The Quality of Corporate Credit Rating: Evidence from Israel, 2005-2013

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Abstract

In the wake of debt restructure in Israel, following a boom in corporate debt issuance, attention was brought to the causes for default, along with its predictability and potential harbingers, such as credit ratings. Using data on Israeli corporate bonds and US defaulters, I suggest the possible risk undervaluation by Israeli credit rating agencies to be of up to 6.12 unaccounted-for rating notches, while yield spreads and other financial indicators alert of a possible default well in advance. Acknowledging that rating agencies are unable to instantaneously reflect new financial information and tend to lag behind the market, my results indicate that Israeli rating agencies provide ratings that are of significantly lower quality than their foreign counterparts. From a series of panel VAR analyses it appears that ratings in Israel are inconsistent with financial indicators, and when adjusted, provide little information to the credit market and often do not affect prices.

1 Introduction

Beginning in 2008, the growing number of corporate defaults and debt restructures in Israel, including those of highly rated firms, has raised concerns regarding the quality of ratings awarded by Israeli credit rating agencies (CRAs).[1] Understanding this failure is of great importance to the general public, as its

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[1] Throughout this paper I use the terms 'default', 'insolvency' and 'financial distress' interchangeably, for the sake of the readers, when I refer to events of default as defined by Standard & Poor's for US firms (mostly following either a missed payment, Chapter 11 filing or distressed exchange), and to the date Israeli firms enter financial distress according to the Financial Stability Division at the Bank of Israel.

savings were invested in the bonds of those companies via the institutional investors. The fact that regulation of pension funds, for example, dictates that their investments must be in bonds bearing certain ratings stresses that importance. Eventually, many of those highly rated firms have proceeded to default on their debt. In a first attempt of its kind, I assess the accuracy of Israeli credit ratings and the financial information they convey. Specifically, I analyze the difference in credit downgrade timings using samples of Israeli and American corporations. I find Israeli credit rating agencies to overrate firms on average by 3.76 notches when weighted by firm and by 6.12 notches when weighted by the amount of debt outstanding (i.e. studying the average ILS rather than firm). I then proceed to examine the development of yield spreads and financial fundamentals as ratings are awarded and fit a panel VAR model suggesting that, in general, ratings do respond to shocks in spread, while the spreads show no such behavior.

Credit markets around the world are afflicted with the basic flaw of asymmetric information. Lenders will forever know less than borrowers about the creditworthiness of the latter and the true prospects of a given project. Additional asymmetries exist between lenders of different seniority and size, and are especially dominant in the event of debt restructure (Bester (1994)). In an attempt to bridge this information gap, credit rating agencies have emerged—offering delegated credit analysis service and allowing small investors to participate in the market. While their initial business model revolved around selling manuals to investors ("investor pays"), free-riding considerations encouraged the shift to having the rated firms pay for the rating service ("issuer pays") as is common today.

Occasional insolvency is a possible outcome of any business that bears risk and one that investors ought to bear in mind. The past few years have brought upon an unprecedented growth of such instances among Israeli corporations,[2] accompanied by widespread media coverage of the debt negotiation process and eventual restructure: Between January 2008 and December 2013, some 119 Israeli corporations have entered restructuring negotiations over roughly 40 billion ILS in debt, while much of it was held by the public through the institutional investors (which provide long term investment management services through pension, insurance, and provident funds). Israeli institutional investors are sophisticated players in the credit market, constituting a major part of it, and are bound by numerous restrictions and regulation of their conduct.[3] Most importantly, regulation does not allow institutional investors to hold securities rated below a local BBB-,[4] which are classified as speculative (An exception to this

[2] It should be noted that the Israeli corporate credit market was not as developed prior to that time, as corporate non-bank credit grew from about 45 billion ILS to roughly 210 billion ILS over the 2004-2007 period (Figure 1).

[3] As of 2011, the total value of institutional investors' assets under management was estimated at 99% of GDP and growing by about 10% annually. Until 2011, institutional investors were not obligated to perform their own analysis for every bond before purchasing. However, their portfolio may still hold up to 5% of non-analyzed corporate bonds.

[4] Or its equivalent, by either Midroog or Maalot—the only credit rating agencies in Israel. It should be stressed that throughout the paper I present Israeli ratings on the local scale,

allows up to 3% of the investment portfolio to be rated lower, or not at all, if an in-house analysis was conducted and the debt is asset-backed). As covered in detail by White (2010), such legislation, in fact, turns the rating agencies into central players in the bond market, allowing lenders to outsource risk evaluation, and institutional investors to rely on external judgment in order to satisfy the regulator's requirements. Since the pension, insurance, and provident funds are mandated to act on the behalf of the public, it is in the highest interest of the savers that their investment decisions are carried out with the best, most complete, precise and relevant information available. It is this notion that has brought much discontent as more and more corporations with publicly-held debt began restructuring their debt. Prime examples are illustrated in figures 2 and 3, where I plot the path of yield spread and rating of Elbit Imaging and IDB Development over time. This apparent dissonance emphasizes the rating stagnation as financial distress ensues and bond yield spreads substantially rise, leading to unserviceable debt allowed to be held by institutional investors.

Instances of apparent unindicative ratings are not uncommon throughout history and have spurred debate of the phenomena and the mechanisms behind it. It could be suggested that low rating quality is attributed to high information costs borne by the rating agencies. In other words, agencies cannot obtain superior information than they do now and provide better analyses of the rated firms without incurring additional financial costs (Ahearne et al. (2004)). I evaluate this claim by comparing Altman's z-scores, developed to predict corporate bankruptcy using a set of financial and economic ratios (Altman (1968); Altman et al. (1995); Altman (2005)), to ratings. This method gives a rule of thumb—with low information costs for investors, since it incorporates only public data—regarding the financial stability of a given firm and an estimate for its risk of default. This helps determine whether information implying a high probability of default was indeed available to the agencies when ratings were issued. A drop in the z-score together with a stagnant rating may raise a warning flag for investors. Examining firm performance through its z-score provides a more stable view of the fundamentals, as opposed to bond yield spreads, which are somewhat volatile and subjected to distortions from speculative investment.[5] My findings support the notion that information indicating a high risk of default was present and available, and suggest that z-scores do precede ratings.

The risk of moral hazard immediately arises when the rated companies are in fact the paying clients of the rating agencies. Given the liberty to choose the rating agency, firms will naturally prefer the one that grants more favorable ratings—what is commonly referred to in the economics and finance literature as "rating shopping" (Benmelech and Dlugosz (2010); Sangiorgi et al. (2009);

in order to accurately follow the developments as the occurred and be consistent with local regulation. As a rule of thumb, local Israeli ratings are five to seven notches lower than global, e.g. an Israeli A is roughly a BB on the global scale. A complete mapping of the S&P scale is available at http://www.maalot.co.il/Content/Ratings/ratingScale.aspx.

[5] See Sasi-Brodesky (2013) for more on the explanatory power of financial fundamentals on yield spread in Israel.

Skreta and Veldkamp (2009); Bar-Isaac and Shapiro (2011); Kronlund (2011); Bolton et al. (2012); Frenkel (2013); Bakalyar and Galil (2014)). This structure incentivizes the raters to keep their client satisfied and endowed with high rating, stimulating rating inflation. Thus, if speculative securities are indeed given investment-grade ratings and in turn purchased and held by institutional investors, public savings are at risk. Given that the Israeli market is significantly smaller than the American and farther away from perfect competition, it is not unlikely that rating shopping would happen more broadly and frequently, and be easier to observe. On top of that, and in contrast to the US, Israeli firms are given the discretion to first be rated and then choose not to report the awarded ratings, which only exacerbates rating shopping and inflation. This policy somewhat polarizes the market, where firms and securities cluster around either high ratings or none at all (Figures 4 and 5). Coincidently, defaults rates among unrated firms are higher than among rated (40% versus 18%) and unrated firms are prevalent among all defaulters (67%), suggesting that a firm's decision not to be rated might be interpreted as a negative signal for its quality.

