UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

DETERMINANTS OF RISK PREMIUMS ON CORPORATE BONDS ON THE SWEDISH MARKET

Bachelor Thesis in Industrial and Financial Management

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Abstract

The purpose of this thesis was to examine how investors acknowledge the four variables; earnings variability, period of solvency, equity/debt ratio and bonds outstanding to determine the risk premium on corporate bonds on the Swedish market.

In order to achieve this knowledge we performed a quantitative study based on regression analysis and a hypothesis of Professor Lawrence Fisher.

Our ambition was to replicate Fisher's theory in the best possible manner to achieve reliable and valid results. Unfortunately, the limited supply and the illiquidity of the Swedish corporate bond market affected the validity of our research.

The results of the study were inconclusive. According to our results, the investors on the Swedish market do acknowledge the length of time a company has been solvent and the amount of bonds outstanding of a firm when determining the risk premium of corporate bonds. Our study does not prove, on a significant level, that the earnings variability of a firm and the equity/debt ratio of a firm are relevant for determining the risk premium on a company's bonds.

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1 Introduction

1.2 Background

A well-run company is always looking to take on new positive NPV projects, in order to retain and hopefully increase their market shares. To do this, the company will need capital to invest into new machinery and production facilities as well as human resources. Companies with high market shares in slow-growing industries, so called cash cows in the Boston Box created by Bruce Henderson in 1970, might be able to generate enough cash flow to support all the necessary investments and pay dividend to their shareholders (Baines, Fill & Page, 2011). However, fast-growing companies will rarely be able to generate enough capital through their sales alone to support all their investments when they are trying to expand their businesses.

The fast-growing company will then have to turn to the financial markets in order to raise capital. This can be done either by issuing stock or by issuing debt. When issuing stock to the public, the shares of the current owners will be diluted unless they defend their shares by investing their own personal capital. Seeing as we have defined these companies as fast-growing, it is likely that the board members will find the company to be undervalued, since they have more information than the average investor. If the company is undervalued, so is its stock and it is therefore expensive to finance investments through issuing of stock. If this is the case, it is preferable to issue debt (Berk &Demarzo, 2011).

1.3 Corporate Bonds

On the Swedish market, the corporations have historically relied on bank debt financing, rather than public debt financing, and this is still the case today. Public debt, i.e. corporate bonds, only contributed to eighteen percent of the total outstanding debt of Swedish corporations in the start of 2011 (Gunnarsdottir & Lind, 2011).

Corporate bonds are debt security instruments that are used by companies to accumulate public debt, the capitals by which private firms borrow money directly from the public. They are considered higher risk than government bonds and as a result, coupon rates are higher (Bodie et al, 2000).

Corporate bonds can be compared to Treasury notes because they typically pay semi-annual or quarter-annual coupons over their lives and return the face value to the bondholder at maturity. They do however, differ from Treasury bonds in degree of risk and default risk (Chorafas, 2005).

Corporate bond contracts sometimes come with options attached. Callable bonds give the firm the option to repurchase the bond from the holder at a stipulated call price. Convertible bonds give the bondholder the option to convert each bond into a stipulated number of shares of stock. In these two examples, the former will require a higher coupon rate than a plain vanilla bond as the issuer has an option that he is willing to pay a premium for. In the latter, the bondholder is the one with the valuable option and for this reason the premium will be lower than for that of a plain vanilla bond (Chorafas, 2005).

There are different organizations that rate the companies who issue bonds, and the two most well know are Moody's Investors Service and Standard & Poor's Corporation. Rating service providers all have their own ranking system, for example, S&P uses AAA as the highest attainable ranking. If a company has obtained an AAA rating, this signals to the market that the company is highly likely to be able to pay interest and to repay the principal on an outstanding bond. S&P's lowest ranking is D, which indicates that the corporation's bonds are in default, and payments are in debts (Miller, 2001).

The corporate bond market can be a difficult task for individual investors, because investors with smaller portfolios may not be able to access professional management and may not have the expertise or ability to invest in individual bonds. It is difficult because it often requires a large amount of money. For these investors, funds can be the best option for investing in the corporate bond market (Sveriges Riksbank, 2012).

There are approximately a hundred corporate bonds listed at the NASDAQ OMX Nordic Stockholm, and as Louis Landeman claims in an article in *Dow Jones NewsPlus: North American Equities*, the Swedish corporate bond market looks set to grow even further.

1.3.1 Historical Background

In the past, the Swedish market for corporate bonds has been distinguished for its illiquidity and the difficulty to retrieve market information. From late 1980's until late 1990's the corporate bond market experienced relatively low growth (Oxelheim, 1996).

A problem on the corporate side has been the restricting minimum value of bonds issued for companies to enter the bond market. The minimum amount for entry on the Swedish bond market has been from 250 million – 500 million SEK (Gunnarsdottir & Lind, 2011), and this made it impossible for small-sized and most mid-sized companies to issue bonds because they do not need and cannot handle those amounts of debt.

