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The impact of credit risk on commercial property leases

An empirical investigation on the Swedish property market

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Abstract

This study consists of an empirical investigation of the impact of credit risk on the rent level in commercial property leases. In particular, we test whether a higher tenant credit risk as well as a positive correlation between the housing market and the industry the tenant is operating in results in a higher required rent. We make use of an extensive proprietary data set of commercial lease agreements drawn from the Stockholm property market over the time period 2007-2009. While our results only partially confirm that a higher credit risk is reflected in a higher rent level, we find full statistical confirmation for the notion that a higher correlation between the lessee's cash flow and the underlying market value is reflected in a higher rent level.

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1 Introduction

1.1 Background and Motivation

Sweden and, in particular Stockholm, rank among the major property markets in Europe. The market is characterized by high transparency and liquidity and has over the past decades achieved some of the highest property returns in the European comparison. While property investors are appealed by high prospective returns, companies are attracted to Sweden thanks to a strong economic environment. Naturally, this makes the country an active market for commercial property leasing.

Despite its strength, the Swedish commercial property market was not left unaffected by the credit crises 2007/2008. During the period not only lower rental volumes and rent levels were recorded, but also many of the commercial tenants faced bankruptcies and defaulted on their lease contracts, causing the market to experience severely aggravated vacancy rates. Even more, the crisis highlighted that commercial tenants whose business operations are highly positively correlated with the underlying property market are more prone to default on a lease when such a downturn occurs.

Overall, the series of lease defaults has raised the awareness for the severity of a tenant’s credit risk. Indeed, for the lessor tenant default has in several respects a negative economic impact: it leads to a temporarily vacant premise and hence foregone rent; additionally, the lessor incurs marketing and search cost for finding a new tenant. In order to compensate for the costs that arise in the event of default, credit risk should be accounted for when setting the terms of the lease agreement.

1.2 Purpose and Contribution

Given the adverse effects the default of a tenant can have for the lessor, it is surprising that the topic has not been treated much up to present. While credit risk in the context of debt instruments has been a widely discussed topic, the same is not true with respect to leases. Few theoretical models acknowledge the impact of the lessee’s credit risk and barely any of the models’ postulations have been empirically assessed so far. In particular, in the context of commercial property leases research on this matter is barely existent.

This is particularly surprising in the light of the discussion that leases are similar to debt instruments. Given the analogy of debt instruments and leasing, the cost for both should approach one another if the underlying market is efficient (Sorenson and Johnson 1977). This would entail that a lessor should be compensated in the case that the lessee is subject to higher credit risk.

Grenadier (1996) is among the few researchers who have captured the notion between credit risk and the lease rate. He has derived a model for the valuation of leases that explicitly accounts for the presence of credit risk and demands that a risky lessee pays a higher lease rate in order to compensate the lessor for the risk he takes on. Furthermore, he shows that a positive correlation between the industry the lessor is operating in and the underlying asset that is being leased increases the risk of tenant default. Likewise, he demands for this a compensation in form of a higher lease rate.

Despite its plausibility, Grenadier's model has to our best knowledge not been empirically tested so far. With the underlying study we aim to close this gap. Using a sample of 700 commercial property lease agreements drawn from the Swedish property market over the period 2007-2009, we apply Grenadier's postulations to the market for commercial property leases and empirically test the following two hypotheses:

Hypothesis (1): *A higher lessee credit risk results in a higher lease rent.*

Hypothesis (2): *A higher correlation between the lessee firm cash flow and the value of the underlying asset results in a higher lease rent.*

1.3 Preview of Results

Contingent on the type of measure we apply as a proxy of credit risk, our findings partially support *Hypothesis (1).* That is, a higher tenant credit risk is indeed reflected in a higher required lease rent. For the cases where this cannot be confirmed, we suggest that provisions that are included in lease agreements and oblige the tenant to provide a security in form of a bank guarantee or a guarantor, compensate the lessor in the event of default.

For *Hypothesis (2)* we find full statistical significance. Surprisingly, however, interviews with property owners indicate that the correlation between the lessee firm cash flow and the value of the underlying asset is not actively considered when setting the rent level.

We interpret our findings in the light of the structure and legal aspects of lease agreements as well as the options and provisions that are typically included in the agreements. Additionally, several interviews with experts from the commercial property sector allowed us to gain an understanding for the market practice that is applied when assessing a lessee's creditworthiness and help explain our findings.

Overall, we believe that our findings are of practical relevance for commercial property owners of all sizes, lessees, investors, real estate consultants as well as insurance companies.

1.4 Delimitations

This study is an empirical investigation on whether credit risk is priced in leasing agreements. We base this investigation on theoretical models that have been put forward in previous studies, predominantly the model by Grenadier (1996). We do, however, not attempt to specify a new or extend a given model but focus solely on the assessment of whether the predictions of the models are correct when applied to real life data.

1.5 Organization

The remainder of this paper is organized as follows: In *Section 2* we describe the institutional background with an overview of the property market in Sweden and Stockholm and a characterization of lease agreements. In *Section 3* we present a synopsis of previous research including Grenadier's (1996) model. *Section 4* follows with a primer of the notion of credit risk and default. In *Section 5* we characterize the underlying data set and in *Section 6* we specify the methodology we have applied. In *Section 7* and *8* we present our findings and discuss possible explanations for them. *Section 9* concludes.

2 Institutional Background

In part one of this section, we provide an overview of the Swedish and, particularly, the Stockholm property market from which our sample of lease contracts is drawn. In part two, we present an introduction to leases with a focus on the contractual aspects of lease agreements.

2.1 Overview of the Property Market in Sweden and Stockholm

2.1.1 The Property Market in Sweden

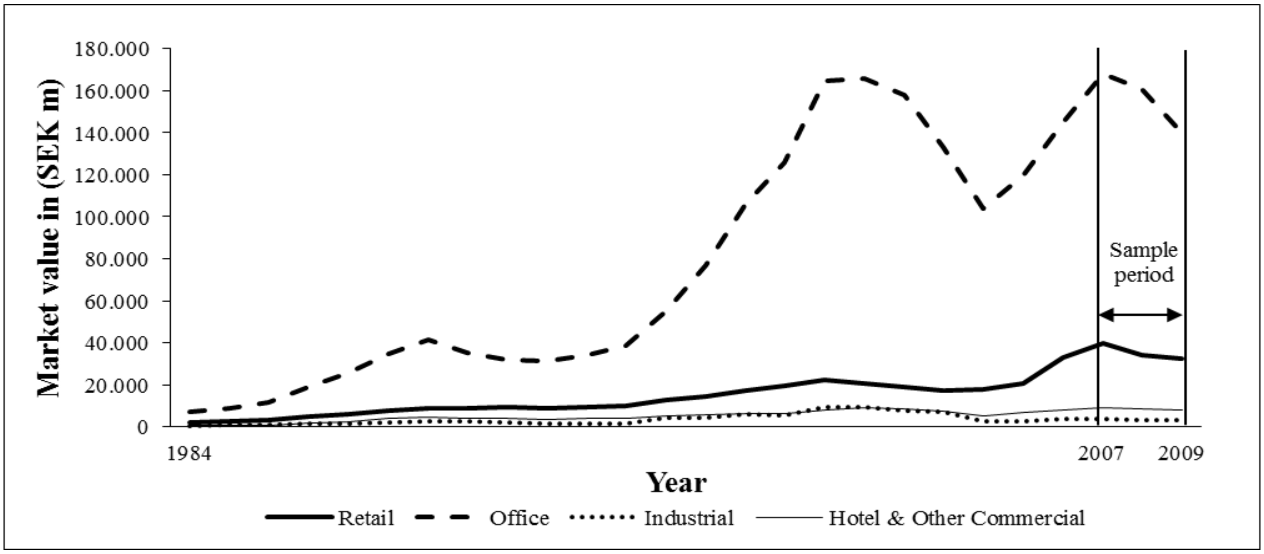
Sweden ranks among the major property markets in Europe. The three largest cities and hence property markets are Stockholm, Göteborg and Malmö.

Generally, the Swedish property market is considered to be a very transparent market in terms of available information. However, most of the information is not publicly accessible. In particular, information on commercial property leases is not publicly available and can usually only be obtained from real estate consultancies or large property owners (Englund, Gunnelin, Hoesli and Söderberg 2004). Selected publicly accessible information on properties in Sweden is contained in the land registry (Fastighetsregistret) while legal aspects regarding property and the leasing thereof are assembled in the Swedish land code (Jordabalken).

Commercial property rents are a prevalent topic in the context of the Swedish property market. While originally subject to rent control, commercial property rents have since 1972 been determined by market forces, that is the interplay of supply and demand in the underlying property market (Jordabalken, Chapter 12, §57a). *Figure 1* shows that the market value for commercial property has experienced a rise over the past decades; in particular the office segment has undergone a large increase in value. *Figure 2* displays the total return development for commercial property market for the same time period and further supports the strength of the office segment. The market development during the years 2007-2009, from which our sample of commercial lease contracts is drawn, mirrors the impact of the credit crisis 2007/2008. As a result of the crisis, the Swedish property market experienced both lower rental volumes and lower rent levels; moreover, bankruptcies increased and lead to higher vacancy rates in the non-residential property sector (NAI SVEFA, 2010). Sweden, however, exhibited a strong recovery in the

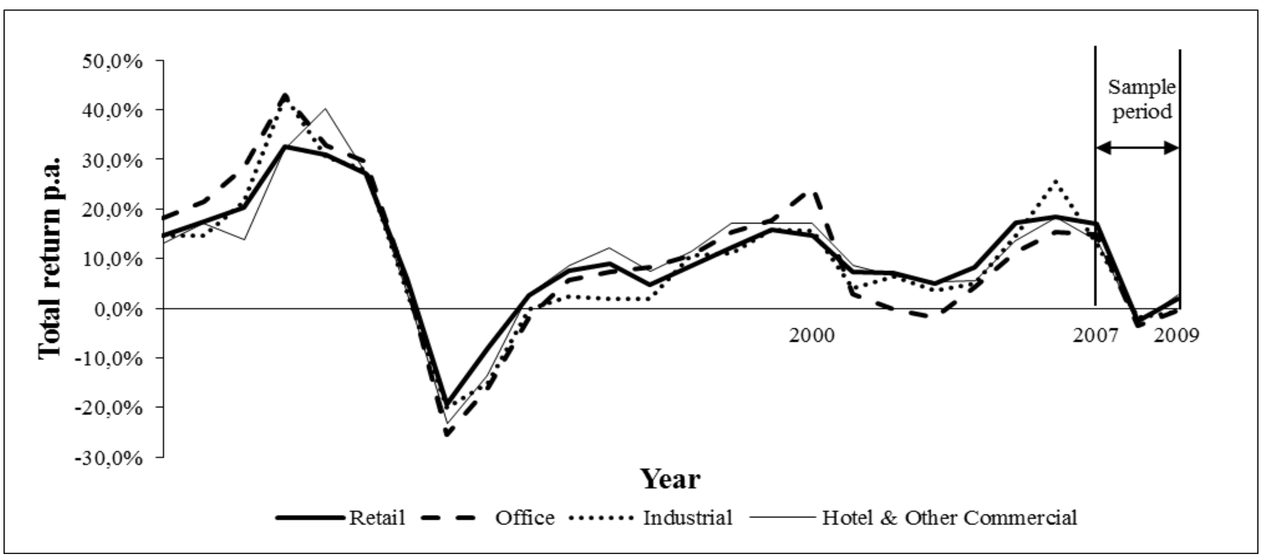
European comparison. Economic key indicators including GDP growth, investments and exports have undergone a positive development post crisis (Konjunkturinstitutet 2011). As a result, the activity on the commercial property market has been reinforced with a significant increase in both transaction volume and average deal size. Also, rent levels are on the rise again while vacancy rates are slowly falling (Aberdeen 2010; Invest Sweden 2011; Newsec 2011).

Figure 1 ■ Market value (SEK m) for commercial property in Sweden over the period 1984-2009



Source: IPD 2011

Figure 2 ■ Total return (% p.a.) for commercial property in Sweden over the period 1984-2009



Source: IPD 2011

2.1.2 Stockholm Commercial Property Market

With a population of about 2 million, the Greater Stockholm area is Sweden's largest and most important property market. The market is generally characterized by a high liquidity as well as low vacancy rates and ranks among the top ten European cities in terms of existing property performance and new property acquisitions (IPD; PwC 2011). In part, this is the result of the city's economic strength, thanks to which the city has also fared the financial crisis 2008 better than expected (NAI SVEFA 2010).

The Greater Stockholm area is typically divided into three parts: Stockholm CBD (Central Business District), Stockholm Central and the rest of Greater Stockholm. The market for commercial property itself is dominated by a few large property owners of which many are institutional owners or pension funds. Major players include AFA, Alecta, AMF Pension, Atrium Ljungberg, Diligentia, Fabege, Hufvudstaden, SEB and Vasakronan (NAI SVEFA 2011), with Vasakronan being the largest commercial property owner in Sweden.

Among the commercial property segments, the office segment is with an approximate area of 11.3 million m² the largest segment in Stockholm and even more the largest office segment in the Nordic countries (DTZ 2011). It also constitutes the majority of lease contracts in our sample. For a further classification of the two segments represented in our sample - the office and retail segment - we present selected property market indicators for the year 2011 in *Table 1*.

Table 1 ■ Property market indicators for prime location commercial properties in Stockholm

	Office	Retail
Rent	3800-4500 SEK	6500-16000 SEK
Yield	4,90% - 5,50%	4,90%-5,50%
Assessed Value	45000-70000 SEK	65000-150000 SEK

Rents and assessed value in SEK/m²
The average exchange rate during this period was 6 SEK/USD
Source: NAI SVEFA 2011

2.2 An Introduction to Leases

2.2.1 Characterization of Leases

From a theoretical perspective, leasing is defined as the purchase of the use of an asset over a specified period of time with the lessee receiving the benefits resulting from the use of the asset and the lessor receiving the value of the rental payments plus the residual value of the asset at the maturity of the contract (cp. McConnel and Schallheim 1983; Grenadier 1995; Grenadier 1996). In the case of property, the asset corresponds to the property space with the lessee obtaining the benefits from using the space (Grenadier 2005).

From an accounting perspective, one differentiates finance and operating leases. According to IAS 17, in a finance lease, all the risks and rewards of the asset are transferred to the lessee. Typical features that lead to the classification as a finance lease include the transfer of ownership at the maturity of the lease, the option to purchase the asset or a lease duration that accounts for the majority of the economic life of the asset. Leases that do not exhibit such features are categorized as operating leases (IASB 2010).

Lastly, from a market perspective and with respect to commercial property, the classification of leases is typically done according to the type of use associated with the property. As a result, one commonly distinguishes ground, industrial, office and retail leases.

2.2.2 Contractual Elements of Commercial Real Estate Lease Agreements

In Sweden lease agreements are subject to the terms postulated in Chapter 12 of the Swedish Land Code (Jordabalken 2011).

In general, the lease agreement specifies a variety of aspects. These include the location and use of the premise as well as its size. Additionally, the agreement states the rental period which is usually set for a minimum of three years in Sweden, sometimes with an option for renewal or an option for early cancellation. Finally, the agreement defines the actual rent as well as additional cost items (Fastighetsägarna 2008).

As mentioned before, the rent is set according to the market rent as defined in §57a, Chapter 12 of the Swedish land code. This is done by comparing rents for similar premises. Only special reasons may justify a deviation from the market rent (Jordabalken 2011). The total rent paid by the lessee exceeds, however, in most cases the market rent. This is the result of rent adjustments that are negotiated as well as property related costs that are added to the market rent.

In particular, the lease agreement may contain an escalation clause. In that case, the rent is periodically adjusted, either according to an economic index or based on an ex ante negotiated fixed rate. The objective is to account for factors such as inflation or fluctuation in costs. In Sweden the rent is typically tied to the Consumer Price Index (CPI) conditional that the contract runs for a minimum period of three years (Fastighetsägarna 2008). Additionally, in the case of lease agreements for retail companies, the rent usually comprises two components, i.e. a fixed base rent plus a percentage of the sales contingent that the sales figure exceeds a certain threshold.

Property related cost may include costs for electricity, water, heat, cooling and ventilation as well as cost for insurance, taxes and the maintenance of the building. The contract needs to state which of these costs are born by the lessee and lessor, respectively.

The sum of the market rent, the rent adjustments and the property related cost items results in the total rent. If the rental period exceeds three years, the lessor and lessee are usually more flexible with respect to structuring the lease contract and may negotiate a different basis for calculating the total rent (Fastighetsägarna 2008). Flexibility means in our context that the lessor is hypothetically also given the possibility to include clauses that adjust for credit risk over time.

