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Thesis

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Valuation of housing attributes and the effect of tenant and landlord characteristics in the Norwegian rental market

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Table of contents

Abstract

The present study uses a standard hedonic log–log framework to analyze rent variations in the Norwegian housing market. Using data from the national rental survey (Leiemarkedsundersøkelsen) as a basis, this study finds that geographical variables, hedonic qualities, and tenant–landlord characteristics explain 49 percent of total rent variations across regions. Unlike previous studies, we compose several interaction variables indicating, for example, the effect of the number of bedrooms for a given dwelling size and the effect of access to an elevator given various floor levels. We also use several dummy variables to study the effect of tenure length, which has not been adequately examined in other research. This study further acknowledges that tenants limit their choices of housing services by property type and location, thereby confining themselves to specific submarkets. This results in distinct price functions for each submarket. Our findings should be of importance to market makers such as appraisers, property managers, and real estate analysts.

1 Introduction

Studies of the valuation of rental housing attributes have been conducted for numerous markets. However, few such studies have been done of the Norwegian rental market. Rental prices are a function of numerous housing characteristics, which, in turn, affect the property's value. This should be of importance to appraisers who make market-derived rent adjustments, property managers, developers that design real estate projects, and investors. This paper examines six issues that affect rental prices for the Norwegian market, both for the aggregate market and for different submarkets.

1.1 Property-specific hedonic attributes

Tenants prefer certain attributes, which increases their willingness to pay for such residences, all else being equal. Conversely, certain restrictions and external factors can have a negative impact on rent. This study examines the physical characteristics of residences and their physical characteristics of the neighborhood. Among the variables we control for are a private balcony and designated parking, both variables tested in studies of multifamily houses by Sirmans et al. (1989, 1990). Based on a linear model, the authors found that amenities including designated parking and a private balcony were valued by tenants. We propose such variables are associated with increased rent, but are frequently correlated with low-density locations, which can offset the effect.

Other attributes we control for are the size of the residence, the number of bedrooms for a given dwelling size, and whether the residence is furnished. Gunterman and Norrbin (1987) ran a regression analysis of rent variations in a university submarket and found that an extra bedroom for a given apartment unit size has a significant positive effect on rental price. A study of student rentals by Marshall (1990) found that the number of bedrooms and residence size have a positive impact on the rental price. Smith and Belloit (1987) found that amenities such as a dishwasher, rentals that include all utilities, and furnished units have a significantly positive effect on rent. Furthermore, The number of bathrooms and bedrooms also had a significantly positive impact on rental price, while leasing period, neighborhood quality, and location convenience had a significantly negative impact in terms of affecting rental price. These studies show that amenities, services, and physical characteristics affect rent, but their data yield

different estimates for the factors. This may be due to location, since different populations have different preferences, and will be further examined in this study.

1.2 Location

Several studies validate the effect of location on rental prices, which will be controlled for in this study. Allen et al. (1973) measured the importance of a central location and found that the distance to an economic focal point significantly affects rent in all submarkets tested (the apartment market, the single-family market, etc.), as well as in the aggregate market. Ogur (1973) found that colleges and universities have a significant effect on rental markets, causing an increase in rental prices in nearby areas. This finding was confirmed by Jaffe and Bussa (1975), who found that rent declined as the distance from a university increased. Jaffe and Bussa (1977), and Prave and Ord (1987) also confirm the importance of proximity to an economic focal point such as a city center or campus. Gunterman and Norrbin (1987) emphasized that accessibility-related factors inherent to a particular location—proximity to employment/campus, distance to an economic focal point, and so forth is often difficult to determine successfully in empirical studies. Our study does not encounter this problem, since our location variable is at the county level. This is, however, unfortunate, since a district-level variable would be of great interest, especially in Oslo, where the prices vary significantly between districts.