After the IT bubble in 2001, when the economy had recovered, the banks started lending out more and more money to corporations all around the world. Like many times before, personal interests and bonuses rather than risk acknowledgement influenced the lending of capital. It was all about the moment and no consideration to what might come one day, when there is a shift in the economic state.

In 2008 the lending and subprime lending peaked and when people started defaulting on their mortgage payments, a downward spiral started. Before the financial crisis the Icelandic banking sector balance sheet total peaked at a level of ten times the Icelandic GDP. This can be compared to the level of the banks of Cyprus which had a balance sheet total that equaled nine times the Cypriot GDP before the collapse in early 2013 (Di.se, *Cypern har lämnat förslag till lösning,* 2013-03-22). When Lehman Brothers, the fourth largest investment bank in the US, declared bankruptcy in September 2008, the recession was a fact.

As an effect of the economic crisis in 2008/2009 the companies in Sweden have increasingly begun to use bonds as an alternative source of funding. This is partly because many of the loans Swedish and external banks gave to the companies before the crisis matured in 2011/2012. In addition, bank loans generally became more expensive after the crisis, partly due to new capital requirements for banks (Sveriges Riksbank, 2012).

To prevent financial meltdowns further down the road, the Basel Committee on Banking Supervision introduced the Third Basel Accord (Basel III) in 2010. Basel III is a global banking regulation standard that intends to strengthen the liquidity and leverage of banks worldwide (Basel Committee on Banking Supervision, 2010).

In an interview, from April 13th 2012, for the *Dow Jones NewsPlus: North American Equities*, Danske Bank's head of credit analysis in Sweden, Louis Landeman said; "Compared with the crisis-struck euro zone, companies in Sweden still have decent access to bank funding, but it has become harder for smaller firms and capital-intensive businesses such as property groups to get loans."

On December 10th 2012, NASDAQ OMX launched their new corporate bonds market, First North Bond Market. This market is different in the fact that its regulations are adapted to fit small and mid-sized businesses and they are able to turn to both private investors and institutions. This is a welcome contribution to the Swedish corporate bond market.

1.4 Problem Discussion

Corporations will always require capital in order to grow, and when the banks' lending policies became stricter, the corporations had to look for alternative financial options. This is one of the reasons why issuing bonds has become a more frequent form of funding for corporations in Sweden and Europe in the recent years.

On the investor side there has been a problem with illiquidity on the secondary market causing corporate bondholders to hold their bonds until expiration (Riksbanken, 2012), since they will not be able to sell their bonds at a fair prices. This of course makes investing in corporate bonds less attractive as the bonds are hard to sell at a reasonable price, because the market does not function properly.

It is difficult for investors to assess the credit risk of the medium-sized Swedish companies that issue bonds and to know if the company is able to meet its financial obligations on time but yet over the past year, several medium-sized Swedish companies have chosen more and more to issue bonds as a means of financing their investments. As a more diverse selection of companies are issuing bonds, and not just the blue chip companies, it is interesting to investigate how investors assess period of solvency, earnings variability and financial structure in the underlying when purchasing corporate bonds.

With more corporations issuing bonds, the investment alternatives for investors increase and it also increases the liquidity on the secondary market as more and more investors open their eyes to corporate bonds and corporate bond funds. In turn, higher liquidity increases the attractiveness of corporate bonds as an investment alternative for investors, or at least it should in theory. Therefore, we find it relevant to examine if the amount of bonds issued by a company influences investors.

Louis Landeman said in the *Dow Jones NewsPlus: North American Equities* that; "Because of the volatility on stock markets and low yields on government bonds, the demand for corporate bonds is also on the rise."

This quote was the foundation for our problem discussion. It made us wonder if this way of thinking made sense, seeing how unstable the situation on the European financial market is these days, and with record low interest rates. As the interest rates being close to zero, the interest rate can either remain at the same level or increase. An increase in interest rates decreases the value of bonds as it implies less effective return on the bonds' coupons (Chorafas, 2005). Landeman's statement also led us to the question; how do the lenders estimate the risk of corporate bonds?

In our search for literature on Google Scholar, we came across a study written by Professor Lawrence Fisher (*Determinants of Risk Premiums on Corporate Bonds*, 1959) which was one of the most referenced studies on the topic of risk premiums on corporate bonds.

Economists have long agreed that the rate of interest on a loan depends on the risk the lender incurs. This thesis presents and tests a theory that was made by Professor Fisher about determinants of risk premiums on corporate bonds.

Fisher hypothesis is as follows: "The average risk premium on a firm's bonds depends first on the risk that the firm will default on its bonds and second on their marketability." Fisher suggested further: "The risk of default can be estimated by a function of three variables: the coefficient of variation of the firm's net income over the last nine years (after all charges and taxes), the length of time the firm has been operating without forcing its creditors to take a loss, and the ratio of the market value of equity in the firm to the par value of the firms debt. The marketability of a firms bond can be estimated by a single variable, the market value of all the publicly traded bonds the firm has outstanding."