3 Literature Review

The literature on leasing is comprehensive and much research has been devoted to develop an understanding for the economics of and the rationale behind leasing. A prevalent topic has been the valuation of leasing contracts. Fundamental theoretical papers in this area stem from Miller and Upton (1976) as well as McConnel and Schallheim (1983), modeling leasing contracts under perfect capital market assumption using an equilibrium approach. Miller and Upton (1976) derive equilibrium lease rates in a single- and multi-period setting for both a case under certainty and uncertainty. McConnel and Schallheim (1983) supplement the framework by providing a more general model for the valuation of asset leasing contracts that also allows pricing the variety of provisions and options typically found in contracts.

Starting in the 1990s, Grenadier has published a collection of theoretical papers and thereby become a recognized researcher in the area of leasing. In several of his papers he has derived a model for the valuation of leases which can then be applied to value lease agreements with a variety of contract specifications. Besides his papers from 1995 and 2005, his most important contribution with respect to this study is his publication from 1996, which deals explicitly with the impact of credit risk on the rent level of a lease.

As opposed to the many existing theoretical papers, empirical research on leasing is generally less available. One of the largest early empirical studies was put forward by Sorenson and Johnson (1977) who provide a descriptive empirical study on 520 equipment leases. Schallheim, Johnson, Lease and McConnel (1987) follow with an empirical study of 363 leases, also for a variety of equipment categories, and confirm the theoretical models by Miller and Upton (1976) and McConnel and Schallheim (1983).

In the further elaborations, we will focus on selected strands of literature with the aim to provide the necessary context and motivation for our two established hypotheses. For that purpose we have divided this section into five sub-sections: The first sub-section elaborates on the analogy of leases and debt instruments and stresses again why credit risk should be priced. The second sub-section deals with the impact of credit risk on lease rates. First, we recapitulate Grenadier's (1996) main arguments and relate them to our hypotheses. Second, we present a synopsis of several further studies treating credit risk. The third sub-section explains the role of options and provisions typically found in leasing contracts and their impact on credit risk. The penultimate sub-section briefly reviews research undertaken on commercial property leases. A final sub-section depicts research gaps and limitations of the existing research.

3.1 The Debt Analogy of Leases

Many studies have discussed the role of leases as a substitute for debt (e.g. Sorenson and Johnson 1977; Bowman 1980; Lewis and Schallheim 1992). In particular it has been argued that leasing is "a substitute for debt for firms that are too risky or unable to access conventional debt markets" (Lease, McConnell, and Schallheim 1990, p.12). In the light of this discussion, Sorenson and Johnson (1977) draw an important conclusion: "If financial lease contracts can be considered debt instruments, and if the relevant capital market is efficient, we should expect the cost of leasing to approach the cost of debt" (Sorenson and Johnson 1977, p.33). The cost of a debt, i.e. a bond, is composed of a base interest rate and a spread whereby the spread is determined by variety of factors, including the credit risk associated with the bond issuer (Fabozzi 2005). If bonds and leases are indeed substitutes, credit risk should likewise be reflected in the cost of leasing. Even more, this is required when we assume that those firms entering into lease contracts tend to be, as stated above, more risky and hence more susceptible to default on average. However, "the theoretical modeling of equilibrium lease determination has been virtually confined to default-free leases" (Grenadier 1996, p.333) so far.

3.2 The Impact of Credit Risk on Lease Agreements

3.2.1 Grenadier (1996): The Theoretical View of Credit Risk in Lease Contracts

The notion of credit risk in the context of leases has most extensively been treated by Grenadier (1996). He bases his arguments likewise on the idea that debt and are leases are substitutes. His postulations constitute the framework for our empirical investigations.

His main argument - the basis for our *Hypothesis (1)* - advocates that in equilibrium the lease rate should be adjusted for the existence of credit risk and its consequences. This adjustment is reflected in the credit risk spread, which corresponds to the difference between the equilibrium lease rent on a lease subject to credit risk and that of a risk-free lease.

In the following we recapitulate Grenadier's (1996) basic model for the equilibrium rent on a lease subject to credit risk including its main underlying assumptions. In the tradition of Miller and Upton (1976) and McConnel and Schallheim (1983), Grenadier makes use of an equilibrium model and applies option-pricing analysis to determine the equilibrium lease rate for a lease subject to credit risk.

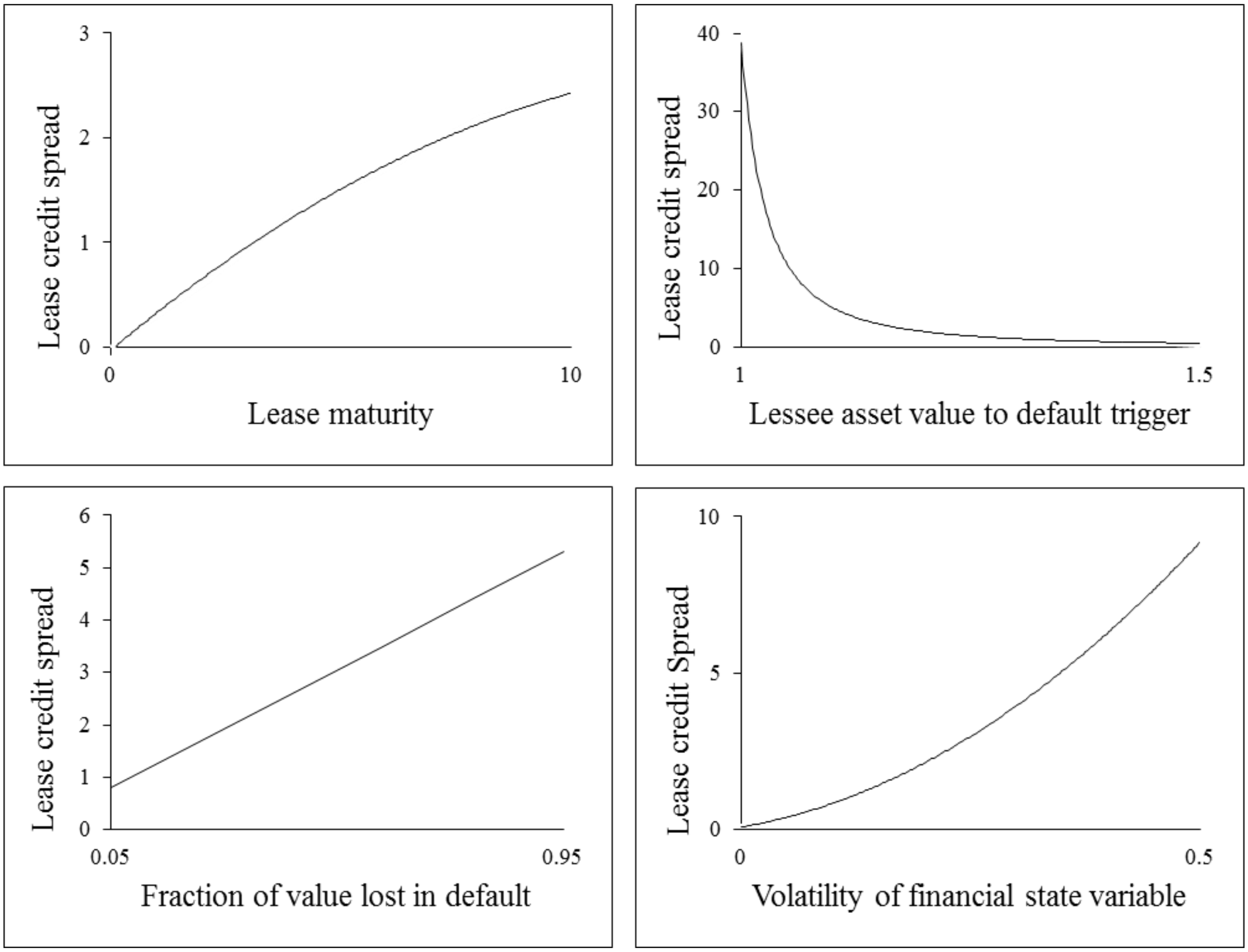
Grenadier's main underlying idea is that in equilibrium "any two methods of selling the service flow of the asset for T years must have the same value", such that the lessor is indifferent between the two methods (Grenadier 1996, p.340). Method one can herein be defined as the lease to a risk-free lessee while method two denotes the lease to lessee that is subject to credit risk.

To model the lease to a risky lessee, Grenadier breaks down the lessee default into two components: the occurrence of default and the consequences of default.

The occurrence of default is determined by a state variable - the lessee cash flow or asset value - and a threshold value or default barrier. Lessee default is triggered when the state variable falls below the threshold value. The state variable is modeled to follow a diffusion process that is correlated with the value of the leased asset. If this correlation is positive, "then default is most likely to occur when the value of the asset is the lowest and the consequences of default are the most severe". In contrast, if the correlation is negative, "default is most likely to occur when the asset value is the highest and the consequences of default are the lowest" (Grenadier 1996, p.339). When modeling the consequences and hence cost of default, Grenadier assumes that the lessor is only able to recover a fraction of the remaining lease value.

The adjustment for credit risk in the equilibrium lease rate for the risky lessee is reflected in the credit risk spread, which corresponds to the difference between the equilibrium lease rate on the lease subject to credit risk and that of the risk-free lessee. The magnitude of the credit risk spread is shown to depend on a variety of factors. In particular, Grenadier (1996) finds that four factors increase the lease credit spread: the lease maturity, the lease asset value to default trigger, the fraction of lease value lost in default as well as the volatility of the lessee's financial state variable. *Figure 3* illustrates the impact of these variables on the lease credit risk spread graphically.

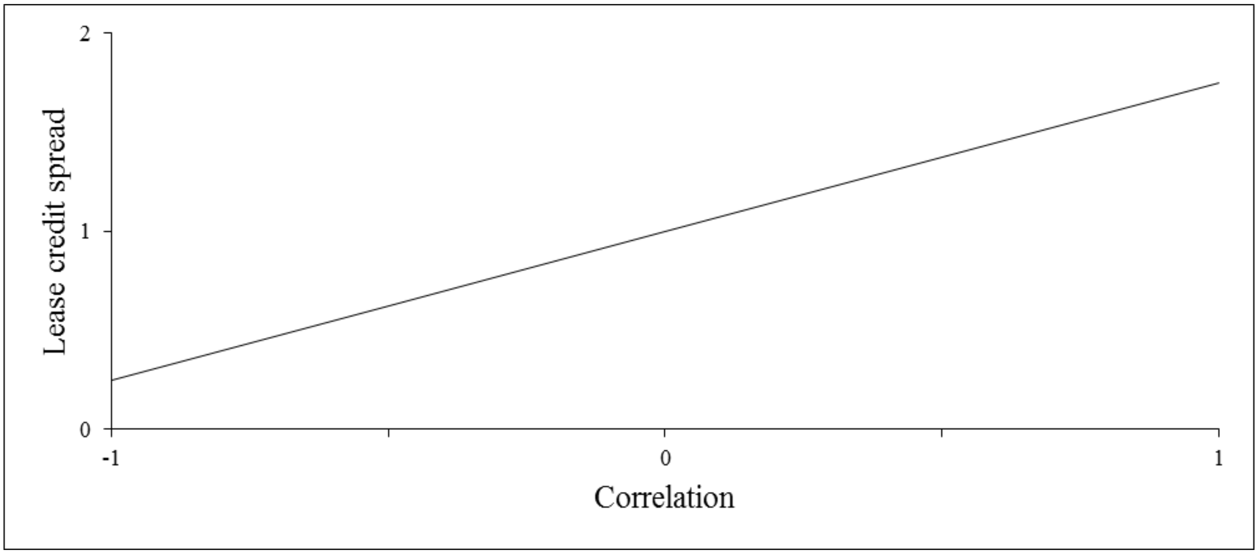
Figure 3 ■ The impact of selected variables on the lease credit spread



The four graphs show the impact of selected variables on the equilibrium lease credit spread. The lease credit spread herein corresponds to the difference between the equilibrium lease rate on the lease subject to credit risk and that of the risk-free lessee. Source: Grenadier (1996)

A further aspect that Grenadier assesses and which is captured in *Hypothesis (2),* is the correlation between the lessee's firm value and the asset that is being leased. The firm value in turn affected by the industry the lessee is operating in. Grenadier reasons that the credit risk spread is a positive function of the correlation of the two measures as illustrated in *Figure 4*. That means that a higher positive correlation worsens the impact of default in a downturn and should likewise be accounted for through a higher lease rent (Grenadier 1996). To exemplify this in the context of commercial leases: the rent charged to a tenant who operates in the retail business and leases a premise in a retail shopping center should be higher than for a tenant who operates in a non-retail sector and leases a premise in the same shopping center.

Figure 4 ■ Impact of the correlation on the lease credit spread



The graph shows the impact of the correlation between the lessee's firm value and the asset that is being leased on the credit lease spread. The lease credit spread herein corresponds to the difference between the equilibrium lease rate on the lease subject to credit risk and that of the risk-free lessee. Correlation refers to the correlation between the lessee's firm value and the asset that is being leased.
Source: Grenadier (1996)

3.2.2 Further Studies that Consider Credit Risk

Though not in the same extent, credit risk and the possible occurrence of default are also recognized in a variety of other studies, of which selected are briefly presented.

On a theoretical level, two more recent papers stem from Realdon (2006) and Ambrose and Yildrim (2008), respectively.

Realdon (2006) compares the valuation and credit assessment of secured bank loans and financial lease contracts and highlights an important difference: while an increase in the lessee's default probability is always accompanied by an increase in the credit spread of the secured debt, a high default probability in the case of financial leases may decrease the and even result in a negative credit spread. In particular this can be the case when the lease agreement includes a terminal purchase option or requires a pre-payment. The benefit for the lessor is higher the earlier the lessee default occurs after inception of the lease.

Ambrose and Yildrim (2008), on the other hand, investigate credit risk with respect to the term structure of leases. They set up an analytic model for the valuation of lease contracts subject to default risk. Using numerical analysis they show that tenant credit risk increases the spread between the default free lease rate and the defaultable lease rate, conclude however that the impact of credit risk becomes only materially effective for leases of a longer term, i.e. for a contract length exceeding five years. An explanation for the limited short-term effect is not given though.

On an empirical level, two interesting studies were put forth by Schallheim, Johnson, Lease and McConnel (1987) and Lease, McConnel and Schallheim (1990).

Schallheim, Johnson, Lease and McConnel (1987), who make use of a set of 363 leases for a variety of equipment categories drawn from the US market, drop the assumptions of a perfect capital market and default-free leases and test the hypothesis "that the yields of risky lessees are [...] a function of the financial condition" (Schallheim, Johnson, Lease and McConnel 1987, p.59). As a proxy for credit risk and the likelihood of lessee default, they set up three financial ratios: a profitability ratio (net income/total assets), a liquidity ratio (current assets/current liabilities) and a leverage ratio (total liabilities/total assets). They find that the liquidity ratio is significant at the 1% and inversely related to the lease yields.

Lease, McConnel and Schallheim (1990) extend the empirical study of Schallheim, Johnson, Lease and McConnel (1987), using a subset of the original sample. Their results show that the ex post realized yields of leases significantly deviate from contractually defined yields. They suggest that this is due to the fact that lessors normally neglect the fact that leases can be subject to default risk and instead assume that all lease payments are made as scheduled and that the estimated residual value of the leased asset is realized at the maturity date of the contract.

3.3 The Role and Impact of Contractual Options and Provisions

Lease contracts typically contain a variety of clauses. Some of these clauses are explicitly designed to ex ante account for credit risk. Grenadier (1996) theoretically analyzes the impact of a variety of such provisions. *Table 2* specifies them and denotes their impact on the level of credit risk and the lease payment.

Table 2 ■ Impact of lease options/provisions on the level of credit risk and the lease rate

Option/ provision	Description	Impact
Security deposit	Placement of funds in an escrow, Letter of credit from a third party, Pledge of personal assets as collateral	Provides an incentive for the lessee not to default and results in a lower lease rate
Pre-payments	Requirement to make one or more payments in advance	Leads to a lower lease rate
Lease credit insurance	Guarantee for the rent payments for the full term of the lease	Helps to eliminate or lessen default risk
Option to purchase	Option to purchase the asset at the end of the term of the lease for a predetermined price	Provides an incentive for the lessee not to default on the lease and hence lowers credit risk

Source: Grenadier (1996)

Empirical research supports the idea that securities are a common component in lease contracts and that they can have a positive impact on the lease rent. In particular, two early empirical studies by Sorensen and Johnson (1977) and Crawford, Harper and McConnel (1981) confirm this picture. Out of the 520 US financial lease contracts for various equipment categories used by Sorenson and Johnson (1977) 23% of the lease contracts were secured by collateral and as much as 65% of the contracts required pre-payments. Similarly, approximately 90% of all contracts required a pre-payment in the sample of financial lease contracts Crawford, Harper and McConnel (1981) examine in their study. Sorenson and Johnson (1977) then show that the collateralization of leases reduces the cost rate of the lease while Crawford, Harper and McConnel (1981) find that a higher percentage of pre-payments leads to an increase in the lease yield. It is to note, however, that the underlying samples in these two studies do not include any commercial property leases, leaving us with no specific indications for our case.