Opponents, however, could rightfully argue that in the less developed, liquid, and sophisticated Israeli market, we might actually expect there to be more merit in CRAs and greater added value in the ratings they award. This is especially prevalent in initial issuances of debt where no market yet exists—as was often the case in Israel in recent years. Most approaches lead to rating agencies providing poor service and suboptimal information to investors and the possibility of market failure. The empirical evidence I present in this paper also supports this view.

In many fields and industries, where no natural monopolies exist, competition is a common and effective mechanism which brings about market efficiency and increases total welfare. It could therefore be suggested as a possible remedy to the low quality of ratings as well—agencies would compete in price and quality and provide better and more accurate rating services. However, recent research has shown that an entry of a third player to the Maalot-Midroog duopoly could actually be detrimental. Becker and Milbourn (2011) analyzed the US credit rating industry, which historically has been dominated by Moody's and Standard & Poor's, with growing legislative and regulatory calls for greater competition. While the entry of a third rating agency (Fitch) was perceived as a move in the right direction, the authors argue that increased competition from Fitch actually corresponds with lower quality ratings: Rating levels went up, the correlation between ratings and market-implied yields fell, and the ability of ratings to predict default deteriorated. Similarly, Bolton et al. (2012) find that competition can reduce efficiency and facilitate rating shopping, instead of improving rating quality.

It should be noted that Israeli CRAs are subsidiaries of Standard & Poor's and Moody's, having access to their methodologies and expertise. Therefore, one has reason to expect their performance to be on par. However, if systematic differences between the two credit markets exist, it is also possible that the years of experience accumulated by American CRAs are of lesser relevance to Israel, setting Maalot and Midroog back in terms of analysis quality and precision:

While the US market is decentralized, with no major issuers in terms of market share belonging to business groups, Israel witnessed a surge of public offerings by members of such groups as IDB, Elbit, Africa-Israel, and Delek. Firms in the top tiers of business groups have been consistently receiving higher ratings, likely due to their ability to tunnel profits up the pyramid. It is only following the financial crisis of 2008 and regulatory changes in its aftermath, Israeli CRAs have begun to account for pyramidal structures, stating that the higher the firm is, the lower it should actually be rated.[6]

In this paper, I first study whether Israeli and American CRAs react on par in terms of timing and magnitude of downgrades, by looking into the rating history of Israeli firms that have reached financial distress and US defaulters between 2008 and 2013. To test whether Israeli credit rating agencies have adjusted ratings significantly more, I compare the timing and magnitude of rating downgrades in subsamples of firms reaching financial distress.

Next, using the much richer Israeli data, I study these trends in conjunction with yields to maturity (more precisely, yield spread over an indexed sovereign bond with similar duration) and a weighted set of financial ratios that may indicate a risk of default, and look for discrepancies between behavior of ratings on the one hand, and market price and financial fundamentals on the other.

Finally, I use a panel vector autoregression (PVAR) framework to estimate the dynamic relation between how the market perceives firms' creditworthiness and how CRAs do. Since, in theory, the sole purpose of rating agencies is to supply valuable and relevant information to investors, this provides an opportunity to gauge how the market responds to the issuance of ratings. This approach allows me to overcome the inherent endogeneity problem using lagged variables as instruments, and more convincingly isolate the effect of a rating change on spreads.

The rest of the paper is structured as follows: Section 2 presents the data, methodology, and empirical specification, while section 3 provides the results. Section 4 is a discussion of the findings, and Section 5 concludes.

2 Data and Methodology

The data I use here is comprised of daily observations from Tel Avive Stock Exchange (TASE) of regular, non-convertible, indexed[7] corporate bonds, and includes amount issued in ILS, local credit rating on the customary S&P scale (data on credit outlook was unfortunately unavailable), and supplementary data on firms collected from their quarterly financial reports and public announce-

[6] According to Midroog CEO in an interview in late 2013: "Our premise was that one can tunnel money from a firm at the bottom of the pyramid to a firm higher up" and "We had some methodology establishing that the higher a firm is up the pyramid, the lower its rating should be, unless there is high liquidity within the pyramid". Available at http://www.themarker.com/markets/1.2130388.

[7] Roughly 12% of the Israeli corporate bond market was comprised of non-indexed bonds. I omit those due to the low variation in duration of non-indexed sovereign bonds, which does not allow me to compute yield spreads in a consistent manner.

ments between 2005 and 2013 (Table 1). The data set covers 293 Israeli firms (excluding financial) with publicly traded debt, 154 of which had rated bonds listed on TASE. Of the 293, 84 have defaulted, and of those, 28 were rated. A breakdown of the default instances and total value is provided in tables 2 and 3. The share of Israeli firms and debt rated is illustrated in Figure 4. Of those, the share receiving investment grade ratings is shown in Figure 5. Historical data on American firms' rating, time of default, and debt outstanding come from Standard & Poor's Annual Corporate Default Studies between 2008 and 2013. These cover 440 firms, with their cause of default, industry, debt amount, and preceding ratings. Note that the way American data were aggregated, differences in industry definitions and distribution in the population, unobserved firm characteristics, and the distinction of exact specifications and timings of US defaults versus Israeli financial distress events may influence my results.

I begin my analysis with a subsample of Israeli defaulters. I examine individual bond ratings and yield spread development from first rating to restructure negotiation as follows: First, on a monthly basis, I find the last rating each bond had received. Since companies often issue multiple bonds (averaging roughly 1.5 in my data), bearing different yields and ratings, I assign the lowest rated issue to the company as a whole.[8] The motivation behind this choice is that rather than looking at the performance of the average bond and the situation of its average holder, it offers a sense of how close the firm is to insolvency—given that a default on one security is often extremely detrimental to all bondholders. Moreover, high rating and low yield spread of bonds often indicate that they are backed by either fixed or floating collateral. This fact is misleading when trying to assess how far a firm actually is from bankruptcy. I then proceed to merge collected data on dates when firms entered debt restructuring negotiations to find the credit ratings at select points in time, relative to that event. The corresponding US dataset contains the amount of debt and assigned (firm-level) credit ratings—last available, one and three years prior to default, and at issue.

Taking the American credit market as a benchmark,[9] with all aforementioned caveats, I estimate the differences in average rating changes between the two countries. If the populations are similar and insolvency definitions are comparable, a larger Israeli figure would suggest whether and by how much is the rating quality of Maalot and Midroog lower than their US counterparts. Since the two agencies are local subsidiaries of Standard and Poor's and Moody's respectively, it is unlikely that any differences measured can be attributed to some methodological inferiority of the Israeli duo.

I continue and focus only on ratings awarded by Israeli CRAs to Israeli corporate bonds and compare them with their spreads over sovereign bonds

[8] This approach also portrays CRAs in the most favorable light, as if the firm as a whole had received the lowest, most conservative rating. I explore an alternative specification where firms are assigned debt-weighted averages and find, as expected, ratings and z-scores to be slightly higher, and spreads slightly lower. However, this analysis produces similar results, which serves to strengthen the notion that my results are not driven by the chosen method of aggregation.

[9] As it is a much larger, less concentrated, more transparent and liquid market, with better developed institutions and regulations.

with similar duration. If we accept the notion that markets are efficient and prices (i.e. spreads) represent all available information, we would expect them to adjust as new financial information is revealed to investors. Similarly, we would expect to see them move in opposite directions and for high spreads to generally correspond with low ratings.