Mathematically, his theory is stated as

$$x_0 = f\ (x_1, x_2, x_3, x_4)$$

where, the risk premium, x_0, is a function of the firms; earnings variability, x_1, period of solvency, x_2, equity/debt ratio, x_3, and bonds outstanding, x_4.

Fisher applied his theory on the American market in the late fifties and we thought that it would be interesting to replicate his theory on the Swedish market, to investigate how the investors on the Swedish corporate bond market determine the risk premiums in present time.

1.5 Purpose

The purpose of this thesis is to examine how investors acknowledge the four variables; earnings variability, period of solvency, equity/debt ratio and bonds outstanding to determine the risk premium on corporate bonds on the Swedish market.

2 Research Method

2.1 Determining Method

After deciding on a topic and purpose for our thesis we determined an accurate way of how to address the problem. Our approach was to apply an existing theory made by Lawrence Fisher and increase the understanding and knowledge of determinants of risk premiums on corporate bonds. Fisher's theory is a quantitative theory that uses log linear regression and it is dependent on secondary data. Our goal is to replicate Fischer's approach at the best of our ability and applying it on the Swedish market. Therefore, our study will also be of quantitative nature and no primary data will be required.

2.2 Quantitative Techniques

The research was well suited for a quantitative research because the main area was to estimate the logarithm of the risk premium on a firm's bonds, and it can be estimated by a linear function of the logarithm of the four variables mentioned earlier. Quantitative research is explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (Aliaga and Gunderson 2000).

2.3 Litterateur Review

Our research started out by using keywords to search the available databases at the Economics Library of Gothenburg University. The databases used were primarily; GUNDA, Libris, SUMMON, and Business Source Premier. Through Google Scholar, we were able to find previously written theses, relevant to our study. It was here we came across Professor Lawrence Fisher's thesis on the Determinants of Risk Premiums on Corporate Bonds. The advantage of using Google Scholar was that it lets the researcher know how many times a thesis has been referenced, and therefore a hint on its reliability on the subject. Fisher's thesis was the second most referred thesis on the subject of "risk premiums". Another way of finding the relevant sources on the topic was to examine which authors had been referenced in related theses.

2.4 Data Collection

2.4.1 Sample Selection

As we previously explained in our introduction, the Swedish market for corporate bonds is limited in regards of supply which came to affect our sample size. In order to find the corporations who issue bonds on the Swedish market we used NASDAQ OMX Nordic's internet site, where we were able to find a list of all the Swedish corporate bonds listed at their market.

When Fisher preformed his study on the American market, he included only industrial corporations, which he defined as "all types of corporations except public utilities, transportation companies, financial institutions, governments, or corporations not incorporated for profit".

A lot of the corporations who issue bonds on the Swedish market are either financial institutions or government related. After the screening process, a sample of thirty-four issuing companies remained and, for reasons we will explain later on, only twenty-nine of those companies could be used in our study.

2.4.2 Finding Earnings Variability, x_1

The coefficient of variation of earnings, or simply the earnings variability, is calculated by dividing the standard deviation of a company's earnings with its expected return. An estimation of a company's expected return can be the mean of its earnings in previous years (Fisher, 1959). Fisher states that there is probably possible to find more accurate estimations on a company's expected earnings than the arithmetic mean of its previous earnings. But this was how he calculated his variable and, therefore, it is also the way we addressed the issue.

The standard deviation of earnings was derived from a sample of nine years counting back from December 31st 2012. This value was then divided by the arithmetic mean of the earnings for these years to reach our variable, x_1. All the required secondary data for this procedure was extracted from Bloomberg's database.

Of our sample of thirty-four companies, five had to be excluded from the study. This because their earnings variability had a negative value and the logarithm of negative values is undefined.

2.4.3 Finding Period of Solvency, x_2

Fisher defined the period of solvency, expressed in years, as "the length of time since the latest of the following events had occurred: The firm was founded; the firm emerged from bankruptcy; or a compromise was made in which creditors settled for less than 100 percent of their claims."

In our search for the length of time the companies had been able to remain solvent, we tried using Bloomberg's database to accurately find our variable according to Fisher's definition. It soon became clear to us that this was a difficult task and we quickly changed strategy. Instead of using Bloomberg, we contacted each of the companies by phone and requested the information we needed. All but five of the companies in our sample provided us with the information we needed. Of the cooperating twenty-nine companies, twenty-eight claimed that the company had been solvent since it was founded, and only one said that there had been a restructure of the company's debt in which creditors had taken a loss. This was in April 2013 and, hence, not relevant to our data collection. Since this was the case, all the responding companies had to be treated as if their period of solvency was the length of time since the company was founded.

Because of our small sample size, we decided to treat the remaining five firm's period of solvency as the time since the firms were founded after having searched Bloomberg's database in order to see if we could prove otherwise.

