	-0.25** (12.5)
5	D>5	0.25 (1.2)	0.39** (5.6)	0.65** (8.32)	0.57	26.5	62	-0.26** (8.6)
6	D>6	0.49** (2.5)	0.42** (9.0)	0.26** (3.7)	0.74	31.8	36	0.16** (3.9)

Raw 1 of the table, demonstrates that for the entire sample (duration>=1) the duration of the bonds do not explains the yields. However, the Rating by both rating agencies affects the bonds yields. Moreover, for the entire sample, "Maalot" rating agency has greater impact on the bond's yields than the "Midrug" agency (Wald 0.52).
The duration of the bonds starts to have a significant positive influence on the bond's yields for longer than 3 years durations[5] . The positive relationship between the durations of the bonds and their yields is well documented in the financial literature. Thereby, liquidity premium leads to higher demanded yields (see for example: Longstaff et al.(2005) and Ericsson and Renault (2002)).
While "Maalot" rating agency has been found to have a stronger impact on yields of bonds for entire sample, "Midrug" has a stronger impact on yields of bonds with durations

[5]With exception of D>5

between 3-6 years. When the impact switches to "Maalot" lead for the longer than 6 years durations bonds. The reason why for middle term durations "Midrug" is more influential while for the longer bonds "Maalot" takes the lead may be sourced by a longer market experienced in the Israeli bond market[6]. It might be the case that the users of the ratings trust the more experienced rating agencies when long to expiration bonds are concerned since longer durations means more risk.

In the described above regressions analysis I have used my entire sample of bonds that included 276 bonds. One might argue that collinearity problem might appear when the bonds are rated by two agencies in the same time. In that case, interdependency between ratings can distort the result of the statistical analysis. In order to avoid that, I have repeated the regression analysis for a narrower sample of 152 bonds that were rated by one of the rating agencies but not by both. The regression and Wald results are as followed:

$$ytm = -6.76 + 0.06D + 1.90Rating_a + 1.44Rating_b \quad (2)$$

(-3.14) (0.15) (9.86) (6.80)

F=34.34, R^2=0.35, N=152, $\beta_2 - \beta_3$ =0.46, Wald F=6.60

The results of regression 2 are similar to the results summarized in Table 1 row 1, i.e., "Maalot" has a significant greater impact on yields than "Midrug". And the duration of the bond does not have a significant impact on yields. The similarity of results prompts that the interdependency of rating does not significantly impact my results.

Next I want to examine market efficiency of the rating process using the following hypothesis. Suppose we select two different bonds with the same rating made by the same rating agency, and with the same duration. Under those conditions, if all market risks are captured by the rating process, yields to maturity should be equal. Equality of yield may imply that the investors effectively react to the bonds rating, meaning that they trust and use those ratings to evaluate bond's risks.

Since I could not find bonds that were traded with the same rating and the exact same duration, I examined bonds that were rated the same by the same agency and traded with duration that differ from each other less than 20%. By this method I sampled 73 couples of bonds and followed their yields for 12 weeks. All together my sample consist 876 couples of yields.

First I used two statistical tests (one parametric and one non parametric) to establish whether there are statistical significant differences in the mean YTM of all couples for the entire sample. For the parametric test I choosed a simple T test and for the non-parametric I choosed the Run test that is also called Wald–Wolfowitz test[7].

According to the Run test, the number of runs in a sequence of N elements is a random variable whose conditional distribution given the observation of N_+ positive values and N_- negative values ($N = N_+ + N_-$) is approximately normal, with Mean and variance as follows:

[6] "Maalot" was founded in 1991 and "Midrug" in 2003.

[7] After Abraham Wald and Jacob Wolfowitz.

$$\mu = \frac{2N_+N_-}{N} + 1$$

$$\sigma^2 = \frac{2N_+N_-(2N_+N_- - N)}{N^2(N-1)} = \frac{(\mu-1)(\mu-2)}{N-1}$$

These parameters do not assume that the positive and negative elements have equal probabilities of occurring, but only assume that the elements are independent and identically distributed.

I used those statistical tests to examine H0: $\Delta YTM = 0$ for bonds, as mentioned before, that are rated the same by the same rating agency and that has approximately the same duration. The results for the entire sample and for each of the rating agencies is given in table 2.