To strengthen my argument of the quality of credit ratings, I also examine them alongside z-scores, a metric consisting of several financial ratios and was found to be predictive of default (Altman (1968)). However, I use the weights and thresholds specified in Altman et al. (1995), since those can be applied to both manufacturing and non-manufacturing firms (which are the majority in Israel). While z-scores themselves have no cardinal meaning, this body of economic literature on corporate bankruptcy points out some rough thresholds indicating a firm's probability to service its debt, with scores above 2.6 suggest high probability, and scores below 1.1 indicate low probability.[10] Although z-scores are susceptible to exact specifications such as factor choice, weights, and thresholds, their steady deterioration should generally raise concerns about creditworthiness and solvency.

Finally, I employ a panel vector autoregression (PVAR) methodology using the Israeli data, allowing for endogeneity of all variables in the system together with unobserved heterogeneity across firms.[11] This approach allows for the estimation of the sign and magnitude with which variables respond to other and own innovations, neutralizing all other shocks. Specifically, I am interested in the response, or lack thereof, of price (spread) to innovations in rating. Orthogonalizing the shocks is needed in order to isolate the response of one variable to innovations in another, while holding all other shocks at zero. This procedure is known as Cholesky decomposition and is done by assuming a particular order of exogeneity between any two variables, and attributing the correlation between their residuals to the variable that is more exogenous. The identifying assumption is that the more exogenous variables affect the following ones contemporaneously, as well as with lags, while the less exogenous variables affect the previous variables only with a lag. In this specification, I assume the order of exogeneity to be {z-score, rating, spread}, i.e. z-score affects rating and spread contemporaneously, and rating affects spread contemporaneously. This order seems reasonable since z-scores are quarterly figures computed from firms' financial statements, and as such, cannot possibly react to monthly changes in neither rating nor spread. Similarly, ratings are awarded and adjusted periodically and unlikely to immediately react to prices, while the capital market can instantaneously react to new ratings. The above ordering is also statistically supported by a series of Granger causality Wald tests. Most importantly, the results are robust to changes in the order and are unlikely to be driven by the exogeneity assumption.

[10] Ingber (1994) proposes using different sets of weights and thresholds adjusted for the Israeli market. For my purposes, I found these z-score to have little variation and no statistically significant predictive power.

[11] This is done in a manner similar to Love and Zicchino (2006), and using a modified version of their *pvar* module.

I specify the model as follows:

$$y_{i,t} = \alpha_{i,t} + \sum_{j=1}^{J} \beta_j y_{i,t-j} + \varepsilon_{i,t} \tag{1}$$

Where $y_{i,t-j}$ is the vector of endogenous variables {z-score, rating, spread} of firm i, j months before time t, $\alpha_{i,t}$ is a firm-month specific intercept, and J is the lag order of the system.[12]

With $\alpha_{i,t} \equiv \alpha_i + \gamma_k + \delta_t$, capturing firm, sector, and time fixed effects respectively and $J = 2$ we get the following second-order VAR model:

$$y_{i,t} = \alpha_i + \gamma_k + \delta_t + \beta_1 y_{i,t-1} + \beta_2 y_{i,t-2} + \varepsilon_{i,t} \tag{2}$$

To avoid imposing the same underlying structure for every firm and sector when applying the VAR methodology to panel data, I must allow for cross-sectional heterogeneity. While sector and year fixed effects can easily be eliminated by mean-differencing $y_{i,t}$ for each sector and year, firm fixed effects (denoted by α_i) cannot be dealt with as simply. Unlike the former two, that affect all firms within a sector or year in the same way, firm fixed effects are correlated with other regressors through lags in the dependent variables. I am able to circumvent this bias through the Helmert transformation, which subtracts the mean of all *future* observations for each i and t, keeping transformed and lagged variables orthogonal, and enabling the use of lagged regressors as instruments. Confidence intervals were generated using Monte Carlo simulations.

According to financial economic theory, if ratings do convey valuable information to investors and markets are efficient, this should be priced-in right away and I would record an immediate spike in the spread. Alternatively, say if the credit market is not completely efficient, a more moderate drift is to be expected over the following periods as information is absorbed and priced-in.

Under this specification, if, as rating agencies claim, they asses the financial fundamentals, creditworthiness and long run prospects of a given firm or bond, I expect prices (and therefore spreads), which are constantly adapting, to have little effect on the attributed rating. If, on the other hand, ratings do follow spreads, it would indicate that CRAs are not as farsighted as initially perceived and do follow the market's "volatile and myopic" pricing.

[12] Results were found to be robust to the addition of explanatory variables such as trade volume, number of transactions, number of ratings, and bond duration, as well as to breaking down the z-score into its five components. The lag order (2) was chosen according to the HQIC and SBIC criteria, while the AIC indicated an order of 13. This alternative seems highly improbable and has no support in economic theory. VAR stability tests were run on all subsamples, finding all eigenvalues to lie inside the unit circle and satisfying the stability condition.

3 Results

3.1 Ratings: Israel versus US

I find that Israeli defaulters were rated, on average, A at issuance and B- at insolvency (roughly equivalent to a global BB- and CCC), while American defaulters were rated, on average, B+ at issuance and CCC- at bankruptcy. In absolute terms, this places Israeli defaulters in close resemblance with the American. Israeli regulation, however, sets investment grade standards according to the local scale. With that in mind, just 12 months before insolvency, the Israeli soon-to-default debt was still highly rated locally and an astounding 84% of rated firms at that point (and roughly 90% of rated debt) qualified as investment grade in the eyes of local regulation (Figure 6). This finding is even more remarkable when compared to the US sample, where only 2% of defaulters received, according to local regulation, investment grade ratings one year prior to default.[13]

Furthermore, examining changes over time, Israeli defaulters have, on average, decreased in rating significantly more (and were initially higher) than their US counterparts. I record an average annual decrease of roughly 1.09 notches until $t-1$, and then a drop of 7.43 whole notches between $t-1$ and insolvency, for a total average drop of 9.44 notches from issuance to default. These figures stand out in contrast to the US data, where the average annual decrease until $t-1$ is about 0.36 notches, and 3.16 between $t-1$ and default, for a total average drop of 5.68 notches from first to last rating—3.76 notches less than the Israeli sample (Table 4, columns 1 and 3).

To test whether results are skewed by the equal weight each firm was assigned, I weigh ratings by the amount of debt outstanding and examine the average ILS, rather than the average firm.[14] My data indicate that Israeli corporate debt has received even higher initial ratings and has undergone sharper downgrades: From A+ at issuance to CCC at bankruptcy (BB- to CCC- on the global scale). Conversely, the US debt-weighted population remained mostly the same, receiving similar average ratings as the unweighted sample at each point in time, with a deviation of one notch up at issuance. While the average US drops stayed similar to their unweighted counterparts — 0.75 annual notches up until $t-1$ and 3.37 between $t-1$ and default, for a total average drop of 7.3 notches from first to last (up from 5.68), the Israeli picture has significantly worsened. I register an average annual downgrade of roughly 0.73 notches until $t-1$, and 10.6 notches between $t-1$ and insolvency. The downgrades add up to

[13] Repeating this exercise with global investment grade thresholds paints a rather dull picture and is not too informative, since a global BBB- is roughly equivalent to a local AAA. To this day, no Israeli defaulter has received such rating at any point in time. In fact, no Israeli firm other than Israel Electric Corporation was ever rated AAA.

[14] I use the Kolmogorov-Smirnov goodness-of-fit test to test whether the simple and weighted data could have come from the same distribution, which would imply that the average firm and average ILS behave similarly. For both populations and at all points in time I reject the null hypothesis (at the 95% confidence level) and conclude that the samples are indeed significantly different.

a total average fall of 13.42 notches from issuance to insolvency (up from 9.44) — a whole 6.12 notches in excess of the American CRAs (Table 4), columns 2 and 4).