3.4 Commercial Real Estate Leases

The spectrum of studies focusing on commercial real estate leases, both on a theoretical and empirical level, is generally limited.

In his theoretical paper from 2005, Grenadier derives an equilibrium model that is specifically designed for the valuation of commercial property leases. He demands that the lease rate is set such that in equilibrium the value that results from using the commercial space is equal to the value of the lease payments regardless of the particular contract specifications. The value of the use of the space is herein derived through an option-pricing approach (Grenadier 2005). In contrast to his article from 1996, default risk is not incorporated into the structure of the model. He stresses, however, that this only a simplifying assumption that does not necessarily reflect reality.

Various empirical studies investigate factors with explanatory power for the rent level of commercial property leases.

Benjamin, Boyle and Sirmans (1990), for instance, focus on the rent in retail shopping center leases. They investigate variations in rent and the interaction between the base rent and the percentage rent rate across 103 retail leasing agreements in a US shopping center. Using regression analysis, they show that the base rent declines as the percentage rent rate increases. In reverse, the base rent rises as the threshold sales level, that needs to be reached for the percentage rent rate to become effective, rises.

Glascock, Jahanian and Sirmans (1990) study rent variations in office buildings for a US medium-sized city using geographic location, physical characteristics, overall market conditions and the level of amenities as determinants of rent.

For the Swedish office property market studies have been published by Gunnelin and Söderberg (2003) as well as Englund, Gunnelin, Hoesli and Söderberg (2004). Both papers estimate the term structure of lease rates and are able to prove a significant impact onto the rent level.

Table 3 presents an overview of the variables that the empirical studies just mentioned have identified to have rent-explaining power.

Table 3 ■ Overview of empirical studies on commercial property leases

Year	Author	Segment	Location	Sample Size	Independent variables used to explain the rent	Sign of coefficient
1990	Benjamin, Boyle, Sirmans	Retail shopping center	USA	103	Cancellation provision	(n.s.)
					Lease term	(−)
					Percentage rent rate	(−)
					Rent escalation	(n.s.)
					Sales (per m^2)	(n.s.)
					Threshold level of sales	(+)
					Type of tenant	(−)
1990	Glascock, Jahanian Sirmans	Office buildings	USA (Louisiana)	675	Building class	(+)
					Location	(+)
					Market conditions	(+)
					Services (Amenities)	(+)
					Size of building	(+)
2003	Gunnelin, Söderberg	Office buildings	Sweden (Stockholm)	861	Age of building	(−)
					Lease term	(−/+)
					Property Owner	(+)
					Renegotiation	(−)
					Size of building	(n.s.)
					Time of contract set up	(+)
2004	Englund, Gunnelin, Hoesli, Söderberg	Office buildings	Sweden	4387	Age of building	(−)
					Age^2 of building	(+)
					Heat	(−/+)
					Lease term	(−/+)
					Renegotiation	(−)
					Rent escalation	(−)
					Size of building	(n.s.)

The table presents an overview of empirical studies that have tried to identify the independent variables that have explanatory power in explaining the rent. In the regressions the rent per square meter was used as the dependent variable. All independent variables that have been used in the regressions and for which the results are reported are listed. The column "sign of coefficient" indicates whether the variables were significant on at least a 10% level and what sign the coefficient carried.
(+) indicates that the coefficient for this independent variable is positive and was at least significant at the 10% level for any of the regressions run in the study; (-) indicates that the coefficient for this independent variable is negative and was at least significant at the 10% level for any of the regressions run in the study; (-/+) indicates that the coefficient for this independent variables showed both positive and negative sign and was at least significant at the 10% level for any of the regressions run in the study
(n.s.) indicates that the coefficient for this independent variable is not significant at at least the 10% level
Explanation of selected variables:
Building class: The property is classified according to its condition with the highest class reflecting the best conditions
Renegotiation: The lease is the result of renegotiations with the current tenant
Services: Services include e.g. water, lighting, security and maintenance. More services should result in a higher rent.

3.5 Research Gaps and Limitations of Published Studies

As pointed out earlier, research on leasing is characterized by a lack of empirical studies. This is essentially due to restricted access to data on individual leasing contracts as the data is not publicly available (Englund, Gunnelin, Hoesli and Söderberg 2004; Stanton and Wallace 2002). As a direct result, many of the theoretical postulations have yet remained unverified (Stanton and Wallace 2002).

Looking at the existing empirical studies, we are faced with limitations in both scope and generalizability. Many of the studies have focused on the US market; studies on the European market are rarely existent. Additionally, sample sizes have been comparably small (Schallheim, Johnson, Lease and McConnel 1987). Finally, many of the samples are drawn from lease contracts for categories of equipment rather than commercial property.

With this study we aim to fill the existing research gap.

4 Credit Risk

This section discusses the concept of credit risk in more detail.

In the first part of this section, this is done from a more theoretical perspective. We start by introducing the terminology used in the context of credit risk and then provide an overview of common models for its estimation.

In the second part of the section, we discuss the concepts from a more practical perspective. First, we give a detailed explanation of the measures for credit risk that we apply for our investigations and then explain the treatment of credit risk in the context of lease agreements.

4.1 Credit Risk from a Theoretical Perspective

4.1.1 Terminology

Several important terms are to be distinguished. Default is defined as "the failure by a counterparty to honor the terms and conditions of a contract". This can comprise the "failure to make timely payment […] or failure to comply with some other provisions or terms of the facility or indenture" (Moles and Terry 1997). This implies that default is tied to a certain contract and based on legal grounds. Credit risk, often also referred to as default risk, is herein a measure for the risk that default will occur (Law and Smullen 2008). In contrast, insolvency refers to the inability to pay debt at the due date and may result in bankruptcy or liquidation. Bankruptcy denotes the state when a corporation is unable to pay outstanding debt and a court has made a bankruptcy order (Law and Smullen 2008). As opposed to default, bankruptcy is not tied to a particular contract but refers to the overall financial condition of the corporation.

4.1.2 Models for the Estimation of Credit Risk

Several approaches exist to determine the probability that a company will become bankrupt or insolvent or default on a contract. Scoring models such as Altman's Z-Score model and credit ratings are prevalent ways to indicate the creditworthiness and likelihood of bankruptcy of corporations. Furthermore, credit risk can be modeled using structural and reduced-form models. We will touch upon each of the mentioned approaches in the subsequent sections.

4.1.2.1 Scoring Models: Altman's Z-Score Model

Altman's Z-Score Model, published in its original version by Edward I. Altman back in 1968, was one of the first and is nowadays among the well-recognized models for the determining the probability that a corporation will enter bankruptcy (Altman 2000).

The model is based on multiple discriminant analysis. The discriminant function determines a value Z based on which a corporation is classified as bankrupt or non-bankrupt. Five financial ratios are weighted by the discriminant coefficients to arrive at the overall score Z. The final discriminant function is composed as follows (Altman 1968):

$$Z = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 \ + 1{,}0X_5$$

where

$X_1 = working\ capital/total\ assets$

$X_2 = retained\ earnings/total\ assets$

$X_3 = earnings\ before\ interest\ and\ taxes/total\ assets$

$X_4 = market\ value\ of equity/book\ value\ of\ total\ liabilities$

$X_5 = sales/total\ assets$

$Z \ \ = overall\ index$

A Z-score below 1,81 classifies a corporation as bankrupt; for a Z-value above 3,00 a corporation is considered to be in the safe zone. Corporations in between are said to be in the grey zone (Altman 1968).

This original formula was estimated solely for publicly held manufacturing companies. Over time, it has however been re-estimated to be also applicable for private manufacturing, non-manufacturing and service companies (Altman 2000).

4.1.2.2 Credit Ratings

Credit ratings, assigned by rating agencies such as Standard & Poor's or Moody's are opinions about credit risk, estimating the ability of a corporation to meet financial commitments in full and on time and indicating relative levels of credit risk from strongest to weakest. Typically, the ratings are expressed as letter grades such as AAA to D, with ratings between AAA and BBB- reflecting investment grade and those beyond BBB- corresponding to speculative grade (Fabozzi 2005; Standard & Poor's 2010)

In order to arrive at their estimates, the agencies usually use a combination of qualitative and quantitative aspects in the form of analyst opinions and mathematical models, respectively. For the qualitative part, the analysts usually obtain information from published reports as well as from interviews and discussions with the corporation's management. That information is then used to assess the entity's financial condition, operating performance, policies and risk management strategies. Quantitative models can be applied either before or after the qualitative judgments (Standard & Poor's 2009).

The range of applications for credit ratings is manifold and depends on the type of user. Investors frequently consult credit ratings when making investment decisions and managing their portfolios. Intermediaries, such as investment banks, may use the rating to set the initial pricing for individual debt issues they structure. Businesses and financial institutions rely on credit ratings to assess counterparty risk. Finally, the issuing corporations may use the rating to provide an independent view of its creditworthiness and the credit quality of the debt issue.

The credit quality of most issuers and their obligations tends to undergo changes over time. For this reason ratings are adjusted so as to reflect variations in the intrinsic relative position of issuers and their obligations. However, such adjustments occur rather infrequently and in indeterminate time intervals (Standard & Poor's 2010).

4.1.2.3 Further Models

Further models for quantifying credit risk include structural and reduced-form credit models. The prevalent model in the category of structural credit models is the Merton Model while the two most notable reduced form models are the Jarrow-Turnbull model and the Duffie-Singleton model. As opposed to credit ratings, these models allow the estimation of default probabilities on a real-time basis (Fabozzi 2005). However, this set of models is more elaborated and relies on input data which we have not access to. In consequence, we do not make use of this set of models in this study.

4.2 Credit Risk from a Practical Perspective

4.2.1 Measures of Credit Risk Applied in our Study

Our main assessment of whether credit risk is priced in leasing contracts on commercial property in Sweden, i.e. *Hypothesis (1)*, is based on two measures that we have received as part of a dataset from Upplysningscentralen, in the following referred to as UC. UC is the leading credit information company in Sweden. Founded in 1977, it has a long experience in providing credit information to their customers.

The first measure given in the dataset, the UC Risk Forecast, is a UC proprietary measure which can normally only be obtained through billable subscription to UC's credit information services. The second measure we make use of, the Payment Remark, is opposed to that publicly accessible. Both measures are presented in detail in the subsequent sections.

4.2.1.1 UC Risk Forecast

The UC Risk Forecast is part of UC Risk Företag, which is a collection of scoring models comparable to Altman's Z-Score Model. UC Risk Företag is reported for all limited liability companies (AB), partnerships (HBK) and sole traders (EN) in Sweden and consists of two dimensions, UC Credit Rating and UC Risk Forecast.

UC Risk Forecast is essentially a score which states in percentage the probability that a company will be subject to insolvency within the upcoming 12 months. According to the UC definition, insolvency is the result of a company's default, distraint or reorganization. The risk forecast is based on statistical credit rating models developed by UC as well as historical data on Swedish company defaults rates. The measure can hence be regarded as objective; however, as it is a forecast it remains nevertheless uncertain.

Contingent on the company type, UC uses different statistical models to assess the risk forecast. The basic framework of the models is however based on the same four cornerstones:

- Financial statements
- Payment remark
- Composition of the board
- Other information

Regarding the financial statements, the assessment is based on factors such as turnover, solidity, the amount of assets, profitability, return on assets, return on equity and a number of different key ratios which determine the state of the company and which have proven historically significant for determining company default. Payment complaints include both the number of complaints as well as how recently the complaints have occurred. The information on the board includes the number of people on the board, how often there have been changes made in the composition of the board as well as the payment history of the board members. The group 'other' assesses factors such as what industry the company operates in, the competitive environment and the size as well as the age of the company. Depending on what type of company is being assessed, different estimated weights are put on the different cornerstones. Overall much of the weight is put on the factor payment complaints. Additionally, for large companies more weight is put on the financial statements, while for smaller companies more weight is placed on information about the board.

Based on the risk forecast, UC assigns a company to a credit rating category from 5 to 1. *Table 4* summarizes the UC rating categories, the corresponding UC Risk Forecast values and their interpretation.

It is important to stress that the credit valuations for the assessed companies are always performed on a standalone basis and not on a consolidated basis for the group. A small weight in the credit assessment is nevertheless placed on potential intra group certifications for payment obligations as contractual agreements are often secured by guarantees from the respective mother company; however, this information is in many cases not available to UC and is often determined separately for each contract signed by the company.

Table 4 ■ Classification of UC Credit Rating Categories and UC Risk Forecast

UC Credit Rating Category	UC Risk Forecast	Interpretation
5	0.03 – 0.24	Very low risk
4	0.25 – 0.74	Low risk
3	0.75 – 3.04	Normal risk
2	3.05 – 8.04	High risk
1	8.05 – > 99	Very high risk

Source: Upplysningscentralen 2011

Since the credit rating models are based on statistical information, they are updated automatically when new information is available and therefore always provide UC's customers with the latest information available. The models are market leading within the European market with respect to accuracy and updating frequency, much thanks to the availability of relevant historical data in Sweden (Upplysningscentralen, Interview).

The predictive power of the UC Risk Forecast and the respective UC Credit Rating Category is highlighted when comparing the rating category with the corresponding number of insolvencies that actually occur one year within the rating is published (*Table 5*). In particular, we see that 23% of the companies rated 1 become insolvent during the predicted time period.

Table 5 ■ Number of insolvencies for respective UC Credit Rating Categories

UC Credit Rating Category	Limited Liability Companies	Insolvencies within one year	
	Number	Number	Percentage
5	90.259	45	0,1%
4	91.061	237	0,3%
3	83.162	898	1,1%
2	30.860	1089	3,5%
1	15.217	3504	23,0%

Source: Upplysningscentralen 2011

4.2.1.2 Payment Remarks

The second measure that we make use of in our study as a proxy for the creditworthiness is the number of Payment Remarks. A Payment Remark is an indication that payments have been mismanaged. In Sweden information on unpaid debt is transmitted from an authority such as the National Tax Board (Skatteverket) to the Swedish Enforcement Service Kronofodgen for collection and then further to UC. Updates on unpaid debt are provided to UC on a daily basis.

Payment Remarks for legal corporations will remain in UC's database for a total duration of five years. During that time, a remark will only be removed from the credit information register if the Enforcement Service has ordered confidentiality. Confidentiality applies in cases where the state and local government are claimants and where the debtor has paid the debt within the constituted time or before the enforcement officer has had time for collection proceedings. UC never decides whether a remark should be confidential or not, this decision is always taken by the Swedish Enforcement Service Kronofogden (Upplysningscentralen 2011).

4.2.2 Credit Risk in the Context of Lease Agreements

In the context of leasing, default occurs when the tenant does not pay the lease rate or fails to adhere to the clauses agreed on in the leasing contract. The reasons for lessee default can be manifold and may range from business failure over liquidity crises up to dissatisfaction with the performance of the lease asset (Grenadier 1996). Likewise, the relevance of credit risk varies across affected parties: From the perspective of the lessor, the adjustment of the lease rate for the creditworthiness of the lessee is important in order to compensate for the cost in the event of default. From the lessee perspective, the adjustment of the lease rate is a way to ensure a fair pricing. Additionally, the acknowledgement of credit risk in leases is relevant for the commercial property investor in structuring the portfolio and for the insurer in designing insurances that help moderate the impact of credit risk.

In what follows, we specify the cost and consequences of default as well as approaches to mitigate credit risk in the design of lease agreements.

4.2.2.1 Cost and Consequences of Default

The default on a lease entails various costs that vary in type and impact. The largest cost usually results from the temporary vacancy of the premise. Additionally, there may be costs due to delay, legal costs as well as brokerage and marketing costs. Also, the lessor may incur costs for bringing the property back in condition for sale. Depending on the type of business the defaulted lessee has run, the lessor also foregoes the initial investment cost. Finally, the lessor faces the risk of a lower rent for the newly negotiated contract compared to the previous tenant (Sing and Tang 2004). Overall, the individual payoff and remedies for the affected claimants including the lessor in the event of default depend to a large extent on the individual bargaining power (Grenadier 1996).

Data on recovery rates for commercial property is rarely found. Schmit and Stuyck (2002) are an exception. They examine 108 defaulted real estate[1] leasing contracts and report recovery rates[2] in the range of 55% and 99% (Schmit and Stuyck 2002). The recovery rate refers in this context to the undiscounted “amounts recovered in comparison with the outstanding amount on the date of default” (Schmit and Stuyck 2002, p.7-8).Though the small sample limits the generalizability of their results, the study indicates that the loss in the event of default is limited.