2.4.4 Finding Equity/Debt Ratio, x_3

We used Bloomberg's database to find the required information for the firm's capital structure. The values of interest were; the market value of the companies' equity and the par value of their total debt. In the market value of the companies' equity, both common and preferred stock were accounted for. For the par value of debt we used the total debt of the companies. The equity and debt values used were the values at December 31st 2012. Our variable, x_3, was then calculated as the market value of the company's equity over the par value of its debt.

2.4.5 Finding Bonds Outstanding, x_4

The total market value of the amount of bonds outstanding of our sample firms was found in the Bloomberg database for December 31st 2012. Our variable will be expressed in millions of SEK.

2.4.6 Finding Risk Premium, x_0

The risk premium, our responding variable expressed as x_0, was defined as the difference between the market yield on a bond and the corresponding pure rate of interest. On the Swedish corporate bond market, a large majority of the bonds are presented as floats which mean that they are based on a floating risk free interest rate, usually the 3-month STIBOR, plus a premium. When the bonds are issued, this premium is the risk premium of the bond. Dependent on the time to the next coupon payment and as the price of the bond changes on the market due to expectations on the underlying, the yield to maturity will change and therefore the risk premium as well.

The yield of the bonds were calculated by adjusting the coupon rate for the current price of the bonds, using the "last" price for the bonds at December 31st 2012, and taking into account the time passed since the last coupon payment. The corresponding risk free rate of interest was then subtracted to determine the risk premium. For consistency we used the 3-month STIBOR as the risk free interest rate for the whole sample.

For the bonds that had not been traded since they were issued, we had to assume that they were worth 100 percent of the face value when we calculated the risk premium. We will discuss this issue further in our analysis section.

2.4.7 Preparing the Data for Linear Least Squares Regression

After we had gathered all the necessary secondary data we needed in order to conduct our research, the data was in the form that we expected to be able to demonstrate a significant relationship of a multiplicative function of the earnings variability, period of solvency, equity/debt ratio, and bonds outstanding to the risk premium of the bonds.

We assembled all the data (Appendix 1) in Microsoft Excel, as it is an easy tool for database construction. To be able to perform a linear least squares regression all of our variables had to be logarithmic so that, $X_i = \log(x_i)$. After the transformation, the variables were suitable for linear least squares regression which was completed in SPSS.

2.5 Reliability and Validity

Whether one is undertaking a research study or investigating someone else's theory, as in our case, determining the impact of the results depends on both reliability and validity. A study can be both reliable and valid, either of the two but not the other, or neither reliable or valid.

In a quantitative research, the reliability is the measurement of the ability of a test to yield the same results if tested over and over again. If an experiment can be performed several times without significantly differing results, then the experiment is assumed to be reliable.

Validity is the ability of a test, or a theory, to accurately measure what it is supposed to measure. When conducting a study, the study is valid if it can answer the questions it set out to answer (Bryman & Bell, 2005).

3 Fischer's Method

3.1 Regression Analysis

Regression analysis is fitting an equation to a given set of data in order to judge the strength of relationships between variables, and it provides a way of empirically identifying how different variables affect another variable. The linear least squares regression is the most widely used of any statistical data. However, as the name suggests, it is only a valid form of regression for linear functions. A way of transforming a multiplicative function of the Cobb-Douglas model

$$y = A \prod_{j=1}^{k} x_j^{\beta_j}$$

to a linear function, is by taking logs of both sides, transforming the equation to

$$\log(y) = \beta_0 + \sum_{j=1}^{k} \beta_j \log(x_j)$$

where, $\beta_0 = \log(A)$. If an appropriate error term is added, the function can be estimated by linear least squares regression (Sen & Srivastava, 1990). Logarithmic regression coefficients are estimates of elasticities.

3.2 Fisher's Hypothesis

According to Fisher, the risk a lender incurs when holding a bond can be divided into; the risk that the underlying firm will default and the risk associated with not being able to turn the security into cash before it matures i.e. its marketability.

Professor Fisher's hypothesis assumes that the risk of default can be estimated by a company's earnings variability, period of solvency, and equity/debt ratio. The variable he used to describe marketability was the market value of the total amount of bonds outstanding of a firm.

Fisher wanted to examine how these four variables relate to the observed risk premiums on corporate bonds on the American market using linear least squares regression. The variables are however influenced by each other. For instance, the risk of default for a firm with a very high equity/debt ratio might be small even though it has very unstable earnings. Because for its debtors to take a loss, if the business becomes unprofitable, the resale value of the firm's assets would have to be a small fraction of the present value of the firm as a going concern. On the other hand, if a firm has a low equity/debt ratio, the bondholders are likely to take a loss even if the earnings vary little (Fisher, 1959).

Since the influence of one variable depends on the magnitudes of the other variables, a Cobb-Douglas function is appropriate. The equation is

$$x_0 = Ax_1^{\beta_1}x_2^{\beta_2}x_3^{\beta_3}x_4^{\beta_4}$$

and it can be transformed to a linear function by taking logs of both sides, giving

$$X_0 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

where, $X_i = \log(x_i)$ and $\beta_0 = \log(A)$.