It could be argued that the two rating scales are incomparable, and that an Israeli AA might very well be an American BBB equivalent (given that, as of December 2014, Israeli sovereign debt was rated A+ on the global scale, this directly caps Israeli corporations) and therefore the high initial ratings in Israel are consistent with and account for certain national systematic risk—something equivalent to a country fixed effect. However, while this is not quite the case,[15] defaulting Israeli corporate debt was still awarded, on average, A to A+ at issuance and kept an Israeli investment-grade status even in the final year of their demise. If defaulted debt received such high ratings—and non-defaulted even higher—it raises concerns of underlying rating inflation. However, I would argue that little emphasis should be put on the levels of ratings awarded, other than their regulatory implication, and that the focus should mainly be on the their dynamics. It seems that Israeli rating agencies are slower to adjust and tend to keep ratings relatively high and stable as firms' creditworthiness deteriorates. When the agencies eventually do react, it occurs abruptly in the last months before financial distress is officially announced.

To illustrate, I plot the disaggregated average and median Israeli ratings in the seven years leading to default, to be able to compare their continuous development to the figure featured in the latest S&P Corporate Default Study (Figures 7 & 8). It is evident that the average downgrade is much sharper as rated corporations approach default. This refutes the criticism that the agencies simply lag behind the market, since, by definition, they attribute long term credit ratings and therefore must make sure the changes are indeed fundamental and long-lasting. If that were the case, we would expect a much more linear trend like the one documented in the US. The findings, however, indicate that roughly 74%-79% of the total average downgrade occurs in the final year before default. For comparison, the figure for US defaulters is 57%-60%. Of course, though intriguing, this comparison is of a strictly descriptive nature, as I have no data on the American control group (rated firms that have no defaulted) and no ability to compare other observables like yield spread or reason for default, nor control for legislation, incentive schemes, and industry or firm unobservables.

3.2 Ratings versus Spreads

With the previous subsection presenting suggestive evidence that ratings are not timely assigned, I proceed to compare Israeli ratings to their respective yield spreads, to get a sense of how CRAs assess firm performance vs how the market does. My findings indicate that the market indeed does not wait for ratings to adjust: roughly 12 months prior to insolvency, while the average defaulting firm's bond still qualifies as investment grade according to Israeli regulation, it

[15] Local AA- is roughly equivalent to a global BBB-, which is still far off the B+ I measure for American defaulters at issuance.

is already traded at a spread of roughly 20 percentage points over a sovereign bond with similar duration. This dissonance is stressed when, in the month of insolvency, the average spread clocks at over 100 percentage points while the average rating assigned is around B- (Figure 9). To illustrate, firms reaching spreads of over 20 percentage points have a 46.6% probability of default versus a probability of 1.7% for spreads under 20. Similarly, conditional on reaching spreads of over 100 percentage points, 78.7% of firms have defaulted, and only 19.1% for spreads under 100 (N = 293). These results imply a 4 to 27 times higher propensity for default, as perceived by the market, upon reaching those spreads. Debt-weighted average spreads are not statistically significant from simple averages.

3.3 Ratings versus Z-scores

Borrowing from the literature on financial economics, a popular, low-information-cost, measure of a firm's solvency is the previously mentioned z-score. My results indicate that about 35.1% of firms whose z-score dropped under 1.1 have defaulted, while only 7% of firms with scores between 1.1 and 2.6 (N = 289). Unsurprisingly, no firm with z-score of over 2.6 has reached financial distress (Table 5). These findings provide suggestive evidence that z-scores and insolvency are indeed well correlated in the Israeli data. I find that while the average defaulting bond drops below investment grade just roughly 9 months to insolvency, the average z-score suggests a consistent high risk of default starting from about 32 months to default. Weighting by debt issued paints a similar picture: while the average rating does not fall below investment grade until 7 months to default, the average z-score points at a high risk of default from about 21 months to insolvency and onwards (Figure 10). In other words, even under the most conservative interpretation, it appears as though z-scores precede ratings by at least a full year.

3.4 VAR Analysis

To study the causal effects of credit rating on yield spread and vice-versa, I fit a panel vector autoregression model to the data and estimate the response of price to shocks in rating, i.e., a measure of the information value that ratings convey. Results of the system GMM estimation are reported in tables 6 and 7, where fixed effects include time, industry, and a dummy for belonging to a business group, and additional controls are bond duration, number of ratings received, trade volume, and number of transactions. Though it is uncustomary to report autoregressive results in terms of their coefficients, the consistency of the estimated effect across the different specifications lessens our concerns of an omitted variable bias and implies that they are not an artifact of a specific functional form. Using Cholesky decomposition, I orthogonalize individual shocks such that all other variables are held constant, and examine impulse response functions (IRFs) to each one independently over a period of 6 months. Using the most comprehensive specification, I find that a shock to rating in the magnitude

of one standard deviation corresponds with no significant response of the spread at any point in time. Meanwhile, the same shock to spread corresponds with a significant response at all ranges, reaching 0.28 standard deviations after 6 months (Figure 11). In other words, a shock to price does bring about a change in rating, while the opposite is not true—ratings on average do not affect prices, implying they do not carry new information (See Kliger and Sarig (2000) for a slightly different approach that does not find rating announcements to affect total firm value, but rather transfer value from stockholders to bondholders). This holds true for the full sample of rated Israeli firms and the subsample of non defaulters (0.07 standard deviations after 6 months), while the effect is insignificant for defaulters. The effect also varies between firms ex ante belonging to business groups and those that do not: 0.62 and 0.12 standard deviations after 6 months, respectively.[16] The estimated differences between defaulters and non-defaulters are in line with the previously discussed timing and magnitude of downgrades in Israel. While spreads rise steadily as a firm approached default and its creditworthiness deteriorates, ratings are slow to respond and adjust, having no effect on ratings.

To complement these findings using orthogonal impulse response functions, I study the forecast error variance decomposition of ratings and spreads to indicate what share of the forecast error variance (FEV) of each variable can be explained by exogenous shocks to the other, over a 6-month period. In line with previous results, I find that shocks to rating explain no statistically significant share of the spread's FEV at any point in time in both the full sample and the business group and insolvent subsamples. Meanwhile, shocks to spread do explain up to 14.8% of the rating's FEV after 6 months using the complete sample. The figures for defaulters and business groups are roughly 27.1% and 36.9% respectively, compared to no significant shares for neither non-defaulters nor for firms outside business groups.

In all aforementioned analyses, different effects were also estimated in the major sectors of industry: Trade and Services, Real Estate, Manufacturing, and Holdings. I find that shocks to rating have no significant effect on spread in the trade and services, real estate, and holding sectors, and a barely significant negative effect in manufacturing. The reverse (the effect of spread on rating) is negative and significant for all sectors except holding, where is it insignificant. The consistent pattern indicates that the results are not driven by a certain sector, and are in fact a wide phenomena. A by-sector forecast error variance decomposition indicates that shocks to rating explain no significant share of the spread's FEV at any point in time in none of the sectors, while shocks to spread explain up to 17% of the rating's FEV after 6 months. These results, however, should be taken with greater caution, as the number of firms in each sector is quite small (63, 131, 46, and 53, respectively).

[16] Note that ratings have no cardinal value in this paper, in a manner similar to utility in the literature. Therefore, interpretation of the quantitative properties of these results (like standard deviations) should not be emphasized. Instead, weight and consideration should be given to the qualitative findings, where such exist.

4 Discussion

This work suggests that Israeli credit rating agencies are influenced by market prices (in the form of yield spreads) and assign ratings with a great delay, thus providing little information to investors. Evident from samples of defaulting firms, these ratings undergo greater corrections and adjustments as firm creditworthiness deteriorates, compared to their American counterparts. The study of rating paths alongside yield spreads and z-scores finds them inconsistent with the information embodied in the latter two. Finally, evidence from panel vector autoregression analyses supports the notion that when these ratings are eventually adjusted, they bring little information to the market, and have no significant effect on bond prices (in contrast with the findings of Hand et al. (1992) and Goh and Ederington (1993), while Afik et al. (2014) reach a similar conclusion using an event-study methodology).