1.3 Landlord characteristics

Little research has been conducted on the relation between market rent and landlord size, but Larsen and Sommervoll (2006) found that small-scale landlords tend to set lower rents than large-scale landlords. Our study examines the impact of landlord characteristics, focusing on the difference between small-scale and large-scale landlords. It is expected that large-scale landlords set higher rents, since they are likely to know more about the market and are thus better able to diversify risk. Large-scale landlords accept that some contracts may be problematic, allowing for a higher incidence of exits and/or damage to the property. Such landlords may therefore include premiums in their rent as insurance against vacancy or depreciation. Small-scale landlords are often the tenant's neighbor. This leads to a selection process that is motivated not only by

revenue, but also by the tenant's personality, giving the landlord incentive to give discounts in order to be more selective.

1.4 Tenant characteristics

As in Larsen and Sommervoll (2006), our dataset includes information on education level and whether the tenant is living alone. Larsen and Sommervoll (2006) found these variables to have a statistically significant impact on rent, and our analysis controls for them. Additionally, our study contains a variable for the tenant´s income level. Education and income level are expected to be correlated, which may force us to omit one of the variables to avoid multicollinearity. These variables are all assumed to be observable by the landlord and, though not a guarantee, provide signals of good tenants.

1.5 Landlord–tenant relationship

The effect of the landlord–tenant relationship on rent has not been widely explored. Larsen and Sommervoll (2006) found indications of reduced rent when there was a direct or indirect relationship between the lessor and the tenant. The authors explain this result with a hypothesis of reduced risk due to more information.

The present study controls for this effect and examines whether the relationship between the landlord and tenant affects rental price. Such a relationship, either direct or indirect, is expected to reduce rent. This is supported by basic risk–return theory, since prior knowledge of the tenant reduces risk and the landlord is therefore likely to give the tenant a discount on rent.

1.6 Length of residence

The academic literature on rental contracts has determined that landlords attempt to minimize costs relating to turnover by giving discounts to long-term tenants. Merrill (1977), Lowery (1981), and Marshall and Guasch (1983) all found a substantial discount on rent associated with tenure length. On the other hand, Goodman and Kawai (1985) found that the transaction costs of moving act as an incentive for tenants to "grow into" a living unit, thereby allowing a rise in rent. This finding is supported by Barker (2003), who finds that residences with low turnover costs charge long-term tenants higher rent than short-term tenants. The author further shows that length-of-residence discounts are less common than

discounts on the first month's rent for new tenants. Hanushek and Quigley (1980 and Ihlanfeldt (1981) also support this, arguing that a tenant's search and moving costs are incentives for households to consider "equilibrium–disequilibrium," that is, choosing a suboptimal housing bundle for the household to grow into based on expectations of family size and income, thereby allowing small future adjustments in rent.

We further examine the effect of length of residence on rent. We propose that length of residence has a negative effect on rental price. A tenant that has paid rent on time and takes good care of the residence is likely to be preferred over new tenants and their associated risk. Landlords may therefore be willing to reduce rent through negotiations or, more likely, bypass nominal rent adjustments.

1.7 Rental submarkets

Straszheim (1973), Schnare and Struyk (1976), Sonstelie and Portney (1980), Goodman (1978), and Allen et al. (1973) have proposed different methods for identifying housing submarkets. Their different criteria include geographic and political boundaries, property types, and household characteristics. This study focuses on submarkets defined by three property types: studios, apartments, and houses. Furthermore, we focus on market segmentation based on regional differences. To obtain a sufficiently large sample, we focus on the regions that contain the largest cities in Norway.

According to the hedonic framework defined by Rosen (1974), each rental market attribute has an observable market price. The implicit prices should be stable in more carefully defined submarkets within a well-defined rental market. When consumers' choices are limited to specific locations or property types, however, the rent-determining process is limited to the different submarkets, resulting in different price functions for each one. We therefore suggest determining differences in all the submarkets defined by either property type or regional affiliation.

2 The sample

2.1 Rental market survey

The sample consists of 9,226 observations collected by Statistics Norway's yearly rental market surveys on 28,000 rental residences in Norway for the period October 2009 to February 2010. Statistics Norway started collecting data in 2005 for research on the Norwegian rental market. A complete register of such rentals does not, however, exist. A combination of different governmental registers administered by Statistics Norway is therefore used to maximize the number of observations. In 2010, Statistics Norway used the following procedure for sample allocation:

- Owner information from Statistics Norway's Ground Property, Address and Building Register was matched to data from the National Population Register to remove owner-occupied dwellings.
- Information on organizational structure from Statistics Norway's Corporate and Business Register was matched to the residential register to remove cooperative shareholders and institutions.