Table 2: Test for equality of means of bonds YTM

	All the sample	"Midrug"	"Maalot"
ΔYTM	0.12	0.17	0.09
T test	2.67 (0.00)	5.34 (0.00)	1.12 (0.26)
	Reject Ho	Reject Ho	Accept Ho
Run test	-17.07 (0.00)	-10.97 (0.00)	-13.37 (0.00)
	Reject Ho	Reject Ho	Reject Ho

As shown in table 2, for the entire sample both test have rejected the hypothesis that yields are equal. Ho was accepted for "Maalot" only by the T test while it was rejected by the Run test. These results may insinuate as found before, that "Maalot" rating gets more credibility among investors.

Since the durations of each couple of bonds were not equal (difference <20%), I tried to establish whether duration differences can explain yields differences holding the rating itself and the rating agency fixed.

Table3: Regression results.

All the sample	"Midrug"	"Maalot"
$\Delta ytm = 0.13 - 0.10\Delta D$	$\Delta ytm = 0.22 - 0.40\Delta D$	$\Delta ytm = 0.07 + 0.08\Delta D$
T stat (2.07) (-0.31)	T stat (4.85) (-1.7)	T stat (0.68) (0.15)
$R^2 = 0.003$, F=0.09, N=876	$R^2 = 0.07$, F=2.93, N=383	$R^2 = 0.000$, F=0.02, N=493

Note: Δytm = the difference of yields. ΔD = The gap between the bonds durations.

Table 3 demonstrates that no relationship between the duration differences and yield differences has been found for the entire sample and for each of the rating agencies. Moreover, opposite to expectations, an almost statistical significant negative relationship has been found between duration gaps and yields gaps. These result shed doubt on the efficiency of the entire rating process. If ratings are fully trustful by investors to capture all risks, than differences in the durations should have explained positively differences of

yields. When that is not the case, than one can assume that durations and the rating process do not capture all the risk involved in the credit market and some other risk component is involved in the process of determining yields to maturity.
Next, I try to visualize differences of yields by plotting the delta YTM (yield to maturity) over time for all ratings categories for both rating agencies (figure1) and testing for equality of yields in table 4.