4.2.2.2 Mitigation of Credit Risk and the Consequences of Default

In practice, a lease agreement should contain clear specifications concerning default. That is, the contract should state what constitutes the lessee’s default, the actions and legal proceedings that follow the event of default as well as the lessor’s remedies and the lessee’s obligations and charges. Also, it might specify how much time, if any, the tenant has to cure the default.

In order to ex ante account for credit risk, lease agreements may contain certain provisions regarding for instance bank guarantees and security deposit. In Sweden contracts usually contain requirements for such securities. The security may consist of a personal guarantee or a bank guarantee. Additionally, a security deposit, equivalent to several monthly rents, may apply.

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[1] It is not specified which property segments are included in the sample

[2] The recovery rates refer to recovery values from resale only and exclude other recovery values such as guarantees, collaterals, debtor’s net liquidation and late payments (Schmit and Stuyck 2002, p.8). When accounting for other recovery values

A personal guarantee should usually cover both the foregone rent as well as other obligations that result from the tenant's other obligations that are set in the contract. The lessor is obliged to notify the guarantor immediately when the lessee does not fulfill its commitments.

A bank guarantee is a commitment from a bank account for the tenant's obligations. The guarantee is usually restricted to only cover the rent and is thereby limited to a certain amount, which may be well below the actual loss the landlord suffers in the event of default. In particular, the lessor cannot require the bank to cover costs such as those resulting from the damage of the premises (Fastighetsägarna 2008).

Also, in the case of a delayed payment the lessor is according to Swedish law entitled to compensation for the written reminders and collection cost. Likewise, the lessor may be compensated with interest for late payments conditional that the parties have agreed on that at inception of the lease contract (Fastighetsägarna 2008).

4.2.2.3 Market Practice for Assessing a Lessee's Credit Risk

In order to get an insight on how and to what extent a lessee's credit is considered and evaluated in practice, we have carried out interviews with market professionals. Our main interview partner was Ulrik Elg, Executive Business Controller at Vasakronan, the leading property company in Sweden. Elg explained that when evaluating potential tenants, Vasakronan follows a dual process and breaks down the assessment into an investment case and a customer case.

The investment case constitutes the first part of the assessment and exists to ensure the overall goal of achieving high investment returns. As part of the case, Vasakronan estimates the fixed and variable costs and sets the yield they want to realize on the premise that is to be leased out. Based on this and the market rent of similar premises the required rent is derived.

The customer case follows in a second step. Vasakronan here decides what type of tenant they want to lease out premise to and whether the potential tenant is suitable to fulfill the overall return goal. If this is the case, the tenant is evaluated with respect to its creditworthiness. Since 2008 Vasakronan has subscribed to the credit information services by Upplysningscentralen and integrated it into its data system, allowing it to receive updated credit information on existing and prospective tenants on a daily basis. It is however, important to stress that Vasakronan mainly makes use of the so provided information when assessing new tenants. For existing tenants it is rather used as a monitoring tool and only rarely to change existing contracts. Based on the assessed creditworthiness, Vasakronan makes a decision on whether and in which amount the tenant has to provide a security at inception of the lease. The security may take the form of a bank guarantee, pre-payments or a loan against a guarantor.

In order to determine the necessary amount of the security, Vasakronan has established an analytical model. The model is grounded on four components: Rent risk (A), investment risk (B), recovery risk (C), security (D). The components are quantified and then summed up as follows: A+B+C-D. Based on the result, a formal recommendation regarding the tenant's credit risk and the required amount of security is given.

In the case that an existing tenant encounters payment difficulties, Vasakronan may take different courses of action, each with the objective to minimize damages. Among others, Vasakronan may choose to extend or rewrite the lease, enhance the security side or provide temporary rebate. In fact, Vasakronan prefers to be flexible in such circumstances, mostly in order to avoid temporarily elevated vacancy rates and the further cost that may arise when having to find a new tenant. Likewise, Vasakronan would accept a tenant with higher credit risk in order to fill vacancies. Also, in areas with high vacancy rates, the company is prepared to not require elevated rent levels or provisions from the lessee as compensation for credit risk, despite a lower credit quality of the lessee. This is due to the fact that they consider the costs of vacant premises to be significantly higher than the costs of a lessee defaulting on their payments.

5 Data Overview

In order to test our hypotheses we have made use of four major data types obtained from three different sources. The data types consist of data on individual leasing contracts, data on the financial risk of the respective lessee companies, industry data as well as a property value index and were obtained from the Svensk Fastighetsindikator (SFI) and Investment Property Database (IPD), Upplysningscentralen (UC) as well as Statistics Sweden (SCB).

5.1 Data Types

5.1.1 Lease Data

The set of individual commercial leasing contracts was obtained from SFI/IPD and constitutes the main part of our data set. IPD was established in 1985 as an independent information provider for the performance measurement of the European property industry. SFI was founded in 1997 by twelve of the major property owners in Sweden (IPD 2011).

The contracts included in the data set are drawn from the Stockholm property market for the time period 2007-2009.

For these leasing contracts two types of data are provided: First, information written on a property level, i.e. information that is the same for all contracts written on the same property. Second, it includes information that is written on a contract level and hence specific for each contract. Data on the property level includes information on location, reconstruction year of the property as specified by Swedish Tax Authorities, vacancy rate and costs for overall maintenance and property care of the building as well as operating costs and capital expenditures. Data on the contract level comprises the annual rent payment and information on whether the space is used for office or retail purposes, information on rent gearing clauses, heating clauses, area as well as the length of the lease agreement.

5.1.2 Financial Risk of Lessee

Upplysningscentralen has supplied information regarding the lessee's credit worthiness as reflected in the UC Risk Forecast as well as the number of Payment Remarks for an assessment of previous payment difficulties. This was supplemented by information on the business and the industry the lessee company is operating in.

The information from Upplysningscentralen has been merged with the lease data from SFI/IPD by the help of a company specific code that allowed matching the lessee's financial information with the individual lease contracts. However, the code is proprietary data and has been removed from the data sample after it was merged. In consequence, when accessing the dataset, we were not able to identify the single companies and hence could also not trace the contracts over the three years.

The combined data set from SFI/IPD and UC was used to test *Hypothesis (1)*.

5.1.3 Industry Data

The industry data was received from Statistics Sweden, an administrative agency and the official source for statistics in Sweden (SCB 2011), and consists of an index containing time series data for the operating profit/loss after depreciation for the time period 1990 to 2007, presented on an annual basis. The information is provided per industry, divided into 53 different main industry categories, each with an industry specification number (Finansstatistik för företag /Företagsstatistiken/ Företagens ekonomi 1980-2007).

5.1.4 Property Value Index

The property value index, known as the SFI/IPD Sweden Annual Property Index, was also received by SFI/IPD. The index is published on an annual basis and shows the market value of the property in accordance with the Swedish Valuation Guideline. These property values are grouped into 16 different property segments depending on the use of and the location of the property.[3] The index is based on standing investments, which are properties held from one annual valuation to the next one year. The index excludes any properties bought, sold, or under development during the year. (SFI/IPD 2009).

[3] (1) Retails Shopping Centres, (2) Retails Other Retails, (3) Offices Stockholm CBD, (4) Offices Stockholm Central Area, (5) Offices Rest of Greater Stockholm, (6) Offices Gothenburg, (7) Offices Malmö, (8) Offices Other Major Cities, (9) Offices Rest of Sweden, (10) Industrial, (11) Hotel and Other Commercial, (12) Residentials Stockholm Central Area, (13) Residentials Rest of Greater Stockholm, (14) Residentials Gothenburg, (15) Residentials Other Major Cities, (16) Other.

The SFI/IPD Sweden Annual Property Index has been combined with the industry data to estimate the correlation measure that is used as input for testing *Hypothesis 2*.

5.2 Data Validity

We consider SFI/IPD, UC and SCB to be large, reliable and independent companies and their data to be accurate and reliable.

What however should be stressed is that the process of combining the two separate data sets from SFI/IPD and UC into one dataset has led to missing values. In particular, we have a substantial amount of missing values for the data on the lessee credit worthiness. We assume it, however, to be a coincidence as to what values are missing and conclude that this should not impose a bias on our estimations.

6 Regression Model

In this section we specify the regression model we have applied to test our two hypotheses. We start with an outline of the model and the process of how it has been generated. Following this, we present in detail the variables that have been used in the model. In the final section we state the general adjustments and statistical tests that have been undertaken.

6.1 The Base Regression Model

To empirically test the model put forward by Grenadier (1996), we have set up the following two hypotheses:

Hypothesis (1): *A higher lessee credit risk results in a higher lease rent.*

Hypothesis (2): *A higher correlation between the lessee firm cash flow and the value of the underlying asset results in a higher lease rent.*

The hypotheses are tested by estimating three different regression models, each including a combination of variables that function as a proxy for the lessee's credit risk. In particular, we apply the UC Risk Forecast, the UC Credit Rating Categories, and the Grouped Number of Payment Remarks as proxies for the lessee's credit risk and hence to test *Hypothesis (1)*. In each of the three regression models we furthermore include a Correlation Measure that approximates the correlation between the lessee's cash flow and the underlying asset value and allows us to test *Hypothesis (2)*. The inclusion of both a credit risk variable and the correlation measures allows us to test the two hypotheses both on a separate and a joint basis.

Accordingly, the different regression models are given as follows:

Regression (1): *UC Risk Forecast and the Correlation Measure*

Regression (2): *UC Credit Rating Categories and the Correlation Measure*

Regression (3): *Grouped Number of Payment Remarks and the Correlation Measure*

The three regressions models are estimated over the time period 2007-2009 and only the contracts that were newly written for each year were included in the estimation. This allows us to test whether the lessee's credit has an impact on the rent level at the inception of the lease.

To make our three regression models comparable, we have first estimated a base regression model. All variables that are part of the base regression model are also included in the three separate regression models. The dependent variable in the estimated base regression model is the natural logarithm of the annual rent per square meter. In the determination of the base regression model, the respective credit risk and correlation variables have been excluded, which further enhances the comparability of the three models.

For assessing which independent variables to include in the base regression model, we have used the approach to add variables that makes sense from an economical perspective. The model has been regressed repeatedly, with the purpose of eliminating the variables that do not prove statistically significant on a 5% level at explaining the dependent variable. Each time the regression was run, the least significant variable out of the non-significant variables was taken out of the model. This process was repeated until all the remaining variables were significant on a 5% level.

Some variables have been omitted from the estimated regression model, even though we believe that they might have some explanatory power in explaining the rent levels. This is due to the fact that only a low number of observations for these variables was available, such that their inclusion would have severely limited the number of lease agreements available to run the regressions on.

Using the above procedure we arrive at the following base regression model, estimated by OLS:

$$\begin{aligned} lnrent = {} & a_0 + a_1 2008 + a_2 2009 + a_3 Age + a_4 (Age)^2 + a_5 OperatingCost \\ & + a_6\, Maintenance + a_7\, Capex + a_8\, PropTax + a_9 VatLiability \\ & + a_{10} Insurance + a_{11} Other + (b') Heating_i + (c') Use_i + (d') Length_i \\ & + (e') MunipCode_i + (f') CurrentUse_i + (g') Gearing + (h') Status_i + \varepsilon \end{aligned}$$

Where b’ = [b1, b2], c’ = [c1, c1], d’ = [d2, . . . , d16], e’ = [e1, . . . , e16], f’ = [f1, . . . , f13], g’ = [g1, . . . , g3], and h’ = [h1, . . . , h3] are vectors of parameters to be estimated, and a0, a1, . . . , a11 are parameters to be estimated.

The independent variables included in the above stated regression formula, are further explained in the following section.

6.2 Regression Variable Specification

This section starts by explaining how the credit risk variables and the correlation measure that we have included in the three regression models have been generated. We then continue by specifying all the control variables that are included in the base regression formula in the same order they appear in the formula above.

6.2.1 Generating the Credit Risk Variables

As stated above, we have made use of three different variables to approximate the lessee’s credit risk in *Regression (1), (2),* and *(3).*

Regression (1) uses the UC Risk Forecast for assessing the lessee’s credit risk. As explained in earlier, the score states in percentage the probability that a company will be subject to insolvency within the upcoming 12 months.

Regression (2) uses the five UC Credit Rating Categories as the variables of interest. The UC Credit Rating Category 5 herein denotes to the highest credit rating and Category 1 the lowest one. The rating categories have been included in the regression formula by constructing dummy variables for each of the five rating categories. Credit Rating Category 5 represents the base case for the dummy variable generation and constitutes 38% of the sample. The Credit Rating Categories 4, 3, 2 and 1 constitute 25%, 24%, 9% and 4% of the total sample, respectively.

Lastly, *Regression (3)* uses as variable of interest the number of payment remarks the lessee has. Due to a large range for the number of payment remarks, we have again made use of dummy variables and grouped the remarks into three groups as follows:

- Payment Remarks Group 1: 0 Payment remarks, 84% of the sample

- Payment Remarks Group 2: 1 – 5 Payment remarks, 11% of the sample
- Payment Remarks Group 3: 6 – 12 Payment remarks, 5% of the sample

As stated above, for all of the three regressions, we have included the Correlation Measure. To recapitulate, the Correlation Measure approximates the correlation between the lessee's cash flow and the underlying asset value.

For generating the measure, we have in a first step assumed that the lessee's cash flow can be estimated by the industry operating profit/loss after depreciation. The data on industry operating profit/loss after depreciation was accessible through Statistics Sweden for the years 1990 to 2007. The data was reported per industry divided in 53 industry categories each having an industry specification number. For each of the lease contracts in the dataset from IPD/UC, the same industry specification number was provided, making it possible to match the leasing contracts with the corresponding industry.

In a second step, we have assumed that the underlying asset value for the leases can be approximated by taking the summarized market value for the property per segment as provided in the SFI/IPD Annual Property Index. The index is split into 16 different property segments. The same segmentation is found in the lease dataset.

For calculating the correlation between the operating profit/loss and the underlying market value for the property types we have applied the following procedure: first, we have computed the correlation between each of the 53 industries provided in the SCB data set and the 16 property segment types. This has resulted in a 53x16 matrix of correlation measures. In a second step, each leasing contract in our sample is attributed one of the calculated Correlation Measures. This can easily be done since the individual leasing contracts in our sample contain the same identification number to describe the industry the tenant is operating in as well as the same classification for the property segment types. A correlation measure is hence attributed to a lease contract when the combination of industry type and property segment for that particular contract matches the combination used for the respective Correlation Measure. Since we did not have an observation for each combination of industry and property segment, we did not make use of all the hypothetical 53x16 combinations of Correlation Measures in the matching process.

Overall, this procedure has resulted in the most detailed approximation possible for the correlation between the lessee's cash flow and the underlying asset value.

6.2.2 Control Variable Specification

In the two following sections, a detailed specification of the control variables used in the base regression formula is given. The first section treats the first eight regular regression variables while the second section discusses the eight sets of dummy variables (b-h) constructed for the regression formula.

As can be seen from the regression formula, the natural logarithm of the annual rent per square meter is used as the dependent variable. The annual rent per square meter is estimated excluding VAT and including additional costs for property tax, heating, water, adjustments, administration costs etc. and after any rent discounts. The rent is reported on an annual basis starting from the 1st of January each year (SFI/IPD 2010).

6.2.2.1 Specification of Regular Variables

The data set includes limited information about the characteristics of the individual premises in the lease agreements. With the given information we can however control for some property specific factors. The variable age is included to control for the effective age of the building. Other property specific variables are included to control for a variety of costs, that is operating costs (Op_cost), planned maintenance and fitting (Maintenance), capital expenditures (Capex), property tax (Prop_tax), VAT liabilities (VAT Liability), insurance (Insurance) as well as cooling, water and electricity (Other).

The above mentioned variables are included in the estimated regression formula since they correspond to costs that are normally borne by the lessee. These costs are common for the property as a whole and are important to control for since they have an impact on the rent level in that the lessor negotiates the total rent with respect to these costs. Optimally, one would, instead of controlling for these factors on a separate basis, have included a property control dummy to control for all property specific factors simultaneously. Due to data availability, it was however not possible to include a control variable for the buildings in the lease contracts. In more detail, this was first due to the fact that the number of control variables in relation to the number of data points would have been unreasonably large. Second, it was not reasonable to assume that the lease contracts have been written on separate buildings over the years.

Presented in *Table* 6 are summary statistics for the variables described in this section.