The sample consisted of 18,000 residences, with an oversampling of 2,000 residences from the county Oslo due to the significant attention on this residential rental market and volatility in rental prices across its submarkets. Furthermore, 8,000 observations from residences inhabited by 20- to 29-year-olds were stochastically added to increase the allocation from all municipalities. This was done to address the potential problem of students registered at a parent's residence while living elsewhere. Since around half of this segment lives in rental residences,[1] age is a significant criterion. The regional share of this segment is uniformly distributed throughout the population. A precise description of the sample is illustrated in Table 2.1.

[1] Statistics Norway Report 2004/28.

	Gross sample	%	Net responses	% of gross	Net sample	% of gross
Total	28,000	100.0%	9,226	33.0%	6,114	21.8%
Region		% of region		% of region		% of region
Oslo	6,328	22.6 %	2,788	30.2 %	1,794	29.3 %
Akershus	2,072	7.4 %	725	7.9 %	493	8.1 %
Hedmark and Oppland	1,708	6.1 %	576	6.2 %	374	6.1 %
Østlandet	4,508	16.1 %	1,309	14.2 %	936	15.3 %
Agder & Rogaland	4,480	16.0 %	988	10.7 %	667	10.9 %
Vestlandet	4,200	15.0 %	1,421	15.4 %	893	14.6 %
Midt-Norge	2,296	8.2 %	744	8.1 %	483	7.9 %
Nord-Norge	2,408	8.6 %	675	7.3 %	474	7.8 %
Age		% of Age		% of Age		% of Age
Under 25	5,292	18.9 %	1,141	12.4 %	895	14.6 %
25–44	15,736	56.2 %	4,765	51.6 %	3,310	54.1 %
45–66	4,984	17.8 %	2,400	26.0 %	1,529	25.0 %
67 and older	1,988	7.1 %	920	10.0 %	380	6.2 %
Education		% of Edu.		% of Edu.		% of Edu.
Elementary school	7,672	27.4 %	2,456	26.6 %	1,741	28.5 %
Secondary School	11,396	40.7 %	3,189	34.6 %	2,028	33.2 %
Higher education	5,656	20.2 %	2,433	26.4 %	1,465	24.0 %
Not answered	3,276	11.7 %	1,148	12.4 %	880	14.4 %

Table 2.1 Gross sample data, net response data, and net data after imputation and truncation.

2.2 Exclusions

Of the 28,000 observations in the original sample, 31 were removed because the residence was owned by an institution, had been destroyed by fire, or had been condemned. Certain residences were dismissed because they did not want to or could not participate in the survey. In addition, a number of residences were unreachable. Total exclusions amounted to 18,774 residences, or 67.05 percent of the total sample. A total of 85.4 percent of exclusions were related to problems with contacting residences, which occurred in 57.2 percent of observations in the gross sample. Refusals comprised 14.6 percent of total exclusions.

2.3 Truncation

Variable	Criteria description	Observation losses	Sample size
Monthly rent	Did not answer monthly rent	2,592	6,704
Size	Did not answer exact or interval size	306	6,378
Tenure length	Did not answer length of residence	41	6,337
Ownership	Answered owner of real estate	107	6,230

Table 2.3.a Excluded observations.

Of the 9,226 residences that answered the survey, some observations had to be excluded due to incomplete answers on key factors: 2,592 observations were removed because they did not report the monthly rent, another 306 observations were removed because the interviewed subject did not respond to questions regarding residence size, and 41 respondents did not state what year their tenure started. We also excluded 107 observations where the interviewed object (IO) listed himself or herself as the owner of the dwelling. A total of 412 respondents did not answer the question and were therefore designated as tenants, allowing us to use the remainder of their data.