Starting with a naive panel VAR system of {rating, spread} alone, I estimate a significant positive effect of shocks to spread on rating, and no effect of rating shocks on spread. My results are robust to the introduction of Altman's z-score to control for financial firm fundamentals, with some attenuation in the estimated effect of spread on rating, while an increased effect is measured when the z-score is replaced with its five components. Accounting for year, industry, and business group fixed effects weakens the estimated effect of spread on rating, while expanding the system of equations to also include the variables {bond duration, number of ratings received, trade volume, number of transactions} increases the estimated effect of spread on rating. Results are robust to changes in the VAR ordering and are not driven by this identifying assumption. Similarly, the findings are unaffected by changes to the aggregation method of day-bond to month-firm level (mean value instead of last, average bond instead of worst).

If we accept that ratings are flawed (or at the very least, not informative), a frequent method in dealing with market failure is the introduction or tightening of regulation. Dictation of methodology, demand for disclosures and periodical reports and clarification are options to consider. Yet, this route has its own drawbacks: regulation does not necessarily achieve its initial goal, while the mechanism does cost taxpayer money. On top of that, current work suggests that regulation aimed to limit rating shopping could be unnecessary, as seasoned investors account for the artificially higher ratings (Kronlund (2011)). Regardless, this was the choice of action in Israel, passing the "Law to Regulate the Activity of Credit Rating Companies" in early 2014.[17]

A different solution that could resolve the core problem is resorting back to the old business model of the rating agencies—reverting to "investor pays" rather than "issuer pays" which is widespread today. As discussed in detail in White (2010), this model indeed incentivizes rating agencies to provide high quality analyses and abolishes rating shopping altogether. However, free riding

[17] Following the report of The Committee to Assess the Debt Restructuring Proceedings in Israel (2014), that found Israeli firms to enter debt restructuring at a relatively late stage, while spreads and financial ratios indicated distress much sooner.

then collapses the market, inhibiting its application nowadays. Nevertheless, even though there exists empirical evidence for rating shopping in Israel, suggesting that Midroog is systematically assigning higher ratings and those of Maalot are subsequently inflated, the distortion is estimated to be on the scale of a single rating notch (Bakalyar and Galil (2014)).

It should be noted that instances where there is substantial merit in ratings are possible and exceed the scope on this paper. These include, for example, the issuance of new debt or very illiquid markets or bonds, where either market prices do not exist at all, or are too slow to adjust ant reflect current information. In such cases, investors could be correct to rely on awarded ratings, as those do incorporate information on borrower creditworthiness.

5 Conclusion

The literature on the Israeli corporate credit market and credit rating agencies is fairly new and far from comprehensive, and its growth and expansion hold great importance and major policy implications regarding issues of moral hazard, incentive schemes and regulation of rating agencies and institutional investors. Specifically, corporate credit ratings and their quality have a direct impact on the welfare of the general, not financially savvy public, whose savings are invested in corporate bonds and subjected to regulation. One of the existing restrictions requires certain ratings to be attributed to a security and almost entirely prohibits institutional investors from holding non-investment-grade securities, disregarding yield spreads, financial indicators like Altman's z-score and other parameters and indices. On the one hand, and as far as the rated part of the market goes, I show that even though institutional investors comply with regulation and invest accordingly, it has little impact when 84% of rated defaulters (and 90% of rated debt) receive investment grade ratings just 12 months before insolvency. My results indicate that Israeli firms are attributed significantly higher ratings at every point in time prior to default; dropping 6.12 notches more than US firms, weighted by debt. When the correction finally comes, it happens at a later stage and more abruptly than it does in the US. Panel VAR estimations suggest ratings convey little value to the capital market, and prices (spreads) generally do not respond to changes in rating. On the other hand, this work tells us little about firms that decided not to be rated and raises questions about the factors that cause firms to self select this way. For example, the rated sample could be biased if the worst firms choose not to be rated and reveal their true nature, so we end up observing only the best performing ones. This story corresponds with an observed default rate of about 40% for non rated firms and roughly 18% for rated, where it could be argued that receiving any rating at all serves as a signal of higher quality and reduced probability of default.

There is much room left for further research, which should try to establish a stronger link between observable firm performance and ensuing financial distress. As for regulatory measures, I was not convinced that CRAs themselves

and their conduct require particular intervention. Instead, regulation should not tie the securities portfolio of institutional investors to arbitrary ratings that evidently hold little financial value. Until that happens, a current extension to this paper will focus on assessing the adverse effect of the aforementioned regulation. Explicitly, I estimate the effect of a drop below investment grade on bond and stock prices. Since institutional investors are forced to dump these securities, and undoubtedly adjust their portfolios in advance, I hypothesize a possible snowball effect on prices, the magnitude of which would vary greatly according to the aggregate share institutional investors hold.

References

Afik, Z., Feinstein, I., and Galil, K. (2014). The (un) informative value of credit rating announcements in small markets. *Journal of Financial Stability*, 14:66–80.

Ahearne, A. G., Griever, W. L., and Warnock, F. E. (2004). Information costs and home bias: an analysis of US holdings of foreign equities. *Journal of International Economics*, 62(2):313–336.

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance*, 23(4):589–609.

Altman, E. I. (2005). An emerging market credit scoring system for corporate bonds. *Emerging Markets Review*, 6(4):311–323.

Altman, E. I., Hartzell, J., and Peck, M. (1995). A scoring system for emerging market corporate debt. *Salomon Brothers*, 15.

Bakalyar, I. and Galil, K. (2014). Rating shopping and rating inflation in Israel. *International Review of Financial Analysis*.

Bar-Isaac, H. and Shapiro, J. (2011). Credit ratings accuracy and analyst incentives. *The American Economic Review*, 101(3):120–124.

Becker, B. and Milbourn, T. (2011). How did increased competition affect credit ratings? *Journal of Financial Economics*, 101(3):493–514.

Benmelech, E. and Dlugosz, J. (2010). The credit rating crisis. In *NBER Macroeconomics Annual 2009, Volume 24*, pages 161–207. University of Chicago Press.

Bester, H. (1994). The role of collateral in a model of debt renegotiation. *Journal of money, credit and banking*, pages 72–86.

Bolton, P., Freixas, X., and Shapiro, J. (2012). The credit ratings game. *The Journal of Finance*, 67(1):85–111.

Frenkel, S. (2013). Repeated interaction and rating inflation: A model of double reputation. *Available at SSRN 2188877*.

Goh, J. C. and Ederington, L. H. (1993). Is a bond rating downgrade bad news, good news, or no news for stockholders? *The Journal of Finance*, 48(5):2001–2008.

Hand, J. R., Holthausen, R. W., and Leftwich, R. W. (1992). The effect of bond rating agency announcements on bond and stock prices. *The Journal of Finance*, 47(2):733–752.

Kliger, D. and Sarig, O. (2000). The information value of bond ratings. *The journal of finance*, 55(6):2879–2902.

Kronlund, M. (2011). Best Face Forward: Does Rating Shopping Distort Observed Bond Ratings? *Unpublished working paper. University of Illinois, Urbana-Champaign*.

Love, I. and Zicchino, L. (2006). Financial development and dynamic investment behavior: Evidence from panel VAR. *The Quarterly Review of Economics and Finance*, 46(2):190–210.

Sangiorgi, F., Sokobin, J., and Spatt, C. (2009). Credit-rating shopping, selection and the equilibrium structure of ratings. *NBER Working Paper Series*.

Sasi-Brodesky, A. (2013). Assesing default risk of Israeli companies using a structural model. *Israel Economic Review*, 10(2):147–185.

Skreta, V. and Veldkamp, L. (2009). Ratings shopping and asset complexity: A theory of ratings inflation. *Journal of Monetary Economics*, 56(5):678–695.