Table 6 ■ Summary statistics of variables

Variable	Mean	Median	Standard deviation	Minimum	Maximum
Annual Rent per m^2	3,037.44	2,571.82	2,056.60	135.54	27,777.78
UC Risk Forecast	1.65	0.41	3.97	0.01	35.30
Number of Payment Remarks	0.4	0.00	1.41	0.00	12.00
Correlation Measure	0.59	0.68	0.29	-0.52	0.98
Operating Cost	841.33	724.63	341.75	34.84	2,111.70
Other	101.19	91.42	62.36	0.00	373.38
VAT_Liability	77.77	91.15	30.05	0.00	100.00
Maintenance	127.06	67.40	162.85	0.00	1,093.56
Age	32.29	28.00	21.89	1.00	80.00
Capex	838.42	259.84	1,487.39	0.00	7,820.71
Length	57.98	50.00	21.96	15.00	252.00
Prop_Tax	178.70	149.08	117.90	-46.06	539.77
Insurance	4.78	3.74	4.21	0.00	41.87

Where; Annual Rent per m^2 = The annual rent per square meter is estimated excluding VAT and including additional costs for property tax, heating, water, adjustments, administration costs etc. and after any rent discounts, as defined by IPD

Number of Payment Remars = an indication that payments have been mismanaged

Correlation Measure = The correlation between the lessee company's cach flows and the underlying asset value of the leased asset as specified in Grenadier (1996). The cash flow of the lessee company has been estimated by taking the industry operating profit/ loss. The underlying asset value is estimated by the IPD sector index which reports the market value of property divided into 14 different groups depending on geographic location and use of the property. The lessee companies has been divided into 53 industry groups as specified by Statistiska Centralbyrån. The correlation measure has then been calculated as the correlation between these two estimates giving 14*53 possible correlation values. Note that due to the low amount of data, not all possible values of the correlation measure are present in the data.

Operating Cost, Maintenance, Other, VAT Liability, Capex and Insurance are property specific costs, that are either paid by the lessor or the lessee depending on the lease

Age = The age of the property has been calculated by taking the last year when the property underwent a large reconstruction (värdeår). The effective age of the property is then defined by Swedish tax authorities.

Length = Length of the leasing contract

6.2.2.2 Specification of Dummy Variables

In order to control for contract and building specific factors an array of dummy variables was used. These variables control for the length of the lease contract, the municipality the building is located in, the use of the property, the start year of the contract as well as for different contract clauses that have an impact on the rent payment.

Since the regression is estimated over the time period 2007-2009, for a cross sectional data set with independent samples, we use a year dummy variable to control for year specific effect. The base case in the regression is year 2007. Hence, dummy variables have been included for the years 2008 (Y_2008) and year 2009 (Y_2009).

Two dummy variables are used to account for the different types of heating contracts included in the lease agreement. The two different types of heating clauses determine whether it is the landlord or the lessee that pays for the heating. The majority of leasing contracts, i.e. 55%, includes heating (Heating1). The other heating clause type (Heating2) constitutes the remaining 45% of the contracts and excludes heating such that the tenant pays in addition to the rent for heating.

To control for the type of property, a total of 13 dummy variables have been included (Current_use). What type of property the building is, is determined by what type of property the majority of the building is intended for i.e. over 50%. The most common property types in our data set are Shopping centers (12%), Offices (74.3%), and Residentials (8.1%).

Two dummy variables are used to control for whether the lessee uses the space for office or retail purposes (Use). In contrast to the current use variable (Current_use) that controls for characteristics on a property level, the use variables control for office or retail spacing on a contract and hence per lessee level . The base case (Use2) is that the lessee uses the space for office purposes, which constitutes 78% of the contracts. The remaining 22% of the contracts are used for retail purposes (Use1). This is an important factor to control for due to the different characteristics of the office and retail leasing markets. These two categories are different for instance in terms of rent levels and property characteristics and different factors might therefore explain the rent levels set in the lease contracts.

The length of the lease contracts are accounted for using 15 different dummy variables (Length) depending on how many years the contracts stretch over. The length of the contracts in the data sample ranges from 1 to 21 years with the main part of the contracts having a length of 4-5 years. Only 4% of the contracts have a shorter term than 3 years. This can be explained by the “law of tenancy” which does not allow for a floating add on clauses in the case of contracts with leasing periods shorter than three years (Fastighetsägarna 2008).

The data sample contains properties in 16 of Sweden’s 289 municipalities and therefore dummy variables are used to control for the location of the property (Munip_code). The main part of the data, 76%, is located in Stockholm and the remaining part of the sample is located in the municipalities surrounding Stockholm.

Four dummy variables were used to control for lease clauses on how the rent is geared. The base case (Garing3) constitutes around 76% of the sample and controls for the case with a normal clause geared to an index. In the other cases, the lease rents is stepped (Gearing1), geared to turnover (Gearing2) or is tied to some other type of escalation clause (Gearing4).

The data set also allows us to control for factors concerning who lets and occupies the space or if the space is vacant. This is done by adding three different control variables controlling for these characteristics (Status), whereby the most common state is that the premises are let and occupied by another owner than the lessor (99%).

For a detailed presentation of the variables used, their division into dummy variables as well as more detailed percentage numbers of the ratio for each defined dummy variable, see Appendix *Table 11*.

6.3 General Adjustments of the Regression Model

This section describes what tests and general adjustments have been done to the data and the regression models when estimating the regression outputs.

First, the regression model has been controlled for multicollinearity between the independent variables. When multicollinearity was found, the variables have not been included in the model.

Second, the residuals in the estimated regression models were tested for homogeneity of their variance (homoscedasticity) using the Breusch-Pagan test. We find that for all regressions run, we can reject the null hypothesis of a homoscedastic data sample and therefore correct for heteroscedasticity by using White's robust estimation. (Gujrati 2004)

Third, the residuals have been tested for normality, using the Jarques-Bera test. The residuals are found to not follow a normal distribution. To mitigate the problem of not normally distributed residuals, the dependent variable (the annual rent per square meter) in the estimated regression model is taken in its natural logarithmic form. This moderates, but does not eliminate the problem. The non-normal distribution increases the probability of making a Type 1 or Type 2 error, i.e. rejecting the null hypothesis when it is true or accepting the null hypothesis when it is false. A large sample size mitigates this problem and the Central Limit Theorem states that when having a large number of values, normally above 30, the effects of non-normal residuals are not too severe. (Wooldridge 2002)

Moreover, the regression model has been tested for specification errors and the omission of explanatory independent variables. These tests show some evidence of under-specification of the model. However, due to a lack of data availability this is not possible to correct for. We take into consideration, though, that this could impose potential biases to the model (Wooldridge 2002)

Finally, the regressions have been run both including and excluding outliers. These two methods result in similar estimation results, wherefore only the regression estimations excluding outliers are presented throughout the paper. Outliers have been corrected for by plotting the regression variables against the dependent variables and a correction has only been made for the most extreme outliers. After excluding outliers detected by plotting the variables, a leverage statistic test has been performed. Thereafter, we have calculated the leverage score. The leverage score indicates which observations dominate the regression results. This has been done by using weights and sensitivities and was therefore independent of the model fit. A leverage score has been calculated for each observation and in cases where the leverage score exceeded 0.2, which is considered to be the estimation level, the observation has been dropped out of the data set.

7 Empirical Findings and Interpretations

This section presents the results from the three estimated regressions. Also presented for each estimation are the results from a joint significance test (F-score test) for all of the variables of interest for each year. The test estimates whether the variables of interest for each model matter at all against the null hypothesis that the variables of interest are jointly restricted to zero. The tests are estimated in two different versions for each regression model: the first one for jointly testing *Hypotheses (1)* (excluding the Correlation Measure); the second one for jointly assessing *Hypotheses (1)* and *(2)* (including the Correlation Measure).

7.1 Results from Regression (1): UC Risk Forecast and Correlation

In this section we present the results from testing *Hypothesis (1) and (2)* through estimating *Regression (1).*

The regression has been estimated by including the following variables into the previously estimated base regression formula:

- UC Risk Score
- UC Risk Score squared
- Correlation Measure

See the Appendix, Section 11.1, for a specification of the total regression formula estimated.

The results running *Regression (1)* found in *Table 7*. The results from the test for *Hypothesis (1)* show that the squared risk score coefficient is statistically significant on 10% level in explaining the rent level while the risk coefficient shows no significance. The results from the test for *Hypothesis (2)* show that the correlation measure coefficient is also statistically significant on a 10% level in this version of the estimated regression model.

From the F-tests for testing *Hypothesis (1)* and *(2)*, we can conclude that the variables included in each test are different from zero on a joint basis and hence statistically significant at explaining the rent level.

Table 7 ■ Results for Regression (1)

Independent Risk Variables	Coefficient	Robust Std. Error	Adjusted R²	Number of Observations	Joint Hypothesis Test (p-values) (excluding correlation)	Joint Hypothesis Test (p-values) (including correlation)
UC Risk Forecast	0.0176	(0.0160)				
(UC Risk Forecast)^2	-0.0014	(0.0007)*				
Correlation Measure	0.1592	(0.0952)*	0.5406	376	0.0299	0.0117

Note: Regression results from estimating regression (1) by OLS
Dependent variable is the natural logaritm of the annual rent per square meter
White-adjusted standard errors are found in the column Robust Std. Error
*** 1% significance level; **5% significance level; *10% significance level

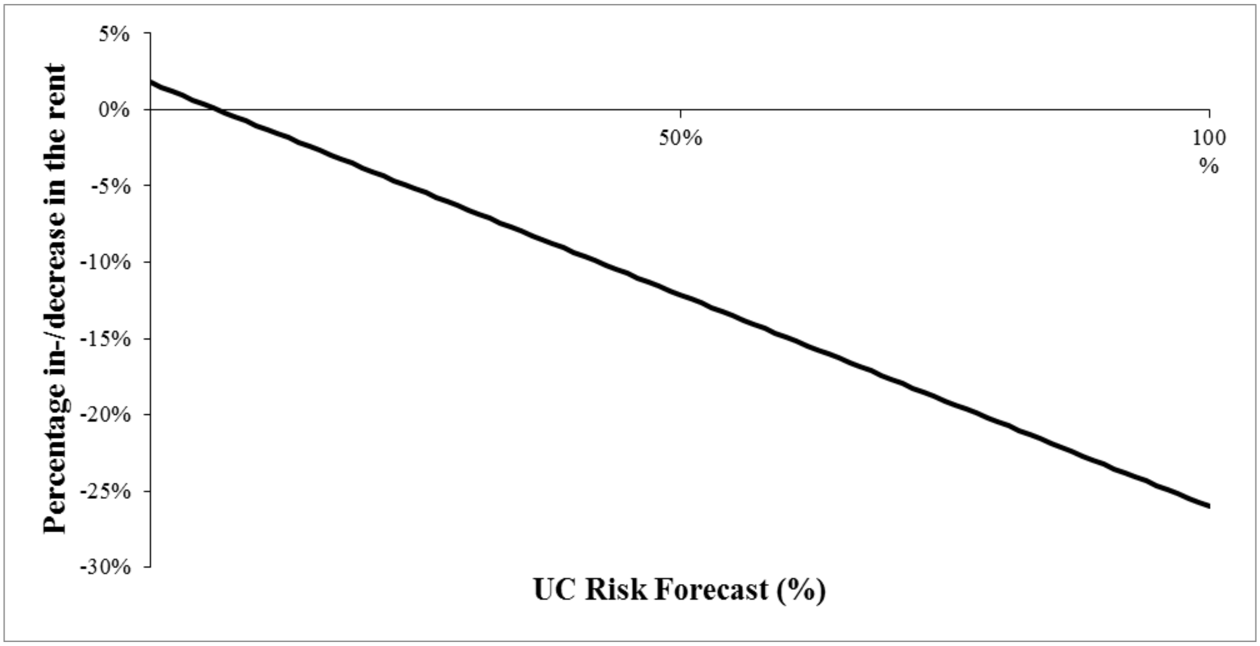
Correlation Measure = The correlation between the lessee company's cach flows and the underlying asset value of the leased asset as specified in Grenadier (1996). The cash flow of the lessee company has been estimated by taking the industry operating profit/ loss. The underlying asset value is estimated by the IPD sector index which reports the market value of property divided into 14 different groups depending on geographic location and use of the property. The lessee companies has been divided into 53 industry groups as specified by Statistiska Centralbyrån. The correlation measure has then been calculated as the correlation between these two estimates giving 14*53 possible correlation values. Note that due to the low amount of data, not all possible values of the correlation measure are present in the data.

The first joint hypothesis test (excluding correlation) shows the result for the test of the restriction that the risk coefficient and the squared risk coefficient are not priced in leasing agreements i.e. that UC Risk Forecast = UC Risk Forecats squared = 0
The second joint hypothesis test (including correlation) shows the result for the test of the restriction that the risk coefficient, the squared risk coefficient and the correlation are not priced in leasing agreements i.e. that UC Risk Forecast = UC Risk Forecast squared = Correlation Measure= 0

Examining the signs of the coefficients, we find that the correlation measure has a positive impact on the rent level, implying that a higher correlation measure results in a higher rent payment. To show the effects of how a one percentage change in the risk score will impact the dependent variable, the natural logarithm of the annual rent per square meter, a graph was constructed (*Figure 5)*.

The graph shows that the marginal impact from an increase in the UC Risk Forecast is changing as the risk score is changing whereby the sign of the marginal impact changes when the Risk Forecast is equal to 6.3%. For lower risk score values there is a positive marginal impact, meaning that for Risk Forecast values below 6.3% an increase in the Risk Forecast will lead to an increase in the rent payment. In the same manner, for Risk Forecast values higher than 6.3%, an increase in the Risk Forecast will lead to a decrease in the rent level. The Risk Forecast mean is 1.7%, implying that an increase in the Risk Forecast around these levels would result in an increase in the rent payment of around 1.3% per year.

Figure 5 ■ Marginal impact on the rent from increases in the UC Risk Forecast



Overall, the results from testing *Hypothesis (1)* are in line with what one would expect from Grenadier's (1996) model. Grenadier (1996) states that a higher lessee credit risk should result in a higher rent payment. This pattern is also found in our results when the Risk Forecast takes on values below 6.3%. However, our results also show that when the lessees have a higher Risk Forecast, an increase in the Risk Forecast has a decreasing effect on the rent, which is not in line with Grenadier's model. We will discuss possible explanations of these findings in the analysis section.

Likewise, the results from testing *Hypotheses (2)* are in line with what is expected from the model by Grenadier (1996): the Correlation Measure coefficient is statistically significant and leads to an increase in the rent level as it rises

7.2 Results from Regression (2): UC Rating Groups and Correlation

In this section we test *Hypothesis (1)* and *(2)* by estimating *Regression (2)* including the UC Rating Groups and the Correlation Measure. The regression has been estimated by including the following variables into the previously estimated base regression formula:

- UC Rating Group 1, UC Rating Group 2, UC Rating Group 3, UC Rating Group 4, and UC Rating Group 5 (base case), where Group 1 is the least credit worthy and Group 5 is the most credit worthy
- Correlation Measure

See the Appendix, Section 11.1, for a specification of the total regression formula estimated.

The results running *Regression (2)* are found in *Table 8*.

Table 8 ■ Results for Regression (2)

Independent Risk Variables	Coefficient	Robust Std. Error	Adjusted R^2	Number of Observations	Joint Hypothesis Test (p-values) (excluding correlation)	Joint Hypothesis Test (p-values) (including correlation)
UC Credit Rating Category1	-0.0706	(0.0957)				
UC Credit Rating Category2	0.1271	(0.1017)				
UC Credit Rating Category3	-0.0362	(0.0517)				
UC Credit Rating Category4	-0.0510	(0.0599)				
Correlation Measure	0.1736	(0.0960)*	0.5424	376	0.3904	0.1462

Note: Regression results from estimating regression (2) by OLS
Dependent variable is the natural logaritm of the annual rent per square meter
White-adjusted standard errors are found in the column Robust Std. Error
*** 1% significance level; **5% significance level; *10% significance level

Correlation Measure = The correlation between the lessee company's cach flows and the underlying asset value of the leased asset as specified in Grenadier (1996). The cash flow of the lessee company has been estimated by taking the industry operating profit/ loss. The underlying asset value is estimated by the IPD sector index which reports the market value of property divided into 14 different groups depending on geographic location and use of the property. The lessee companies has been divided into 53 industry groups as specified by Statistiska Centralbyrån. The correlation measure has then been calculated as the correlation between these two estimates giving 14*53 possible correlation values. Note that due to the low amount of data, not all possible values of the correlation measure are present in the data.

The first joint hypothesis test (excluding correlation) shows the result for the test of the restriction thatUC Rating Category 1, 2, 3, 4 are not priced in leasing agreements i.e. thatUC Rating Category 1 = UC Rating Category 2 = UC Rating Category 3 = UC Rating Category 4 = 0
The second joint hypothesis test (including correlation) shows the result for the test of the restriction that UC Rating Category 1, 2, 3, 4 and the Correlation Measure are not priced in leasing agreements i.e. that UC Rating Category 1 = UC Rating Category 2 = UC Rating Category 3 = UC Rating Category 4 = Correlation Measure = 0

Interpreting the results presented in the table, we find that none of the Rating Group coefficients are statistically significant on a 10% level. The results from the test for *Hypothesis (2)* show that the Correlation Measure coefficient is statistically significant on a 10% level in explaining the rent level also in this version of the estimated regression.