3.3 Risk Premium, x_0

The riskiness of a corporate bond is reflected by the risk premium, that is, the market yield of a bond less the corresponding pure rate of interest. It is the investors who determine the risk premium on a bond by what they are willing to pay for it. If a bond is sold for more than 100 percent it means that the investors believe that the riskiness of the bond has decreased. The risk premium will then be less because the yield to maturity will be affected by the price of the bond (Fisher, 1959).

3.4 Earnings variability, x_1

Fisher's study suggests that a series of observations of a firm's net income may be treated as a random sample from a normally distributed population of potential annual net incomes. A firm with a small coefficient of variation of earnings is less likely to default on its bonds than a firm with a large coefficient of variation of earnings.

The hypothesis says that the investors believe that, bonds issued by a firm whose earnings have varied a lot are riskier compared to bonds issued by a firm whose earnings have varied little in the past. To be able to test the hypothesis, earnings data for the different firms must be compared to each other. If the risk premium varies with the coefficient of variation in earnings we want to measure the elasticity of risk premium with respect to this measure of the risk of default (Fisher, 1959).

Fisher used Moody's Manual for his secondary data on earnings. Moody's Manual gave data on earnings after tax for more companies than earnings before tax, and therefore the earnings variability was calculated using net income. Data was covered for the previous nine years as this was a long enough time for the earnings to fluctuate substantially (Fisher, 1959).

3.5 Period of solvency, x_2

The length of time a company has been solvent i.e. the length of time a firm has been able to make its obligations to its debt holders should provide an important factor for how reliable a firm is to pay its debt holders in the future (Fisher, 1959).

For example, if a firm was founded five years ago or it emerged from bankruptcy at this time, the firm might be able to show good results and remain solvent without any problems. However, when the period of solvency is only five years, the role of chance might play an important role as the economy might have been booming during these years, allowing companies in all industries to flourish.

If a company has met its obligations for a hundred years straight, it has proven that it can survive in a good economic climate as well as a poor economic climate seeing as it has remained solvent for many economic cycles. When a company has been able to remain solvent for a hundred years straight, even though the company might have been lucky in its first years, the role of chance should be infinitesimally small.

The length of time a company has been able to meet its obligations to its debtors, x_2, was defined as the latest of the following occurrences:

The company was founded;

The company was unable to repay its debtors in full, but a compromise was made in which the creditors received less than a hundred percent of their claims; and

The company emerged from bankruptcy.

3.6 Equity/Debt Ratio, x_3

The corporate bondholders will be interested in learning about a firm's capital structure in order to know how much the firm's assets can decline in value before the firm becomes insolvent. The measure of this factor used in Fisher's study, is the ratio of the market value of the firm's equity to the par value of its debts. The more leverage in a firm, the riskier the asset and this should lead to investors demanding a higher risk premium on their bonds if the underlying is highly geared.

3.7 Bonds outstanding, x_4

Up till now we have focused on the determinants of the risk of default of a firm. The other type of risk an investor incurs by holding a corporate bond is not being able to turn the bond into cash before it matures. How difficult this is depends on how frequently the bond is traded and the spread between the "bid" and "ask" prices.

If the security market is perfect, there will not be a problem turning a bond into cash, as a perfect market implies that there are no transaction costs and there is always another investor willing to purchase the bond for its actual value (Berk & Demarzo).

If the bonds are rarely traded, as is the case on the Swedish market, then the spread between the "bid and "ask" prices will be large and the bondholder will have a hard time receiving its full worth in cash before it matures. If this is the case, then the bondholder will require a higher premium.

How can an investor estimate the market imperfection for a particular security? As we discussed earlier, a good measure for the imperfection would be to study the spread between the “bid” and “ask” prices and see how this spread varies over a period of time. Fisher considered this measure in his thesis, but was unable to use this as his variable of marketability due to the fact that he was examining both listed and unlisted bonds. Instead he chose the amount of bonds outstanding of a firm as the variable of marketability, $\boldsymbol{x_4}$.

According to Fisher the amount of bonds outstanding is a good measure of the market imperfection for a particular bond because, other things equal, the smaller the amount of bonds outstanding of a firm, the less frequently a trade of the bonds will occur. The less frequently a trade occurs, the thinner the market and the thinner the market, the more uncertainty about the actual price of the instrument.

4 Results

Exhibit 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	,713[a]	,508	,426	,26190

a. Predictors: (Constant), X4, X3, X1, X2

Exhibit 1 presents a summary of the outcome of our regression.

The most relevant information contained in Exhibit 1 is the coefficient of determination, R^2, which is a measure of how much of the variation in the dependent variable can be explained by the independent variables (Sen & Srivastava, 1990). The coefficient of determination for our regression is 0,508 which means that the independent variables X_1, X_2, X_3, and X_4 can explain 50,8 percent of the change in X_0. A result of an R^2 of 0,508 is a clear indicator that there exists more predictor variables, than those examined, that explain the dependent variable.