Further, we are only interested in modeling the "normal" population, leading us to truncate some outliers. The remaining sample is described in Table 2.3.b

Variable	Criteria description	Observation losses	Sample size
Monthly rent	[1,000, 25,000] NOK	47	6,183
Size	[10, 300] square meters	19	6,164
Tenure length	[0, 20] years	20	6,144

Table 2.3.b Truncated data.

Our truncation process mainly involved the key aspects of rent, residence size, and tenure length. While monthly rent ranged from zero to 76,945 NOK, to obtain a representative sample of residences we selected those observations with monthly rent in the range of 1,000 NOK to 25,000 NOK, losing 47 observations. Second, we limited our sample by imposing a size constraint of 10 square meters to 300 square meters, thereby dropping 19 observations. Third, we did not include observations with tenures longer than 20 years, since longer tenures are likely to suffer from idiosyncratic components and offer little insight into current rental information. (Larsen and Sommervoll, 2006)

2.4 Imputation

In the survey, the IOs had two alternatives when answering the question on residence size: The first and optimal alternative was to state an accurate size and the second alternative was a multiple choice answer based on 7 ranges, intended for those who did not know the exact size. These ranges were; less than 20 square meters, from 20 to 29 square meters, 30 to 39 square meters etc., up to 119 square meters where the range were 120 square meter or more. Several IOs answered with both an exact size and a range, the latter of which was ignored. When the interval option was chosen, the value was set to the mean of the interval; for example, 70 square meters was input as the dwelling size when the option 60–80 square meters was selected. By including observations that only stated an interval size, we avoided omitting 787 observations. Observations in the uppermost interval (over 120 square meters) were replaced by the mean of the size of all observations between 120 and 300 square meters, from the accurate responses. This led to an increase in the mean number of square meters from 72.25 to 72.28, a change that is statically insignificant. The final sample comprised 6,114 observations.

2.5 Descriptive statistics

Table 2.5 reports descriptive statistics for the variables in this study for 2010.

Variable	Interval data		Continuous data		Aggregate data	
	Mean	Variance	Mean	Variance	Mean	Variance
Rent	5,744	2,937*	6,527	3,008*	6,428	3,010*
Location:						
Akershus	5.8 %	0.055	8.4 %	0.077	8.1 %	0.074
Aust-Agder	1.3 %	0.013	1.4 %	0.014	1.4 %	0.014
Buskerud	3.6 %	0.034	4.1 %	0.039	4.0 %	0.039
Finnmark	2.2 %	0.021	1.2 %	0.012	1.3 %	0.013
Hedmark	3.7 %	0.036	2.9 %	0.028	3.0 %	0.029
Hordaland	10.5 %	0.094	9.2 %	0.084	9.4 %	0.085
Møre og Romsdal	4.8 %	0.046	3.6 %	0.035	3.8 %	0.036
Nordland	4.3 %	0.041	2.9 %	0.028	3.0 %	0.030
Nord-Trøndelag	1.9 %	0.019	1.4 %	0.014	1.5 %	0.015
Oppland	5.8 %	0.055	2.7 %	0.026	3.1 %	0.030
Oslo	21.1 %	0.167	30.5 %	0.212	29.3 %	0.207
Østfold	5.1 %	0.048	4.8 %	0.045	4.8 %	0.046
Rogaland	8.5 %	0.078	6.7 %	0.062	6.9 %	0.064
Sogn og Fjordane	2.2 %	0.021	1.3 %	0.013	1.4 %	0.014
Sør-Trøndelag	6.5 %	0.061	6.4 %	0.060	6.4 %	0.060
Telemark	3.2 %	0.031	2.1 %	0.021	2.3 %	0.022
Troms	2.4 %	0.024	3.5 %	0.034	3.4 %	0.033
Vest-Agder	2.4 %	0.024	2.6 %	0.026	2.6 %	0.025
Vestfold	4.7 %	0.045	4.2 %	0.040	4.2 %	0.040
Hedonic attributes:						
Size	72.613	29.27*	72.286	36.7*	72.328	35.836*
Studio	4.3 %	0.041	4.5 %	0.043	4.5 %	0.043
One bedroom	39.8 %	0.240	44.7 %	0.247	44.1 %	0.247
Two bedroom	31.7 %	0.217	31.6 %	0.216	31.6 %	0.216
Three bedrooms	15.2 %	0.129	13.6 %	0.117	13.8 %	0.119
Four bedrooms	7.0 %	0.065	4.3 %	0.041	4.6 %	0.044
Five bedrooms	1.5 %	0.015	1.0 %	0.010	1.1 %	0.011
Six bedrooms	0.6 %	0.006	0.3 %	0.003	0.4 %	0.004
Floor level	2.347	2.387*	2.800	2.616	2.743	2.592
Elevator	6.7 %	0.063	9.5 %	0.086	9.1 %	0.083
Balcony	62.8 %	0.234	59.0 %	0.242	58.8 %	0.242
Furnished	26.9 %	0.197	24.6 %	0.185	24.7 %	0.186
Ln(High standard)	0.774	0.248	89.6 %	0.246	85.8 %	0.261
Characteristics:						
High income	14.1 %	0.122	39.5%	0.156	18.1 %	0.148
Single	54.5 %	0.248	44.0%	0.247	45.3 %	0.248
Private landlord	44.1 %	0.247	45.2%	0.248	45.0 %	0.498
Multi-complex owner	14.7 %	0.126	22.0%	0.171	21.0 %	0.166
Relative or friend	11.4 %	0.101	11.4%	0.101	11.4 %	0.101
Market mediation	28.1 %	0.202	42.1%	0.244	40.3 %	0.241
Tenure length 0–1 year	55.0 %	0.248	1.4%	0.014	11.6 %	0.014
Tenure length 2–5 years	67.9 %	0.218	71.1%	0.206	54.9 %	0.248
Tenure length 6–10 years	17.3 %	0.143	14.9%	0.127	15.2 %	0.129
Tenure length 11–15 years	6.9 %	0.064	5.1%	0.049	5.4 %	0.051
Tenure length 16–20 years	1.7 %	0.016	2.4%	0.023	2.3 %	0.022