The two F-tests, for testing *Hypothesis (1)* and *(2)*, show that we cannot conclude that the variables are different from zero on a joint basis.

Looking at the signs of the coefficients, we find that the Correlation Measure has again a positive coefficient. The Rating Groups, however, have a pattern of negative coefficients, indicating that they have a decreasing effect on the rent level. However, one should note that they are not statistically significant after all. The only coefficient that stands out from the pattern is the positive coefficient for Rating Group 2. The positive coefficient implies that a lessee in Rating Group 2 would be subject a higher rent payment than a lessee in any of the other Rating Groups.

The results from testing *Hypothesis (1)* are, with exception of Rating Group 2, contradicting the model by Grenadier (1996) both due to the insignificant values as well as the negative signs of the coefficients. We can therefore conclude that when testing *Hypothesis (1)* with this estimated regression model, credit risk does not seem to be priced in lease agreements.

The results from testing *Hypotheses (2)* are also in this version of the estimated regression model in line with what is expected from Grenadier's (1996) model.

7.3 Results from Regression (3): Payment Remarks Groups and Correlation

In this section we test *Hypothesis (1) and (2)* by estimating *Regression (3)* including Payment Remarks Groups and the Correlation Measure as the variables of interest. The regression has been estimated by including the following variables into the previously estimated base regression formula.

- Payment Remark Group 1, Payment Remark Group 2, Payment Remark Group 3 (base case), where Group 1 is the least credit worthy and Group 3 the most credit worthy.
- Correlation Measure

See the Appendix, Section 11.1 for a specification of the total regression formula estimated.

The results running the regression formula presented above, are found in *Table 9*. Looking at the results, we find that none of the Payment Remark Group coefficients are statistically significant on 10% level. The results from the test for *Hypothesis (2)* show that the correlation measure coefficient is statistically significant also in this version of the estimated regression model, this time even on a 1% level.

Table 9 ■ Results for Regression (3)

Independent Risk Variable	Coefficient	Robust Std. Error	Adjusted R²	Number of Observations	Joint Hypothesis Test (p-values) (excluding correlation)	Joint Hypothesis Test (p-values) (including correlation)
Payment Remark Group 2	-0.0546	(0.0825)				
Payment Remark Group 1	-0.0419	(0.0964)				
Correlation Measure	0.2295	(0.0878)***	0.5458	390	0.7424	0.0761

Note: Regression results from estimating regression (2) by OLS
Dependent variable is the natural logaritm of the annual rent per square meter
White-adjusted standard errors are found in the column Robust Std. Error
*** 1% significance level; **5% significance level; *10% significance level

Correlation Measure = The correlation between the lessee company's cach flows and the underlying asset value of the leased asset as specified in Grenadier (1996). The cash flow of the lessee company has been estimated by taking the industry operating profit/ loss. The underlying asset value is estimated by the IPD sector index which reports the market value of property divided into 14 different groups depending on geographic location and use of the property. The lessee companies has been divided into 53 industry groups as specified by Statistiska Centralbyrån. The correlation measure has then been calculated as the correlation between these two estimates giving 14*53 possible correlation values. Note that due to the low amount of data, not all possible values of the correlation measure are present in the data.

The first joint hypothesis test (excluding correlation) shows the result for the test of the restriction that the Payment Remark Group 1 and the Payment Remark Group 2 are not priced in leasing agreements i.e. that Payment Remark Group 1 = Payment Remark Group 2 = 0
The second joint hypothesis test (including correlation) shows the result for the test of the restriction that Payment Remark Group 1, the Payment Remark Group 2 and the are not priced in leasing agreements i.e. that Payment Remark Group 1 = Payment Remark Group 2 = Correlation Measure = 0

The results for the F- tests testing *Hypothesis (1)* show that Payment Remark Groups variables seem to be jointly equal to zero. When jointly testing *Hypothesis (1)* and *(2)*, we find that the variables are not jointly equal to zero, however the reason for this seems to stem from the inclusion of the Correlation Measure. Looking at the signs of the coefficients, we find that the Correlation Measure, just as in *Regression (1)*, has a positive coefficient. The results also show that the Payment Remarks Groups have a negative coefficient, indicating that they have a negative impact on the rent level.

Payment Remarks Group 3 is the most credit worthy group, while Payment Remarks Group 1 the least credit worthy. Therefore, the regression results found indicate that a lessee in Rating Group 1 and 2 would have a lower rent payment than a lessee with no payment remarks. The rent would be 4.2% and 5.5% lower, respectively. The mean amount of payment remarks for a lessee are 0.4, implying that the majority of the lessees are in Payment Remarks group 2 or 3.

The results from testing *Hypotheses (1)* suggest that credit risk is not priced in leasing agreements using this estimated regression formula which contradicts Grenadier (1996), both due to the insignificant values as well as the negative signs of the coefficients. Stated differently, we can conclude that the number of Payment Remarks the lessee has does not seem to be taken into consideration when determining the rent level. As opposed to this, we can reject the null hypothesis for *Hypothesis (2)* and conclude that the Correlation Measure seems to be also in this case priced in leasing agreements as proposed by Grenadier (1996).

7.4 Comparing the Regression Results with Grenadier's (1996) Model

Summarizing we find that only the UC Risk Forecast and the Correlation Measure are statistically significant at explaining the rent level. Below we relate these results to what would be expected from the model by Grenadier. This is done in two sections, the first one treating the findings from testing *Hypothesis (1)* and the second one treating the findings from testing *Hypothesis (2).*

7.4.1 Hypothesis (1)

We can conclude that the results from testing *Hypothesis (1),* i.e. if credit risk is priced in lease agreements, support to some extent the model put forward by Grenadier (1996).

We find that the UC Risk Forecast proves to be statistically significant and to have a positive impact on the rent level for values below 6.3%. This clearly indicates that a higher credit risk may indeed result in a higher rent, which is in line with expectations from Grenadier's article. However, the relationship is reversed for UC Risk Forecast values above 6.3%, implying that a higher credit risk would result in a lower rent. This is a contradiction to Grenadier's (1996) model and leads us to assume that other market factors and characteristics may have affected the results.

As opposed to the UC Risk Forecast, we do not find the UC Credit Rating Category and the Payment Remark Groups' coefficients to be statistically significant. We conclude that there seems to be an overall negative pattern of the effect that a higher value of these coefficients would have on the rent level. This is the opposite of what Grenadier's model postulates.

7.4.2 Hypothesis (2)

From testing *Hypothesis (2),* i.e. if an increase in the Correlation Measure is priced in leasing agreements, we can conclude that there is complete empirical evidence that an increasing correlation between the lessee's cash flow and the underlying asset value results in an increased rent level. This is fully in line with Grenadier's (1996) model.

8 Analysis of Results

In this section we aim to give plausible explanations for the results found in our empirical study and why they are in line with or contradict Grenadier's model. We support our explanations with results from previous empirical studies as well as input from market professionals (Vasakronan, Statistiska centralbyrån, IPD/SFI).

The analysis is divided into two parts, the first one analyzing the results from testing *Hypothesis (1)* and the second one analyzing the results from testing *Hypothesis (2)*. The first section in its turn is divided into three subsections: the first subsection discusses possible reasons for only finding significant results for the UC Risk Forecast as an approximation for credit risk; the second and third subsection discuss the impact of the UC Risk Forecast on the rent level for forecast values below 6,3% and above 6.3%, respectively.

8.1 Hypothesis (1)

8.1.1 Comparison of Results for the Credit Risk Proxies

In the following section, a possible explanation as to why we find statistical significance for the UC Risk Forecast while the UC Rating Groups and the Grouped Number of Payment Remarks are not significant, is given.

We believe that a plausible reason for this outcome is that the lease contract data from SFI/IPD is collected from their member companies, which are large property owners (Per Alexandersson, IPD). Data from UC is not public, but something property owners have to pay for. The credit information from UC is market leading on the Swedish market and it is something that Vasakronan has daily access to. (Per Alexandersson, IPD) (Ulrik Elg, Vasakronan) One could therefore assume that this is information that lessors in our data set have access to.

The information Payment Remarks for a lessee is publically accessible whereby also lessors who do not have access to UC's services could still get credit information on the lessee's Payment Remarks from other sources. The UC credit risk data is, however, superior to the Grouped Number of Payment Remarks variable as a measure for the lessee credit risk, since it takes the number of Payment Remarks into consideration but also includes a large amount of complementary information. Given the superiority of the data from UC and that lessors in our sample are large property owners, it is not surprising to find that they seem to consider the UC Risk Forecast and not the number of Payment Remarks.

The pattern of negative coefficients for the Payment Remark Groups, are in line with the pattern we find of UC Risk Forecast above 6.3% having a negative impact on the rent level.

It is more puzzling to find that the UC Credit Rating Groups are not statistically significant and show a pattern of negative coefficients. However, this might simply be due to the distribution of the data sample and the fact that *Regression (1)*, with the UC Risk Forecast and the squared UC Risk Forecast, better captures this distribution.

8.1.2 Explanation for UC Risk Forecast Values Below 6.33%

For the first part, we believe that the increasing effect that a higher UC Risk Forecast value has on the rent could be explained by the fact that lessors do take lessee credit risk into account when determining lease rents.

Despite that and as mentioned previously, we do not find evidence of that the credit risk of the lessee is taken into consideration in determining the rent level given how standardized leasing contracts are structured. Investigating how Vasakronan works with the issue of lessee credit risk, we find that the company does have daily access to UC's systems. Also during the interview with Ulrik Elg, he stated that the information from the UC database is considered when negotiating the lease terms and the negotiations could potentially be influenced by the credit information Vasakronan has access to. What we also see, is that the lessee's credit risk is typically accounted for by requiring securities and prepayments in roughly 50% of the contracts. (Ulrik Elg, Vasakronan)

We therefore find it likely that, even though the rent level is determined with the market rent as the basis and Vasakronan do not have clear public guidelines of how to take the credit risk into consideration for adjusting the rent level, they still do to an extent. This is due to the fact that the exact rent level determined in the contract is eventually based on a negotiation between the lessor and the lessee and it seems likely that throughout the negotiation process the lessor could enforce an upward pressure on the rent level for a less creditworthy lessee. We also believe this conclusion to be general and applicable for the other large property owners (Interview with Ulrik Elg, Vasakronan).

8.1.3 Explanation for UC Risk Forecast Values Above 6.33%

For the second part, we believe that the decreasing effect that an increase in the UC Risk Forecast for values above 6.33% has on the lease rent could be explained by the following factors:

One possible explanation is based on the use of a combination of rents and provisions to adjust for the lessee credit risk. Both Grenadier (1996) and Realdon (2006) reason that contractual provisions can significantly reduce the credit risk of a financial lease and are a way of compensating the lessor for lessee credit risk. A combination of rent payments and provisions would therefore be an equally sufficient way to compensate the lessor for lessee credit risk, as would be demanding a higher rent payment.

Our estimated regression models do unfortunately not include variables that control for such provisions, wherefore the effects they may have on the lease rent level were not adjusted for. Based on the theoretical explanations by Grenadier (1996) and Realdon (2006), the inclusion of these provisions in the contract should, however, result in a lower rent level. Given that it is common for property owners to require provisions for lessees with a low creditworthiness, the impact of these provisions might explain the decreasing effect on the rent level the UC Risk Forecast has for values above 6.3% and hence a higher projected credit risk.

Another plausible explanation for the pattern of a negative effect on the rent level as a result of an increase in the UC Risk Forecast for higher risk forecast values, is the fact that the estimated regression model used does not control for property specific characteristics. Due to data availability, we do not control for a variety of property specific factors, such as the exact location of the building, the condition of the property or other positive/negative features of the premise such as what floor it is located on, view etc. Assuming that a less credit worthy lessee, i.e. a lessee with low liquidity and higher credit risk, often is a less successful company and therefore rents premises with low rents in comparison to other premises in the same area, this could explain the pattern of a decreasing rent level that results from an increase in the UC Risk Forecast for values above 6.33%.

Since the Stockholm property market, is characterized by relatively low vacancy rates, lessors tend to choose lessees with a relatively high credit quality. However, the market vacancy rates are also important to consider given that a higher vacancy rate imposes high costs on the lessor. As mentioned by Ulrik Elg, Vasakronan is prepared to not require elevated rent levels or provisions from the lessee as compensation for credit risk in areas with higher vacancy levels even if the lessee is subject to higher credit risk. The vacancy level of the building is also a factor that the estimated regression models used in the study do not control for due to data availability. This implies that the mentioned effect of lower rent levels and omission of required provisions in less attractive areas/buildings with high vacancy rates are not controlled for. This would in our case turn out in line with the pattern we see with lower rent levels for lessees with a high credit risk.

8.2 Hypothesis (2)

The results given from testing *Hypothesis (2)* indicate that there is evidence supporting Grenadier's (1996) idea that an increase in the Correlation Measure for the correlation between the lessee cash flow and the underlying asset value has an increasing impact on the rent level.

From an empirical perspective, we find these results again somewhat surprising given that in a standardized lease contract, the correlation does not seem to be considered when determining the rent level (Ulrik Elg, Vasakronan; Fastighetsägarna, 2008).

Furthermore, information on the UC Risk Forecast, the UC Credit Rating Categories and the Payment Remark Groups is information that is more easily accessed and that large property owners, such as Vasakronan, presumably have immediate access to. As opposed to that, the Correlation Measure needs to be calculated separately and estimated from historical numbers by the lessor itself, which is more cumbersome. We would therefore find it surprising that this would be considered and find it possible that there is another explanation as to why we find evidence of the correlation measure being priced. We have arrived at the following explanation for the results pattern:

The Correlation Measure estimates the correlation between the market values of the underlying properties from the IPD/SFI index and the industry operating profit/loss. Given this, we can assume that in the case of a high positive Correlation Measure, the business cycles of the lessee company and the property market are similar.

The market value of a property is determined by the rent levels through discounted cash flow models (Interview, Ulrik Elg, Vasakronan). The rent in its turn is determined by market forces of supply and demand. Therefore, if a lessee has a high correlation with the property market it is expected to also have a high correlation with the rent levels.

Since the market value for properties in Sweden has been increasing substantially during the estimation window used in this study (1990-2007), see *Figure 1*, an industry with a high correlation with the property market would have had a positive outlook too during the aforementioned period. Assuming that a successful company with a high operating profit is prepared to pay more for their premises than a less successful company and therefore on average rents premises that are superior in factors that our estimated regression model does not account for, this might be a possible explanation to the significant correlation measure.

8.3 Comparison with Previous Research

Since this study, to the best of our knowledge, is the first one to empirically assess if an increase in the Correlation Measure leads to an increase in the rent level as suggested in the model by Grenadier (1996), we cannot directly compare our findings. In the following sections, we try, however, to compare our findings of how the credit risk impacts the rent level with results found in studies we have highlighted in the section on previous research.

Realdon (2006) concludes that for financial leases, an increase in the credit risk would result in a lower credit spread, especially when the lease includes prepayments and is subject to early defaults of the lessee. This is not something that we can conclude since we cannot control for prepayments and provisions in our estimated regression model. However, this could be an explanation for the results showing a decreasing impact of a higher credit risk for UC Risk Forecast values above 6.33%. We believe that this result is due to the fact that it is a common measure to demand provisions and prepayments from lessees as a compensation for low creditworthiness (Ulrik Elg, Vasakronan). Depending on the amount of provisions and prepayments, the rent might be subject to a downward adjustment in the case of more risky lessees.

The study by Sorenson and Johnson (1977) shows that the use of collaterals and provisions seems to decrease rent levels and that they are very common on the U.S commercial leasing market. The authors find that as much as 23% of the lease contracts were secured by collateral and as much as 65% of the contracts required prepayments. Provisions seem to also be common for the Swedish commercial property leasing market. Ulrik Elg estimates that over 50% of their lease contracts include some type of provision. However, provisions are not controlled for in our estimated regression model. Given that they are more common for lessees with a low credit quality, the provisions might be a likely explanation decreasing relation between the UC Risk Forecast and the rent level for Risk Forecast values above 6.33%.

8.4 Other Findings, Including Control Variables

This section aim to compare additional results found from running our estimated base regression model, to findings in previous research on leases and lease agreements. We aim at pointing out the most interesting results and comparing them with previous research.

First of all, we find that the term of the lease contracts is significant on a joint basis at explaining the rent level. There is, however, no clear pattern as to whether shorter or longer terms have an increasing or decreasing effect on the rent level. A possible explanation might be that for a leasing contract with a longer time to maturity a risky tenant must pay a higher premium compared to a risk free tenant. This effect is however offset by the additional costs incurred in a shorter contract (Englund, Gunnelin, Hoesli and Söderberg, 2004). Comparing our results to what others have found, Benjamin, Boyle, Sirmans (1990) find that longer lease terms have a negative impact on the rent level. Gunnelin, and Söderberg (2003) show that the lease term has both positive and negative implications for the lease rate depending on the length of the lease which is in line with the results found in this study.