Figure 1: Delta YTM per week for both rating agencies

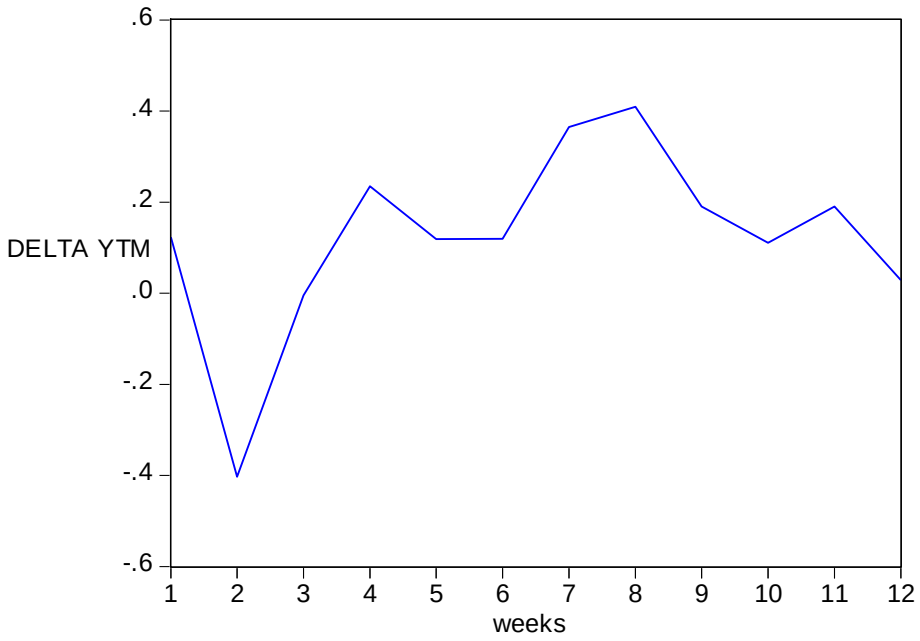

Table 4: YTM differences for 12 weeks for the entire sample

Week	1	2	3	4	5	6
ΔYTM	0.12	-0.40	0.00	0.23	0.12	0.12
T-stat	2.87	-0.89	-0.03	2.21	1.98	0.82
Sig	(0.00)	(0.37)	(0.97)	(0.03)	(0.05)	(0.41)
	Reject H0	Accept H0	Accept H0	Reject H0	Reject H0	Accept H0
Runs Test	-1.04	-0.30	0.87	-0.51	-1.66	0.16
Sig	(0.29)	(0.76)	(0.37)	(0.6)	(0.05)	(0.87)
	Accept H0	Accept H0	Accept H0	Accept H0	Reject H0	Accept H0
Week	7	8	9	10	11	12
ΔYTM	0.36	0.40	0.19	0.11	0.19	0.03
T-stat	2.70	4.88	4.69	3.23	2.26	0.34
Sig	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.73)
	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Accept Ho
Runs Test	-1.57	2.18	2.27	-1.75	-1.12	0.78
Sig	(0.05)	(0.03)	(0.02)	(0.05)	(0.25)	(0.43)
	Reject H0	Reject H0	Reject H0	Reject H0	Accept Ho	Accept Ho

Table 4 and Figure 1 show that yield gaps fluctuate over time. Simple T test has found that for 8 out of 12 weeks, there is a statistically significant gap between the bond's yields. However when we use Run tests, an inequality of means was found for only 5 weeks. Both tests agree that the gap statistically disappear at week 12. Those statistical results support the inefficiency of the credit market discussed earlier. Now I examined the YTM differences for each of the rating agencies in order to establish any differences of behavior over time. Figure 2 and Table 5 summarizes the results for "Midrug" while Figure 3 and Table 6 "Maalot".

Figure 2: Delta YTM Midrug per week

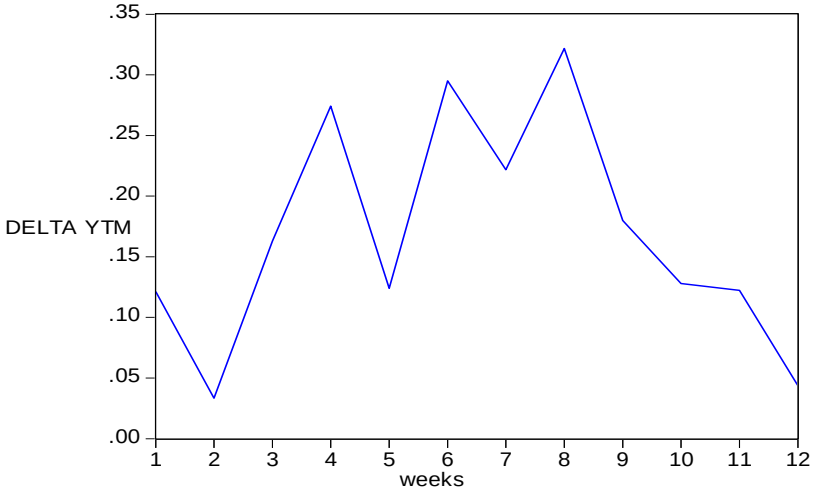

Table 5: YTM differences for 12 weeks for "Midrug" agency

Week	1	2	3	4	5	6
ΔYTM	0.12	0.03	0.16	0.27	0.12	0.29
T-stat Sig	1.92 (0.05)	0.38 (0.70)	1.96 (0.05)	1.61 (0.18)	1.35 (0.13)	1.53 (0.13)
	Reject H0	Accept H0	Reject H0	Accept H0	Accept H0	Accept H0
Runs Test Sig	0.00 (1.00)	0.00 (1.00)	1.28 (0.19)	1.14 (0.25)	-0.52 (0.59)	0.00 (1.00)
	Accept H0	Accept H0	Accept H0	Accept H0	Accept H0	Accept H0
Week	7	8	9	10	11	12
ΔYTM	0.22	0.32	0.18	0.13	0.12	0.04
T-stat Sig	1.77 (0.05)	3.00 (0.00)	3.77 (0.00)	2.39 (0.02)	2.01 (0.05)	0.32 (0.70)
	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Accept Ho
Runs Test Sig	0.00 (1.00)	0.31 (0.75)	-1.84 (0.05)	-0.88 (0.36)	-0.45 (0.64)	0.12 (0.90)
	Accept H0	Accept H0	Reject H0	Accept H0	Accept Ho	Accept Ho