Exhibit 2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,698	4	,424	6,188	,001[b]
	Residual	1,646	24	,069		
	Total	3,344	28			

a. Dependent Variable: X0

b. Predictors: (Constant), X4, X3, X1, X2

Exhibit 2 shows the results of the analysis of variation.

The information we are looking for in Exhibit 2 is if our function of the four predictors has a significant relationship with the dependent variable. It clearly shows that there is a significant relationship between at least one, but likely more than one and possibly all, of our predictor variables to the responding variable (Sen & Srivastava, 1990).

Exhibit 3

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,628	,352		4,619	,000
	X1	,119	,144	,128	,824	,418
	X2	-,341	,127	-,426	-2,691	,013
	X3	-,060	,129	-,071	-,462	,648
	X4	-,243	,107	-,360	-2,270	,032

a. Dependent Variable: X0

Exhibit 3 shows the best approximation of our four independent variables to the dependent variable, X_0.

Exhibit 3 gives us the elasticities for the independent variables that produce the best linear approximation of the dependent variable. It also lets us know which of the variables' elasticities are significantly different from zero. We can see that the variables X_2 and X_4 are significantly different from zero on a 5 percent level, whereas X_1 and X_3 are not. The best approximation of X_0 using our predictor variables X_1, X_2, X_3, and X_4 is:

$$X_0 = 1{,}628 + 0{,}119X_1 - 0{,}341X_2 - 0{,}060X_3 - 0{,}243X_4$$

Figure 1

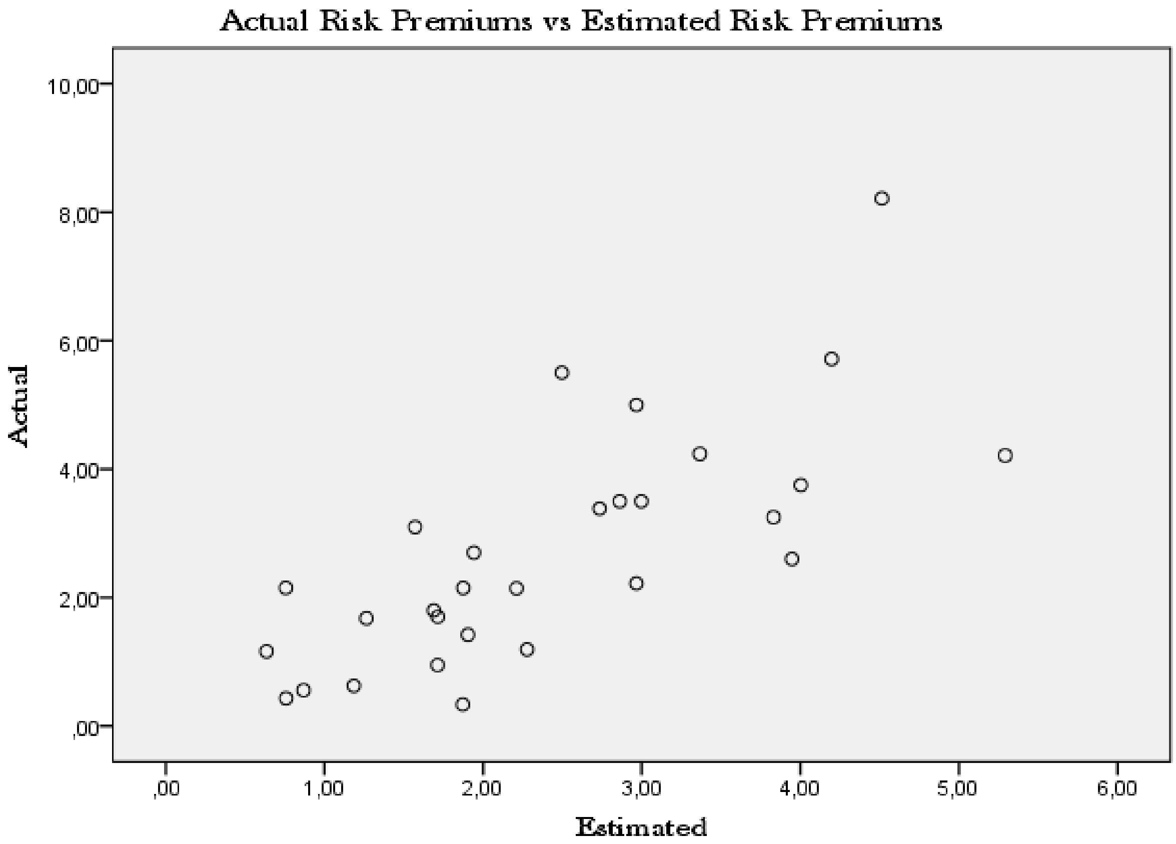

Fig. 1. - Scatter of actual risk premiums against estimated risk premiums calculated as a multiplicative Cobb-Douglas function.