White, L. J. (2010). Markets: The credit rating agencies. *The Journal of Economic Perspectives*, 24(2):211–226.

Table 1: Summary Statistics, Israel

	Defaulted		Rated		Inv. Grade		
	(1) Yes	(2) No	(3) Yes	(4) No	(5) Yes	(6) No	(7) All
Defaulted			0.141	0.311	0.124	0.570	0.222
			(0.348)	(0.463)	(0.330)	(0.496)	(0.416)
Business Group	0.177	0.249	0.388	0.0656	0.388	0.408	0.233
	(0.382)	(0.432)	(0.487)	(0.248)	(0.487)	(0.492)	(0.423)
Spread (pp)	23.64	6.998	6.675	15.04	5.268	43.27	10.70
	(47.38)	(14.69)	(15.50)	(34.49)	(8.304)	(57.61)	(26.74)
Rated	0.328	0.573					0.519
	(0.469)	(0.495)					(0.500)
Investment Grade	0.850	0.981	0.963				0.963
	(0.357)	(0.135)	(0.189)				(0.189)
Rating (local scale)	8.043	6.123	6.393		6.123	13.39	6.393
	(3.443)	(2.077)	(2.412)		(1.904)	(3.468)	(2.412)
Number of raters	0.366	0.577	1.023		1.026	0.948	0.530
	(0.563)	(0.620)	(0.472)		(0.470)	(0.515)	(0.614)
Z-score (Altman 95)	-0.182	1.479	1.463	0.758	1.605	-2.438	1.134
	(4.515)	(2.388)	(1.886)	(3.924)	(1.648)	(3.293)	(3.033)
Z-score (Ingber 94)	0.201	0.702	0.697	0.487	0.738	-0.451	0.600
	(1.146)	(0.748)	(0.622)	(1.076)	(0.568)	(0.907)	(0.868)
Working Capital /	0.0198	0.0762	0.0659	0.0617	0.0738	-0.155	0.0639
Total Assets	(2.569)	(1.375)	(0.197)	(2.462)	(0.185)	(0.336)	(1.709)
Retained Earnings /	-0.354	0.00904	0.0729	-0.225	0.0880	-0.337	-0.0707
Total Assets	(3.282)	(1.464)	(0.220)	(2.887)	(0.167)	(0.655)	(2.015)
EBIT / Total Assets	0.0197	0.0518	0.0521	0.0372	0.0577	-0.101	0.0451
	(0.548)	(0.147)	(0.0757)	(0.404)	(0.0616)	(0.185)	(0.282)
Market Value of	0.226	0.419	0.431	0.317	0.443	0.0969	0.377
Equity / Total Assets	(0.279)	(0.435)	(0.336)	(0.477)	(0.334)	(0.218)	(0.414)
Sales / Total Assets	0.275	0.266	0.246	0.293	0.245	0.287	0.268
	(1.396)	(0.417)	(0.485)	(0.955)	(0.413)	(1.444)	(0.743)
Debt Issued (ILS	0.392	0.590	0.907	0.157	0.923	0.501	0.546
Billion)	(0.774)	(1.102)	(1.284)	(0.430)	(1.295)	(0.834)	(1.041)
Market Value (ILS	0.402	0.538	0.844	0.145	0.860	0.409	0.507
Billion)	(0.802)	(1.077)	(1.284)	(0.383)	(1.297)	(0.785)	(1.024)
Daily Trade Volume	1.060	1.494	2.355	0.366	2.416	0.763	1.397
(ILS Million)	(2.861)	(3.976)	(4.624)	(2.073)	(4.687)	(1.852)	(3.761)
Duration	3.005	3.222	3.667	2.643	3.749	1.539	3.174
	(1.662)	(1.869)	(2.082)	(1.311)	(2.072)	(0.843)	(1.827)
Observations	4206	14704	9807	9103	9444	363	18910

mean coefficients; sd in parentheses

Table 2: Israeli defaults by year and industry, frequency

Industry	2008	2009	2010	2011	2012	2013	Total
Trade & Services	1	1	0	2	5	1	10
Real Estate	5	16	8	9	6	5	49
Manufacturing	0	4	1	0	1	1	7
Holding	1	3	2	6	4	2	18
Total	7	24	11	17	16	9	84

Table 3: Israeli defaulted debt by year and industry, ILS billion

Industry	2008	2009	2010	2011	2012	2013	Total
Trade & Services	0.0	0.1	0.0	0.2	0.5	0.6	1.5
Real Estate	0.8	9.4	0.7	2.2	0.8	3.9	17.7
Manufacturing	0.0	0.2	0.1	0.0	0.0	0.7	1.1
Holding	0.1	0.5	0.5	1.7	1.8	3.2	7.9
Total	0.9	10.2	1.3	4.2	3.0	8.4	28.1

Table 4: Rating development of US and Israeli defaulters

	US		Israel	
	(1) Simple average	(2) Debt weighted	(3) Simple average	(4) Debt weighted
Debt amount	2.74		0.72	
	(10.14)		(1.32)	
Last rating	19.06	19.43	15.92	18.10
	(2.12)	(2.57)	(5.02)	(4.85)
Rating at t-1	16.26	16.76	8.83	7.66
	(1.60)	(1.23)	(1.61)	(2.07)
Rating at t-3	15.54	15.27	6.64	6.20
	(2.09)	(1.50)	(1.28)	(0.79)
First rating	13.60	12.65	6.48	4.68
	(3.29)	(3.74)	(1.87)	(1.82)
t-1 to last	3.16	3.37	7.43	10.60
	(2.40)	(2.11)	(5.49)	(5.86)
t-3 to t-1	0.65	0.67	2.50	2.49
	(1.69)	(1.60)	(1.61)	(2.13)
First to t-3	1.90	1.89	0.64	0.78
	(2.85)	(3.52)	(1.28)	(1.39)
First to last	5.68	7.30	9.44	13.42
	(3.90)	(4.57)	(5.75)	(5.92)
Observations	440	391	25	25

mean coefficients; sd in parentheses

Note: Debt amount is in USD billion and ILS billion. Ratings levels are coded from 1 (AAA) to 26 (D).

Table 5: Implied probability of default by z-score category

	Low	Medium	High	Total
Insolvent	0	3	79	82
Solvent	21	40	146	207
Total	21	43	225	289

Note: Implied probability of default and actual outcomes. According to Altman et al. (1995), scores above 2.6 indicate a low risk of insolvency, while scores below 1.1 imply a high risk.

Table 6: PVAR estimation, spread as the dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
spread_{t-1}	1.267**	1.182***	1.259***	1.243***	1.255***	1.245***
	(0.449)	(0.200)	(0.175)	(0.171)	(0.169)	(0.167)
rating_{t-1}	-1.162	-0.743	-0.160	0.064	-0.190	0.057
	(1.478)	(0.877)	(0.245)	(0.298)	(0.236)	(0.297)
spread_{t-2}	-0.149	-0.171	-0.205	-0.202	-0.202	-0.201
	(0.132)	(0.091)	(0.129)	(0.128)	(0.126)	(0.126)
rating_{t-2}	0.346	0.445	0.402	0.181	0.382	0.138
	(0.386)	(0.338)	(0.211)	(0.267)	(0.211)	(0.269)
z-score_{t-1}		-0.531	-0.371		-0.391	
		(0.444)	(0.212)		(0.214)	
z-score_{t-2}		0.314	0.426*		0.388*	
		(0.277)	(0.201)		(0.196)	
Fixed effects	No	No	Yes	Yes	Yes	Yes
Z-score breakdown	No	No	No	Yes	No	Yes
Additional controls	No	No	No	No	Yes	Yes
N	9272	8516	8516	8297	8516	8297

b coefficients; se in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Fixed effects include time and industry controls, and a dummy for belonging to a business group; z-score breakdown replaces the variable with its 5 components; additional controls are bond duration, number of ratings received, trade volume, and number of transactions.