Secondly, we find that the age of the building has a negative relation to the rent level and that the squared age variable has a positive impact on the rent level. This is in line with what Gunnelin and Söderberg (2003) as well as Englund, Gunnelin, Hoesli and Söderberg (2004) found for the age variable included in their studies. This is in line with the fact that rent levels on average tend to be higher for newly constructed buildings (Ulrik Elg, Vasakronan).

Thirdly, we find that both when the rent is stepped and when it is indexed to the lessee turnover, the rent level is lower compared to normal leases. Both, Benjamin, Boyle and Sirmans (1990) and Englund, Gunnelin, Hoesliand Söderberg (2004) show similar results when testing for rent escalation clauses.

Finally, an array of property specific variables proves to be significant at explaining the rent level. For example, we find that the current use of the property, i.e. what the majority of the property is used for, as well as the municipality in which the property is located can explain the rent level. The signs of the coefficients for the dummy variables used are both positive and negative, depending on which use/municipality they control for. This is not very surprising, due to different market prices in more and less attractive areas as well as for different types of properties. It also supports the findings by Glascock, Jahanian and Sirmans (1990) who show that the the building class and location have a rent explaining power. Unlike our results however, they find the effects from these variables to be positive. Additionally, several variables for building specific costs were significant in our sample. This is in line with previous studies such as Englund, Gunnelin, Hoesli and Söderberg (2004) and Glascock, Jahanian and Sirmans (1990) control for in their studies.

In addition to the above findings, we conclude that there is a significant difference in the rent level, depending on whether the premise is used for office or retail purposes. Furthermore, the area variable was shown to not be significant at a 5% level. This again is in line with Gunnelin and Söderberg (2003).

Please see the Appendix *Table 11* for total output from the base regression model and hence a complete overview for the findings for the different groups of variables.

8.5 Further Regression Results

To summarize the main findings so far, we do find that there seems to be an initial pricing impact on the lease rent from an increase in the UC Risk Forecast or the Correlation Measure, however, this initial impact does not tell us how credit risk and the Correlation Measure is accounted for over time.

To investigate this matter, we have estimated an additional regression model. This was done by including lease contracts written over the time period 1972-2009 into the estimated base regression model. From running the regressions we can conclude that the initial pricing impact of the credit risk and the Correlation Measure seems to vanish over time and hence that a decrease in the lessee's creditworthiness is not reflected in an upward adjustment of the lease rent in an existing contract.

One should note that also this regression model does not control for provisions. Nevertheless, we find it plausible to assume that the decreasing pattern that an increase in the credit risk or the Correlation Measure has on the lease rate might be the result of securities that compensate for the lessee's credit risk.

For a complete reasoning of the matter and the estimated regression model and results for the pricing impact over time, please see the Appendix.

9 Conclusion

9.1 Concluding Remarks

The aim of this study was to empirically investigate the impact of a lessee's credit risk on the rent level in commercial property leases. Our investigations are based on the theoretical model by Grenadier (1996). We have transferred his postulations to the market for commercial property leases and empirically test the following two hypotheses:

Hypothesis (1): *A higher lessee credit risk results in a higher lease rent.*

Hypothesis (2): *A higher correlation between the lessee firm cash flow and the value of the underlying asset results in a higher lease rent.*

As an approximation for the credit risk of the lessee, three different variables were used: the UC Risk Forecast, the UC Credit Rating Categories and the Payment Remark Groups.

Additionally, we have calculated a Correlation Measure as an estimate for the correlation between the lessee firm cash flow and the value of the underlying property market.

Overall, we arrive at the following conclusions:

- A higher lessee credit risk results in a higher lease rent for values of the UC Risk Forecast below 6.33%. For values above 6,33%, the pattern is reversed. This is partially in line with the model by Grenadier (1996).
- A higher correlation between the lessee firm cash flow and the value of the underlying asset results in a higher lease rent. This is fully in line with the expectations from the model by Grenadier (1996)
- The results indicate an initial pricing effect, which is not controlled for over time, implying that as the credit risk or the Correlation Measure of the lessee changes, the lease rent will not be adjusted.

Possible empirical explanations for the results found are that the credit risk of a lessee is something that is considered by lessors. However, from interviews with market experts we find that the most common way to practically account for lessee credit risk is through securities such as bank guarantees. Summarizing, we find empirical support for the model by Grenadier (1996). However, the empirical results are not fully in line with common market practice.

From the insights into the common market practice, we can conclude that credit risk is something that is considered by property owners when assessing potential lessees. However, our results indicate that this is not done to a sufficient extent and more focus should be turned toward this question. Examples of how to do this would be through adjusting the rent level for the lessee's credit risk when determining the lease rent or by including clauses in the contracts that allow adjusting the rent level and the amount of securities in response to changes in the lessee credit risk. However, the costs of focusing further on the issue must of course be offset by potential gains from doing so.

9.2 Limitations to the conducted and suggestions for further research

The main limitations to the study herein conducted result from a lack of data availability. Due to limit access to data on commercial property leases, we were restricted to the variables that were comprised in the original data set. As a result of missing values, some of the variables with potentially explanatory power also had to be omitted from the regression. Additionally, we were not able to run separate regressions for the two commercial property segments office and retail. Overall, the data restrictions limited our ability to undertake tests with additional variables that might have helped to further explain our results or prove significant in explaining the rent level.

As regards the set-up of our base regression model, one set of variables we lacked was the set of specific property characteristics. This includes the exact location, floor level and degree of modernization of the building as well as a property specific number for the identification of the properties over the years. Earlier studies have shown that the respective characteristics have a high explanatory power with respect to the rent level (e.g. Englund, Gunnelin, Hoesli, Söderberg 2004). The exclusion of such variables naturally imposes a bias on our regression results. Another apparent advantage would have been the possibility to identify the single leasing contracts over time so as to be able to organize the data set as panel data.

With respect to *Hypothesis (1),* a drawback was the absence of data regarding provisions and pre-payments for the individual lease agreements. Given their relevance with respect to the mitigation of credit risk, the omission of such data limits the generalizability of our results. In particular, actual figures on the amount of security deposits and bank guarantees could help to quantify their impact on the rent level. We therefore suggest that further empirical research includes these variables in order to find more plausible explanations for the pattern we find. In relation to this, it would have also been also interesting to extend the set of credit risk variables and test for other proxies for the creditworthiness and financial health of the lessee such as the return on assets.

With respect to our results from testing *Hypothesis (2)*, we suggest further research on the factors that have caused the Correlation Measure to have a significant impact on the rent level despite it being not directly considered by property owners in the process of setting the rent.

In addition to the inclusion of further variables and the organization of the data set, we believe that it would prove useful to extend the sample period to also include years prior to the crisis.

Finally, from a more broad perspective further research on leasing should focus on empirical studies in order to close the existing gap between the suggested hypothetical models and their empirical verification. Efforts should be made to obtain larger supra-regional samples that allow for a better generalization of results and to countervail the hitherto existing focus on the US market.

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11 Appendix

11.1 Overview of Regression Models

Regression (1)

$$
\begin{aligned}
lnrent = a_0 &+ a_1 UC\ Risk\ Forecast + a_2 (UC\ Risk\ Forecast)^2 + a_3 Correlation\ Measure \\
&+ a_4 2008 + a_5 2009 + a_6 Age + a_7 (Age)^2 + a_8 OperatingCost \\
&+ a_9\ Maintenance + a_{10}\ Capex + a_{11}\ PropTax + a_{12} VatLiability \\
&+ a_{13} Insurance + a_{14} Other + (b') Heating_i + (c') Use_i + (d') Length_i \\
&+ (e') MunipCode_i + (f') CurrentUse_i + (g') Gearing + (h') Status_i + \varepsilon
\end{aligned}
$$

Where b’ = [b1, b2], c’ = [c1, c1], d’ = [d2, . . . , d16], e’ = [e1, . . . , e16], f’ = [f1, . . . , f13], g’ = [g1, . . . , g3], and h’ = [h1, . . . , h3] are vectors of parameters to be estimated, and a0, a1, . . . , a13 are parameters to be estimated.

Regression (2)

$$
\begin{aligned}
lnrent = a_0 &+ a_1 UC\ Credit\_Rating\_Category1 + a_2 UC\ Credit\_Rating\_Category2 \\
&+ a_3 UC\ Credit\_Rating\_Category3 \\
&+ a_4 UC\ Credit\_Rating\_Category4 + a_5 2008 + a_7 2009 + a_8 Age \\
&+ a_9 (Age)^2 + a_{10} OperatingCost + a_{11}\ Maintenance + a_{12}\ Capex \\
&+ a_{13}\ PropTax + a_{14} VatLiability + a_{15} Insurance + a_{16} Other \\
&+ (b') Heating_i + (c') Use_i + (d') Length_i + (e') MunipCode_i \\
&+ (f') CurrentUse_i + (g') Gearing + (h') Status_i + \varepsilon
\end{aligned}
$$

Where b’ = [b1, b2], c’ = [c1, c1], d’ = [d2, . . . , d16], e’ = [e1, . . . , e16], f’ = [f1, . . . , f13], g’ = [g1, . . . , g3], and h’ = [h1, . . . , h3] are vectors of parameters to be estimated, and a0, a1, . . . , a16 are parameters to be estimated.

Regression (3)

$$
\begin{aligned}
lnrent = a_0 &+ a_1 Payment\_Remark\_Group1 + a_2 Payment\_Remark\_Group2 \\
&+ a_3 Correlation\ Measure + a_4 2008 + \ a_5 2009 + \ a_6 Age + a_7 (Age)^2 \\
&+ a_8 OperatingCost + a_9\ Maintenance \ \ + a_{10}\ Capex\ + a_{11}\ PropTax \\
&+ a_{12} VatLiability + a_{13} Insurance + \ a_{14} Other + (b') Heating_i + (c') Use_i \\
&+ (d') Length_i + (e') MunipCode_i + (f') CurrentUse_i + (g') Gearing \\
&+ \ (h') Status_i + \varepsilon
\end{aligned}
$$

Where b’ = [b1, b2], c’ = [c1, c1], d’ = [d2, . . . , d16], e’ = [e1, . . . , e16], f’ = [f1, . . . , f13], g’ = [g1, . . . , g3], and h’ = [h1, . . . , h3] are vectors of parameters to be estimated, and a0, a1, . . . , a14 are parameters to be estimated.

11.2 Further Variable Specifications

11.2.1 Control Variables

Table 10 ■ Estimated Regression Output from Base Regression Model

The table shows the results from estimating the base regression model in section 6.1. Also presented in the table is an F-test of join significance between the dummy variable groups. Included as well are the regression R-squared and number of observations. This is an outline of the estimated base regression, to which the credit variables have been included at a later stage.

Control Variables	Coefficient	Robust Std. Error	Adjusted R²	Number of Observations	Joint Hypothesis Test (p-values)
y_2008	0.1850	(0.0382)			
y_2009	0.0879	(0.0385)			0.0000
age	-0.0128	(0.0033)			
agesq	0.0002	(0.0000)			
operating_cost	0.0005	(0.0001)			
maintenance	-0.0005	(0.0001)			
capex	0.0001	(0.0000)			
prop_tax	0.0006	(0.0002)			
vat_liability	-0.0020	(0.0006)			
insurance	0.0067	(0.0035)			
other	-0.0007	(0.0003)			
heating2	-0.0378	(0.0345)			
use1	0.3470	(0.0490)			
length2	-0.0394	(0.0829)			
length3	0.0677	(0.0695)			
length5	0.1120	(0.0720)			
length6	0.1529	(0.0663)			
length7	0.0174	(0.1155)			
length8	0.2545	(0.1015)			
length9	-0.1667	(0.1730)			
length10	-0.0068	(0.1701)			
length11	-0.1446	(0.1322)			
length12	-0.2330	(0.2299)			
length13	0.4450	(0.0735)			
length14	0.5070	(0.3160)			
length15	(omitted)	-			
length16	-0.0665	(0.1246)			0.0000
munip_code1	-0.3281	(0.1894)			
munip_code2	(omitted)	-			
munip_code3	0.2272	(0.1350)			
munip_code4	0.9797	(0.0577)			
munip_code5	-0.6673	(0.2507)			
munip_code6	-0.7339	(0.1125)			
munip_code7	-0.0207	(0.3680)			
munip_code8	0.2936	(0.1264)			
munip_code9	-0.1146	(0.1344)			
munip_code11	-0.2855	(0.0735)			
munip_code12	-0.0784	(0.0751)			
munip_code13	-0.0089	(0.0712)			
munip_code14	-0.1847	(0.0622)			
munip_code15	0.1693	(0.1029)			
munip_code16	0.5186	(0.3645)			
munip_code17	-0.0792	(0.1366)			0.0000

current_use1	-0.3720	(0.1639)			
current_use2	-0.1862	(0.0928)			
current_use3	(omitted)	-			
current_use4	0.2028	(0.0752)			
current_use5	-0.0901	(0.0920)			
current_use6	0.2163	(0.0708)			
current_use8	0.1065	(0.3043)			
current_use9	(omitted)	-			
current_use10	-0.4385	(0.0932)			
current_use11	-0.6250	(0.2486)			
current_use12	(omitted)	-			
current_use13	(omitted)	-			0.0000
gearing1	-0.2995	(0.3082)			
gearing2	-0.0869	(0.1256)			
gearing4	0.0162	(0.0439)			0.7855
status2	(omitted)	-			
status3	-0.1738	(0.0943)			0.0657
_cons	7.5357	(0.1224)	0.4259	1067	

Note: Regression results from estimating the base regression model by OLS

Dependent variable is the natural logaritm of the annual rent per square meter

White-adjusted standard errors are found in the column Robust Std. Error

∗∗∗ 1% significance level; ∗∗5% significance level; ∗10% significance level

The joint hypothesis test shows the result for the test of the restriction that the the group of dummy variables are not

priced in leasing agreements i.e. that Variable A = Variable B = 0

Table 13 includes all of the dummy variables used for estimating the base regression model. The table shows the actual name for the factor we are controlling for, the corresponding name used in the regression model as well as how many percentages of the data sample that correspond to each dummy variable.

Table 11 ■ Overview of Dummy Variables

Variable		Percentage
Municipality code		
Upplands-Väsby	munip_code1	0.98
Österåker	munip_code2	0.80
Järfälla	munip_code3	1.60
Huddinge	munip_code4	0.09
Salem	munip_code5	0.57
Upplands-Bro	munip_code6	0.18
Täby	munip_code7	0.80
Danderyd	munip_code8	2.04
Sollentuna	munip_code9	0.80
Stockholm	munip_code10	75.86
Södertälje	munip_code11	0.80
Nacka	munip_code12	4.97
Sundbyberg	munip_code13	2.88
Solna	munip_code14	5.06
Lidingö	munip_code15	2.33
Norrtälje	munip_code16	0.24

Variable	Corresponding Regression Variable	Percentage
Gearing		
Rent is stepped	Gearing 1	0.71
Rent is geared to turnover	Gearing 2	5.40
Normal lease with index clause	Gearing 3	76.62
Other	Gearing 4	17.18

Variable	Corresponding Regression Variable	Percentage
Current Use		
Standard shops unit(s) and Other retail	current_use1	0.97
Shopping Centre	current_use2	11.59
Retail Warehouse	current_use3	0.18
Supermarket	current_use4	0.27
Department store	current_use5	0.53
Retail - not specified	current_use6	1.95
Office	current_use7	76.19
Industrial	current_use8	0.53
Residential	current_use9	6.81
Hotel	current_use10	0.35
Other commercial - leasure trade	current_use11	0.09
Other commercial - lab	current_use12	0.18
Other commercial - not specified	current_use13	0.35

Variable	Corresponding Regression Variable	Percentage
Status		
Let and occupied by a separate organisation.	Satus 1	99.1
Let, but no rent is received, because tenant is insolvent, etc.	Satus 2	0.40
Let and owner occupied.	Satus 3	0.50

Variable	Corresponding Regression Variable	Percentage
Use		
Retail	Use 1	21.91
Office	Use 2	78.09

Variable	Corresponding Regression Variable	Percentage
Heating		
Including heating	Heating 1	54.73
Excluding heating – the tenant pays addition to rent for heating	Heating 2	45.27