Figure 1 is a scatter that plots the actual risk premiums against the estimated risk premiums calculated as a multiplicative function using the elasticities found in Exhibit 3. The estimated risk premiums are calculated by the function:

$$Estimated\ Risk\ Premium = 1{,}628x_1^{0{,}119}x_2^{-0{,}341}x_3^{-0{,}060}x_4^{-0{,}243}$$

5 Analysis

Going into this study we had certain expectations on the outcome. We expected that a greater coefficient of variation of earnings would yield a larger risk premium, as it means that the underlying is less stable. We therefore expected the elasticity of X_1 to be a positive value. For our variable x_2, the length of time since a company's debt holders had taken a loss, if ever, we anticipated that if the period of solvency was longer, then the required risk premium would be lower as this would be a sign of stability in a firm. Likewise, a higher equity/debt ratio was predicted to result in investors settling for a lower yield and therefore lower risk premium. This because the investors are less likely to take a big loss in case the firm becomes unprofitable and for that reason we expected a negative value for the elasticity of X_3.

For our measure of marketability, bonds outstanding, x_4, we were uncertain what to expect, as the liquidity on the Swedish market for corporate bonds is so poor that most investors hold their bonds until maturity (Sveriges Riksbank, 2012). Because of this situation we were not even sure if there would be any relation between the amount of bonds outstanding of a firm and the risk premium on its bonds. We did however, assume that the investors would demand a higher risk premium in general due to the illiquidity on the Swedish market. Since a larger amount of bonds outstanding is only likely to let the bonds change hands more frequently and therefore to some extent increase the liquidity, we thought it would be probable with a positive value of the elasticity of X_4 even though we thought the value would be small.

All of the elasticities, which were computed in the linear least squares regression analysis, have the expected sign. This information points towards, that there is a relevant relationship between the risk premium of corporate bonds and the independent variables which we have examined. However, only two of the elasticities are significantly different from zero.

The results, displayed in Exhibit 3, demonstrate that there is a significant relationship between the risk premium and our variables "period of solvency", x_2, and "bonds outstanding", x_4. The results do, however, not show that the remaining independent variables “earnings variability”, x_1, and “equity/debt ratio”, x_3, are significant when investors estimate the risk premium of corporate bonds on the Swedish market.

We had expected to find that all of the independent variables would be significant to investors when estimating the risk premium of corporate bonds, partly since these are the results that Fisher’s study on the American market showed and also because this is what common sense would let us believe.

There are two possible explanations for why our results turned out the way they did: (1) the Swedish investors do not consider the earnings variability of a firm or the equity/debt ratio when entering into a corporate bond contract, or (2) there is a problem with either the reliability or the validity of our research or possibly even both.

Of these two possible explanations, the latter seems far more likely than the former, and we are almost positive that we have identified the flaw in our study that causes our results to differ from those of Professor Fisher.

We encountered a big problem related to the illiquidity on the Swedish market when we were trying to calculate the risk premium for several of the examined bonds. About half of the bonds in our sample had never been traded since they were issued, and for those bonds no “last”, “bid”, or even “ask” price was available. Because there was no price on the bonds, we had to assume that the price of the bonds were 100 percent of the face value of the bonds. As we had to make this assumption, it affected our calculation of the risk premium for some of the bonds in the sample, and they are therefore only assumed risk premiums rather than the actual observed risk premiums.

If the underlying population of bonds had been greater, the fact that some of the bonds were without a price would not have been a problem. They would simply have been excluded from the sample of our study, as we would have had a sufficiently large sample anyways. Unfortunately, our sample size was merely twenty-nine corporate bonds and therefore we were unable to exclude the bonds without a price if we wanted to conduct the study, as the sample would have been too small otherwise.

Our decision to include the bonds without a price in the study did of course affect the validity of our research in a negative way. Rather than examining the relationship of our four independent variables to the observed actual risk premium, we instead examined their relationship to an assumed risk premium for some of the bonds.

Of the dependent variables, only the period of solvency is of questionable reliability. Partly because we made an assumption about five of the companies that they had been solvent ever since they were founded. The other reason is that we had to rely on information given to us by people working at the companies. Though we did, for the most part, speak to representatives of high positions in the companies, usually the CFO or sometimes even the Vice President, there is always a risk of these individuals to be ignorant of the information we sought or possibly even biased in their responses.

6 Conclusions

This study examines if the hypothesis of the well cited article of Professor Lawrence Fisher can be applied to determine the risk premiums on corporate bonds on the Swedish corporate bond market. The hypothesis is that the risk premiums on corporate bonds can be determined by the four variables; “earnings variability”, “period of solvency”, “equity/debt ratio”, and “bonds outstanding”.

The results we found are somewhat inconclusive. All of the coefficients extracted from the regression analysis had the expected signs, and we found a significant relationship between the risk premium and the length of time a company had been solvent and also between the risk premium and the amount of bonds outstanding of a firm. It could not be proven on a significant level that investors acknowledge the earnings variability and the equity/debt ratio when determining the risk premium of corporate bonds on the Swedish market.