Table 7: PVAR estimation, rating as the dependent variable

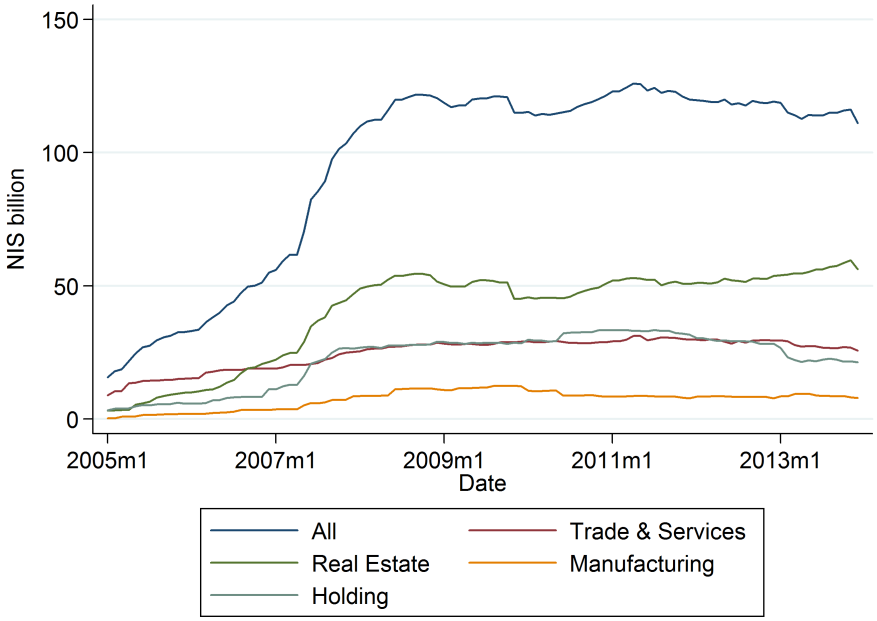
	(1)	(2)	(3)	(4)	(5)	(6)
spread_{t-1}	0.053	0.043*	0.032*	0.030*	0.030*	0.029*
	(0.031)	(0.020)	(0.016)	(0.015)	(0.015)	(0.014)
rating_{t-1}	0.767***	0.753***	0.876***	0.873***	0.870***	0.868***
	(0.123)	(0.115)	(0.070)	(0.070)	(0.070)	(0.070)
spread_{t-2}	-0.013	-0.015	-0.020	-0.019	-0.019	-0.019
	(0.009)	(0.009)	(0.012)	(0.011)	(0.011)	(0.011)
rating_{t-2}	0.020	0.019	0.052	0.045	0.053	0.044
	(0.062)	(0.067)	(0.062)	(0.062)	(0.062)	(0.062)
z-score_{t-1}		-0.132*	-0.062		-0.066	
		(0.061)	(0.036)		(0.036)	
z-score_{t-2}		0.007	0.050		0.048	
		(0.040)	(0.033)		(0.033)	
Fixed effects	No	No	Yes	Yes	Yes	Yes
Z-score breakdown	No	No	No	Yes	No	Yes
Additional controls	No	No	No	No	Yes	Yes
N	9272	8516	8516	8297	8516	8297

b coefficients; se in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

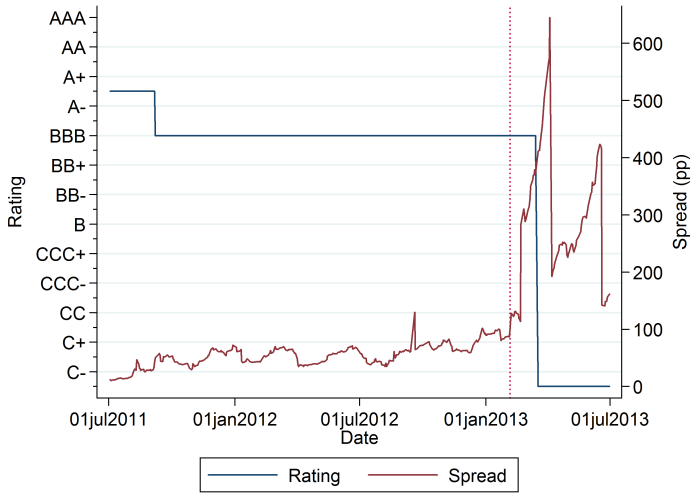
Note: Fixed effects include time and industry controls, and a dummy for belonging to a business group; z-score breakdown replaces the variable with its 5 components; additional controls are bond duration, number of ratings received, trade volume, and number of transactions.

Figure 1: Corporate debt breakdown by sectors



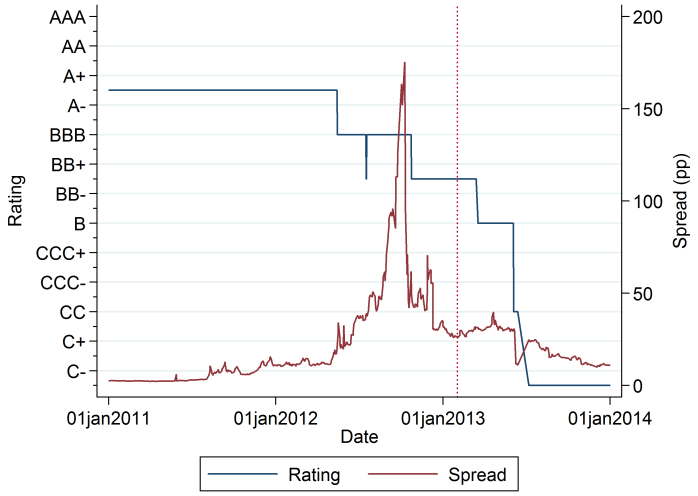
Note: Israeli issuers, 2005-2013.

Figure 2: Elbit Imaging Ltd.



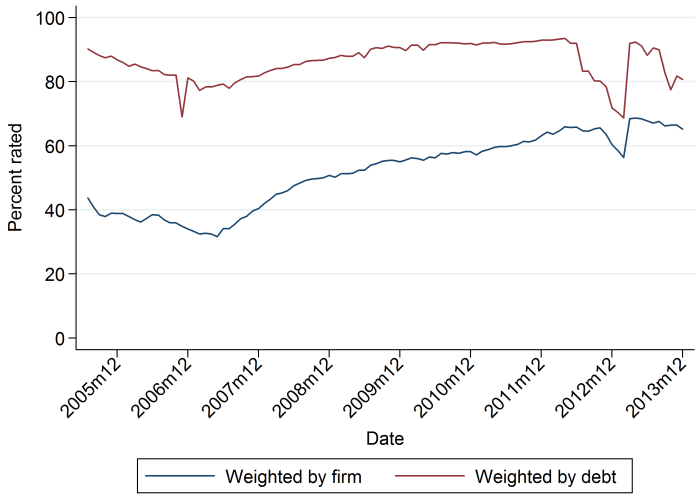
Note: Credit rating and yield spread, mid-2011 to mid-2013. The firm announced insolvency on Feb 5th 2013 (dotted line). By the time its rating was cut down below investment grade, its securities reached a yield spread of roughly 400pp.

Figure 3: IDB Development Corp.