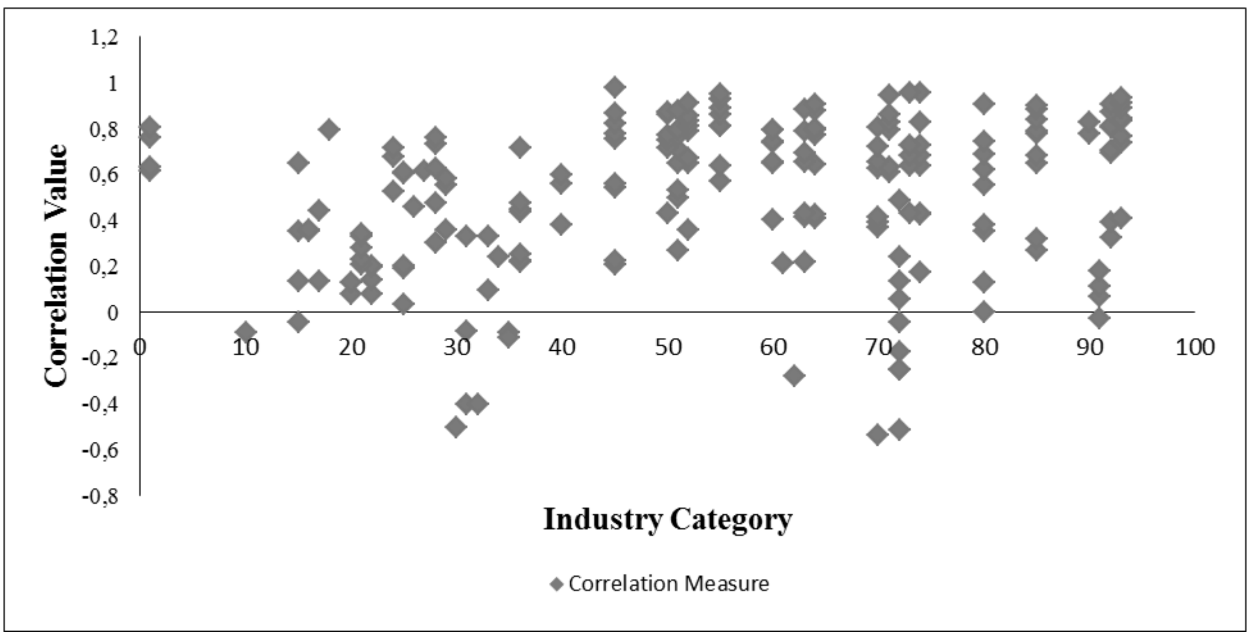
Variable	Corresponding Regression Variable	Percentage
Year		
2007	Y_2007	35,61
2008	Y_2008	34,27
2009	Y_2009	30,12

Variable	Corresponding Regression Variable	Percentage
Length in Years		
2	term2	3.95
3	term3	6.56
4	term4	28.35
5	term5	27.36
6	term6	16.06
7	term7	10.32
8	term8	2.78
9	term9	1.44
10	term10	0.72
11	term11	0.99
12	term12	1.08
13	term13	0.18
14	term14	0.09
15	term15	0.09
21	term16	0.09

11.2.2 Correlation Measure

Figure 6 describes the plotted correlation measures, showing the correlation between the operating profit / loss per industry and the underlying market value. As an approximation of the underlying market value, 14 different property segments have been used, dependent on what the majority of the building is used for as well as its location. This results that each industry, as plotted in the table below, will have up to 14 different correlation measures, depending on where the lessee in the industry was active. We find that there is no clear conclusion that can be drawn from how the correlation measures are distributed over the industries. It is difficult to say if some industry has a higher correlation with the underlying market on average than another one, however there is a pattern of that the industries to the right in the table, consultancy firms, data technology companies, building constructors and other, that seem to on average have a slightly higher correlation compared with the property market. Industries to the left at the table, starts from left to right with farming, fishing, manufacturing of food, consumer goods, electronics, retail companies, manufacturing of machinery etc. These industries, seem to on average have a lower correlation with the underlying property market.

Figure 6 ■ Estimated Correlation Values per Industry Category



11.3 Summary of other Conducted Regressions

So far, we have tested Hypothesis 1 and 2, through the three regression models specified so far: *Regression (1), Regression (2), and Regression (3).*

We find that an increase in the regression variables included in *Regression (1),* the UC Risk Score and the Correlation Measure prove to have an increasing effect on the rent level. Therefore we can conclude that these variables seem to be priced in the lease agreements. This pricing effect on the lease rate is for the year the contract is signed. These results do not however say anything regarding how the rent levels adjust over time with regards to changes in the lessee's credit risk.

Due to that lease rates can include indexes and other clauses specifying contract specific items, it would be possible for the lessor to include clauses in the lease contracts to control for fluctuations of the lessee credit risk. We have therefore made further empirical tests to see if this seems to be something that is accounted for in the lease rates over time.

This is done by estimating regression models including all the contracts that were originally included in our data, not just the contracts that were newly written during the years of study (2007 – 2009). This substantially increases the amount of available data. However, due to that the data is lacking a contract specific code, we cannot follow a specific contract over the three years of study, wherefore we for these regression models, have to run separate regressions for each year (2007, 2008 and 2009). (This since the data samples for each year are not independent samples)

The process of running the estimated regressions for this section is based on the same approach as for the previous regression models (1-3).

A base regression model has been estimated, but due to the larger amount of data available, the base regression model includes a larger amount of explanatory variables. This since they were statistically significant at a 5% level. This results in the following estimated base regression formula.

$$\begin{aligned} lnrent = a_0 &+ a_1 Age + a_2 (Age)^2 + a_3 Area + a_4 OperatingCost + a_5 Administration \\ &+ a_6\ Maintenance\ \ + a_7\ Capex\ +\ a_8 PropCare + a_9\ PropTax \\ &+ a_{10} VatLiability + a_{11} Insurance + a_{12} Other + (b') Status_i \\ &+ (c') NewLett_i + (d') Heating_i + (e') Use_i + (f') Length_i \\ &+ (g') MunipCode_i + (h') CurrentUse_i + (i') StartYear + (j') Gearing\ + \varepsilon \end{aligned}$$

Where b' = [b2, . . . , b4], c' = [c1, . . . , c3], d' = [d1, . . . , d3], e' = [e1, . . . , e6], f' = [f1, . . . , f26], g' = [g1, . . . , g22], h' = [h1, . . . , h16], j' = [j1, . . . , j3] and i' = [i1, . . . , i25] are vectors of parameters to be estimated, and a0, a1, . . . , a11 are parameters to be estimated.

This estimated regression formula includes the same explanatory variables as the previous base regression formula except for that the following variables are added.

Regular variables that are included in addition to the ones found in the base regression formula, the first version, are Administration (*Administration*) and Property Care (*PropCare*).

Additional dummy variables that are included in addition to the first verion of the base regression formula are the variables (*New Lett*) and (*Start year*), for which an explanation is given below.

To control for renegotiations and renewals of the contracts during the year, three dummy variables are used. The base case is that there is no change in the contract which constitutes 79% of the contracts. A number of leases have had a continuation of the current lease but with renegotiated lease terms (*New_lett2*) and the remaining contracts are new lets (*New_lett3*).

To control for year specific effects for when the contracts were signed, the start year of the lease contracts are accounted for by including 25 different dummy variables, one for each start year (Start_Year). The majority of the lease contracts are written after year 2004 (85%).

We estimate these regression models, both for the total data set, as well as divided into the two groups: only office and only retail contracts. The reason for this is that one could expect to find different results for these two separate groups on the back of their different market characteristics. However, since the results turned out in line with the results for the total sample, we have chosen to present only the results from the total sample.

To test our previous hypothesis 1 and 2 we have included the following variables to the base regression model;

- UC Risk Forecast
- UC Risk Forecast squared
- Correlation Measure

The results from estimating the regression model are presented in *Table 10*:

Table 12 ■ Estimated Regression result using the UC Risk Forecast

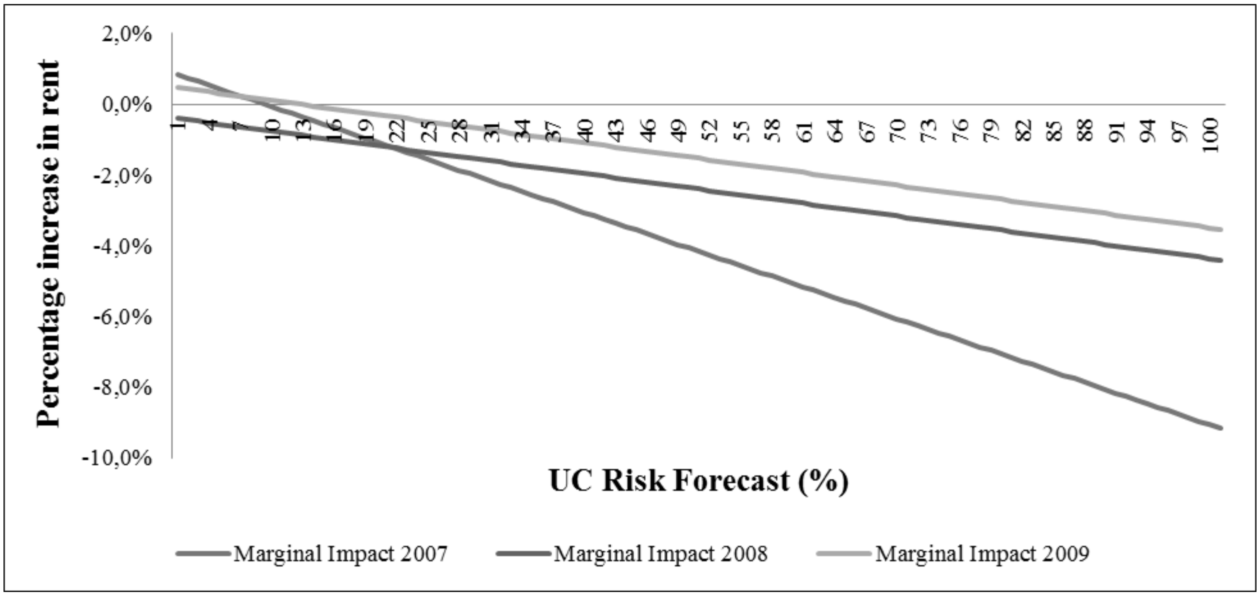
Year	Independent Risk Variables	Coefficient	Robust Std. Error	Adjusted R²	Number of Observations	Joint Hypothesis Test (p-values) (excluding correlation)	Joint Hypothesis Test (p-values) (including correlation)
	Risk score	.0084	(.0125)				
	(Risk score)^2	-.0005	(.0004)				
2007	Correlation	-.1382	(.1103)	0.3492	724	0.3219	0.2762
	Risk score	-.0040	(.0067)				
	(Risk score)^2	-.0002	(.0003)				
2008	Correlation	-.0183	(.0293)	0.6958	1667	0.0442	0.0915
	Risk score	.0047	(.0039)				
	(Risk score)^2	-.0002	(.0001)*				
2009	Correlation	-.0776	(.0415)*	0.7034	1003	0.1141	0.0298

Note: Regression results from estimating regression (1) by OLS
Dependent variable is the natural logaritm of the annual rent per square meter
White-adjusted standard errors are found in the column Robust Std. Error
*** 1% significance level; **5% significance level; *10% significance level

Correlation = The correlation between the lessee company's cach flows and the underlying asset value of the leased asset as specified in Grenadier (1996). The cash flow of the lessee company has been estimated by taking the industry operating profit/ loss. The underlying asset value is estimated by the IPD sector index which reports the market value of property divided into 14 different groups depending on geographic location and use of the property. The lessee companies has been divided into 53 industry groups as specified by Statistiska Centralbyrån. The correlation measure has then been calculated as the correlation between these two estimates giving 14*53 possible correlation values. Note that due to the low amount of data, not all possible values of the correlation measure are present in the data.

The first joint hypothesis test (excluding correlation) shows the result for the test of the restriction that the risk coefficient and the squared risk coefficient are not priced in leasing agreements i.e. that Risk score = Risk score squared = 0
The second joint hypothesis test (including correlation) shows the result for the test of the restriction that the risk coefficient, the squared risk coefficient and the correlation are not priced in leasing agreements i.e. that Risk score = Risk score squared = Correlation = 0

Figure 7 ■ Marginal Percentage Impact on the Rent from an Increase in the UC Risk Forecast



The graph plots the marginal impact that an increase in the risk score has on the rent level. The graph therefore show the percentage increase / decrease in the rent level as a result of a one percent change in the risk score.

The results show that for year 2007, none of the coefficients of interest are statistically significant neither on a standalone or joint basis.

For year 2009 the majority of the coefficients are significant on a standalone basis, the coefficient for the UC Risk Forecast squared and the correlation measure are statistically significant on a 10% level. We can also conclude that the F-test of joint significance, including the correlation measure is statistically significant on a 5% level, while the one excluding the correlation measure is not.

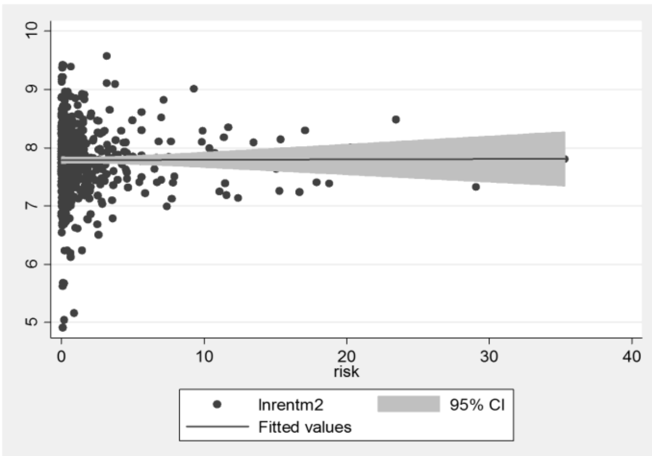
For year 2008 none of the coefficients are significant on a standalone basis. We can however conclude that both of the F-test, testing for joint significance between the variables is statistically significant. The F-test excluding the correlation measure on a 5% level and the F-test including the correlation measure on a 10% level.

Notable is that there is a clear pattern of negative values for all of the correlation measures, which one would not expect to find according to Grenadier’s model. For year 2008, the only year when the UC risk score is significant, we see that an increase in the risk, has an overall decreasing impact on the rent level for year 2008.

From these results we conclude that there seem to be an impact of the UC risk factor and correlation measure on the rent level, however the negative sign of the coefficients implies that an increase in the measures have a decreasing impact on the rent level. This, as stated, contradicts the model by Grenadier as well as the result found in the previous results found in this study.

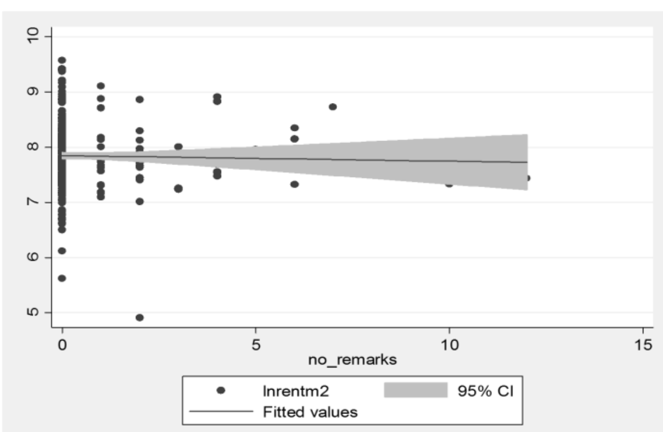
11.4 Plot for Relation between Rent and Credit/Correlation Measures

Figure 8 ■ Plotted Distribution of the UC Risk Forecast



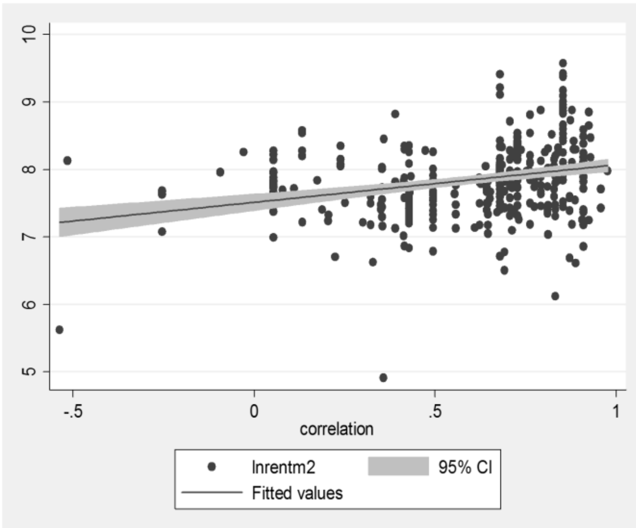
The figure show a plot of the natural logarithm of the annual rent per square meter on the y-axis and the UC Risk Factor on the x-axis

Figure 9 ■ Plotted Distribution of the Number of Payment Remarks



The figure show a plot of the natural logarithm of the annual rent per square meter on the y-axis and the UC number of payment remarks that the lessee has on the x-axes.

Figure 10 ■ Plotted Distribution of the Correlation Measure



The figure show a plot of the natural logarithm of the annual rent per square meter on the y-axis and the correlation measure on the x-axes.