Figure 3: Delta YTM Maalot per week

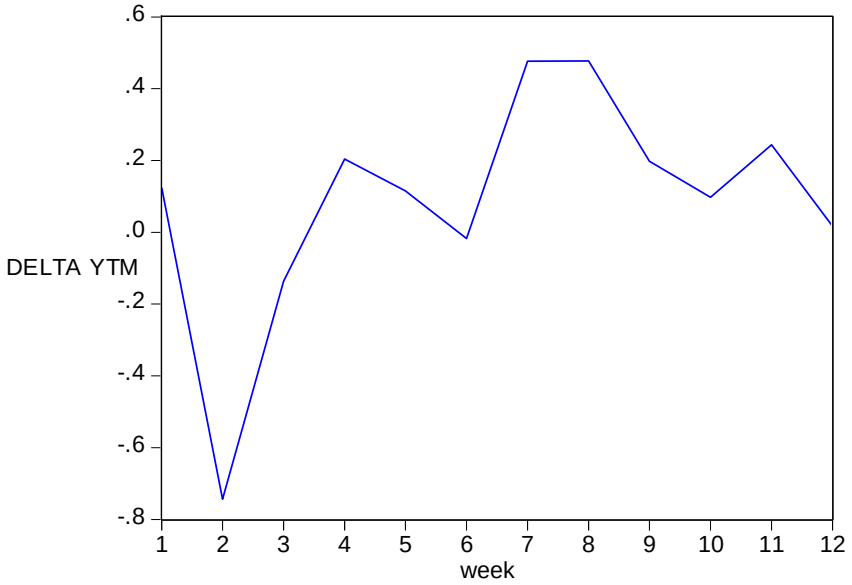

Table 6: YTM differences for 12 weeks for "Maalot" agency

Week	1	2	3	4	5	6
ΔYTM	0.12	-0.74	-0.13	0.20	0.11	-0.02
T-stat	2.10	-0.93	-0.50	0.15	0.14	-0.08
Sig	(0.04)	(0.35)	(0.61)	(0.14)	(0.16)	(0.93)
	Reject H0	Accept H0	Accept H0	Accept H0	Accept H0	Accept H0
Runs Test	-1.55	0.00	-0.48	-0.45	2.28	0.00
Sig	(0.05)	(1.00)	(0.62)	(0.64)	(0.02)	(1.00)
	Reject H0	Accept H0	Accept H0	Accept H0	Reject H0	Accept H0
Week	7	8	9	10	11	12
ΔYTM	0.47	0.47	0.20	0.10	0.24	0.02
T-stat	2.17	3.85	3.18	2.16	1.70	0.16
Sig	(0.03)	(0.00)	(0.00)	(0.03)	(0.05)	(0.87)
	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Accept Ho
Runs Test	1.77	-1.19	-1.66	-0.62	0.00	0.00
Sig	(0.05)	(0.23)	(0.05)	(0.52)	(1.00)	(1.00)
	Reject H0	Accept H0	Reject H0	Accept H0	Accept Ho	Accept Ho

Results that were shown in Figures 2 and 3 and in Tables 5 and 6 tell approximately the same story. For both rating agencies the simple T test has found inequality of YTM in 6 out of 12 weeks examined. The non-parametric Run test has found inequality of yields 1 out of 12 weeks for "Midrug" and 4 for "Maalot". In both cases the difference of yields fluctuate from equality to inequality over time insinuating that something is wrong with the rating process, preventing it to seize the entire risk and suggesting that external risk is involved the credit market.

4 Summary and Conclusions

In this research I have used two different data set of bonds in order to establish to what extent the Israeli Credit market is efficiently rated by both of the rating agencies that operates in that market. The first date set consisted of 276 different corporate bonds. Examining that data show that the market does refer to the rating as a measurement of risk, giving the senior agency "Maalot" more credibility in general than to "Midrug". That result was not consistent for the bond series. For middle durations (3-6 years), it has been found that "Midrug" has a greater impact on yields than it counterpart rating agency. Following for 12 weeks a second data base that consists 876 couples of bonds that were rated the same by the same rating agency and that had smaller than 20% difference in their durations, I wanted to examine how differences of yields fluctuate over time. The hypothesis behind that method of research was that if rating is fully trusted by investors to capture the bond's entire risk, than durations differences must explain any observed yields differences. Results have proven that durations do not explain yields differences between bonds that were rated the same by the same rating agency suggesting that the rating process do not capture the entire risk involved. Moreover, an inequality of yields has been found to fluctuate over time for both rating agencies suggesting external risk factors that are considered by investors. The results of this research suggests that a better rating model should be adopted perhaps by adding a new investor-paid rating agency that would separate the unhealthy linkage between the issuer of the bond and the rating agency, enabling the rating process to be more objective and trustfully by investors to capture all related risk.

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