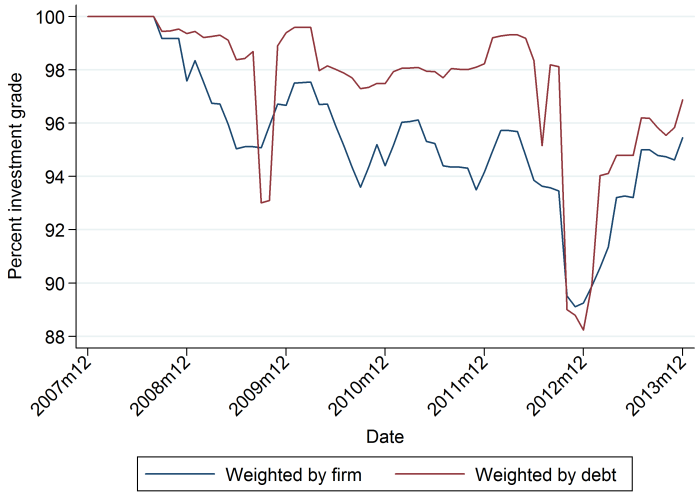
Note: Credit rating and yield spread, 2011-2013. The firm announced insolvency on Feb 1st 2013 (dotted line). Note that even after the firm had defaulted on its debt, it continued to be rated above D for roughly five additional months.

Figure 4: Percent Rated



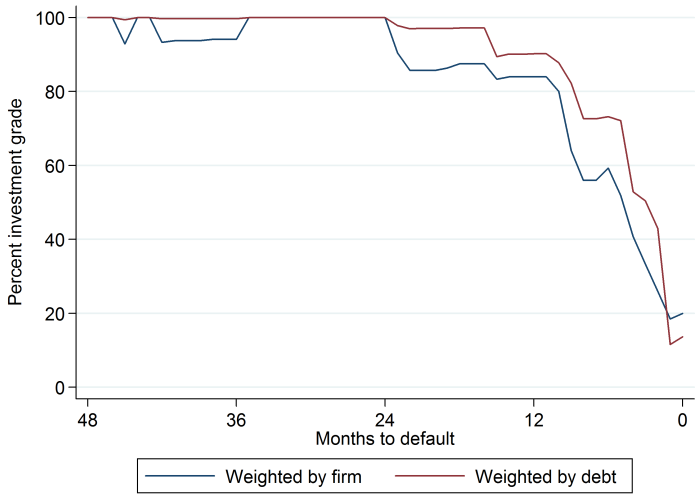
Note: Share of rated Israeli firms out of total firms.

Figure 5: Percent Investment Grade



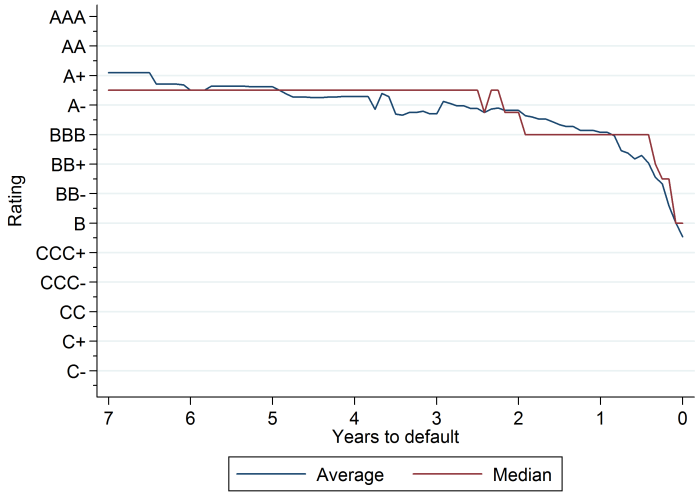
Note: Israeli firms rated BBB- and above, weighted by firm and debt, excluding financial sector, 2008-2013. Regulation states that institutional investors may only hold securities bearing this rating.

Figure 6: Percent Investment Grade - defaulters



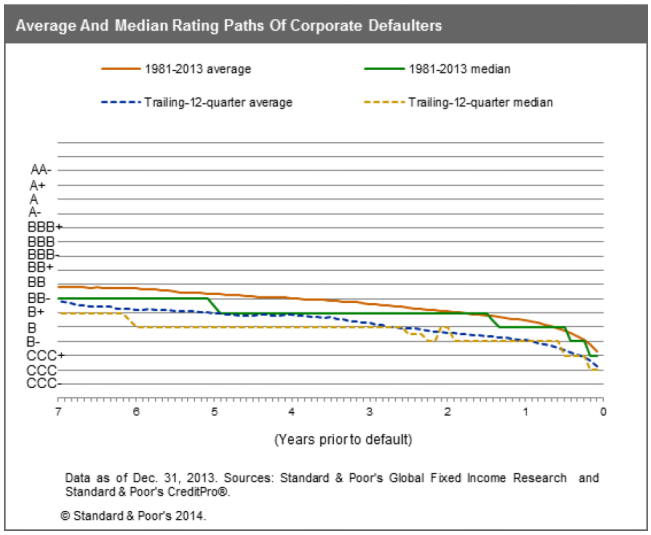
Note: Israeli defaulters rated BBB- and above, weighted by firm and debt, excluding financial sector, 2008-2013. Regulation states that institutional investors may only hold securities bearing this rating.

Figure 7: Average and median rating paths of Israeli corporate defaulters



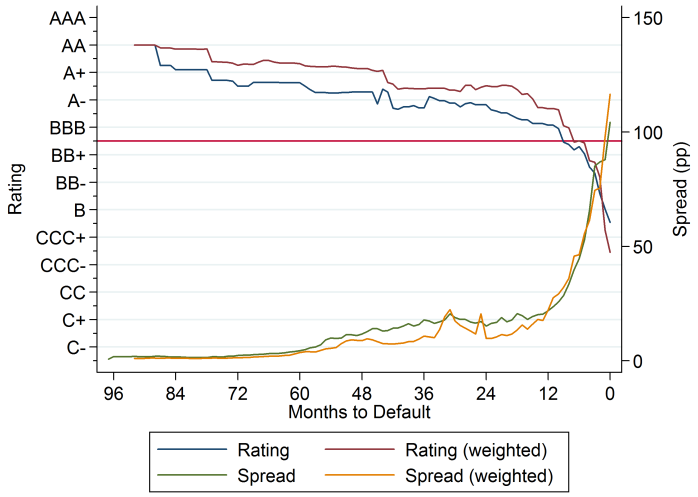
Note: Israeli rated defaulters, simple average and median, 2005-2013.

Figure 8: Average and median rating paths of US corporate defaulters



Note: US defaulters rated by S&P, simple and trailing average and median, 1981-2013.

Figure 9: Mean rating and spread

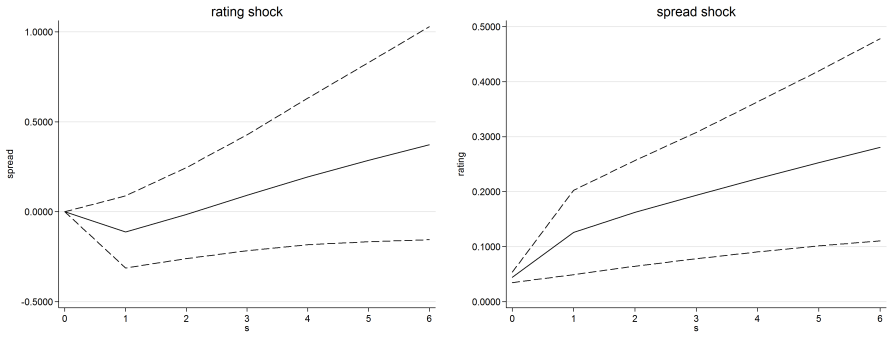


Note: Israeli defaulters, wighted by firm and debt, 2008-2013. Solid horizontal line indicates BBB- rating, the regulatory investment grade threshold.

Figure 10: Mean rating and z-score

Note: Israeli defaulters, wighted by firm and debt, 2008-2013. Solid horizontal line indicated the BBB- regulatory investment grade threshold. Dashed horizontal lines indicate the z-score thresholds featured in Altman et al. (1995): low risk of insolvency above 2.6, medium between 2.6 and 1.1, and high under 1.1.

Figure 11: Impulse-responses for 2 lag VAR of x controls rating spread



Note: 95% confidence interval generated by Monte-Carlo simulation with 10000 repetitions.