The illiquidity and the limited amount of bonds on the Swedish corporate bond market prevented us from finding valid data to determine the observed risk premiums and this in turn affected the validity of the entire study.

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Appendix 1

Risk Premium, x0	Earnings Variability, x1	Period of Solvency, x2	Equity/Debt ratio, x3	Bonds Outstanding, x4		X0=log(x0)	X1=log(x1)	X2=log(x3)	X3=log(x3)	X4=log(x4)
5	-34,48936828	6	0,399512068	350		0,698970004	#NUM!	0,77815125	-0,398470097	2,544068044
8,712	-0,8629354	7,75	2,186381908	3519		0,940117867	#NUM!	0,889301703	0,339726025	3,546419267
2,6	0,705120352	12	0,553615626	525		0,414973348	-0,15173675	1,079181246	-0,25679166	2,720159303
0,95	0,747326002	82	1,954565943	829		-0,022276395	-0,126489907	1,913813852	0,291050327	2,918554531
3,25	0,60996323	19	2,513595851	200		0,511883361	-0,214696344	1,278753601	0,400295451	2,301029996
2,21904554	0,832225766	16	0,616184971	1200		0,346166215	-0,079758842	1,204119983	-0,210288898	3,079181246
4,212	1,89787789	26	0,409708138	93		0,624488363	0,278268266	1,414973348	-0,38752541	1,968482949
5,5	1,767482239	101	0,27328503	325		0,740362689	0,247355058	2,004321374	-0,563384158	2,511883361
2,15	0,854704919	66	0,482123802	1170		0,33243846	-0,068183797	1,819543936	-0,316841427	3,068185862
1,675030741	0,437583065	109	1,89138714	1500		0,224022782	-0,358939494	2,037426498	0,276780432	3,176091259
0,557324206	0,838930611	404	1,006375624	1800		-0,253892094	-0,076273959	2,606381365	0,002760109	3,255272505
1,4210194	1,007613085	98	1,69470947	500		0,152600007	0,003293799	1,991226076	0,229095256	2,698970004
2,151722917	0,320659494	324	1,373983375	2515		0,332786345	-0,493955897	2,51054501	0,137981478	3,400537989
3,1	0,590390077	90	1,418267528	1000		0,491361694	-0,22886095	1,954242509	0,15175816	3
0,626829195	5,236462146	69	2,105663556	12215		-0,202850784	0,719037968	1,838849091	0,323388981	4,086893471
1,7	2,953096209	77	9,408692936	1200		0,230448921	0,470277596	1,886490725	0,973529295	3,079181246
3,5	1,225224506	16	0,366815688	1580		0,544068044	0,088215675	1,204119983	-0,435552099	3,198657087
4,237400528	1,175738356	11	0,228662307	1825		0,627099516	0,070310686	1,041392685	-0,640805418	3,261262869
0,333829438	0,937914521	69	0,870939753	1000		-0,476475368	-0,02783674	1,838849091	-0,060011886	3
1,193298737	0,785310136	59	0,943716687	500		0,076749181	-0,104958797	1,770852012	-0,025158366	2,698970004
3,5	1,172070742	23	1,450654094	801		0,544068044	0,068953825	1,361727836	0,161563868	2,903632516
2,144802301	0,545040202	25	0,49259032	1850		0,331387267	-0,263571463	1,397940009	-0,307514127	3,267171728
9,212	-5,33876128	19	0,292605282	2888		0,964353929	#NUM!	1,278753601	-0,533717839	3,460597189
2,7	0,416190091	54	0,380091481	1000		0,431363764	-0,380708264	1,73239376	-0,420111864	3
9,712	-1,869918407	7	0,057174075	500		0,987308674	#NUM!	0,84509804	-1,242800856	2,698970004
1,8	0,652644597	76	0,918447889	1100		0,255272505	-0,185323253	1,880813592	-0,03694548	3,041392685
5,712	1,531797814	13	0,343556845	600		0,756788199	0,185201445	1,113943352	-0,464001394	2,77815125
1,162869493	0,614305743	151	1,91431647	19056		0,065530977	-0,211615425	2,178976947	0,282013736	4,280031744
0,432267113	0,366833299	106	1,94127599	11716		-0,364247805	-0,435531248	2,025305865	0,288087283	4,068779363
5	6,86045936	36	6,666065782	600		0,698970004	0,836353196	1,556302501	0,823869595	2,77815125
3,384032658	1,034835989	13	0,613685477	2500		0,529434546	0,014871524	1,113943352	-0,212054154	3,397940009
3,75	10,54170198	66	0,289249582	200		0,574031268	1,022910734	1,819543936	-0,538727259	2,301029996
9,712	-1,709927032	6,67	0,95977629	304		0,987308674	#NUM!	0,824125834	-0,017829983	2,482873584
8,212	3,24461054	12	3,681481186	400		0,914448941	0,511162575	1,079181246	0,566022585	2,602059991