Table 2.5 Descriptive statistics, 2010. Here * denotes standard deviation.

The results in percentages in Table 2.5 are dummy variables indicating the number of respondents in the sample with a positive value for the corresponding variable. In addition to showing the aggregate data, Table 2.5 divides the sample into interval data and continuous data to illustrate the differences between respondents who reported dwelling size with an interval and those who reported the exact size. For some of the variables the difference are quite noteworthy, though without an intuitive explanation why.

3 Theoretical framework

This study applies the hedonic framework used by Larsen and Sommervoll (2006). Freeman introduced this framework in 2003, building on the contributions of Rosen (1974). The hedonic hypothesis states that goods do not, per se, provide utility to the consumer, but are instead valued for their utility-bearing attributes (Lancaster, 1966). Such an extension enables studies of heterogeneous goods within the framework of classical consumer theory and creates a direct link between the market price and attributes of a complex good such as housing services. We first describe the application of this conventional approach before defining the rental market extensions of Larsen and Sommervoll (2006).

We assume that a tenant obtains utility by consuming rental housing services and other goods , which gives the following equation for the tenant's utility:

(1)

where is the tenant's unspecified utility function and is a vector function consisting of housing features that are themselves functions of . These functions encompass the hedonic qualities, location, and amenities of the rental housing. The vector contains tenant characteristics that allow for variations in tenant preferences. However, we assume that these preferences are not universally shared but, rather, that they are shared for pools of different types. We thus allow for variations of preferences across tenant types, but not within the different types. Furthermore, the tenant's utility function is given by the budget constraint

(2)

where is the price vector of other goods, is a vector of implicit prices for rental housing characteristics, and represents tenant income. This terminology assumes that the vector contains not only hedonic qualities, but also other characteristics with the offered rental services, such as the interactions between landlord and tenant. These elements all have an impact on maximizing the tenant's utility. Following this methodology, we assume that the tenant can observe the price vector of explicit or implicit prices, , for each element and solve the following constrained utility maximization:

(3) such that

The optimized solution for the demand of housing services and other goods results in the direct utility , where * denotes the optimal solution. We also derive a solution for the indirect utility function by satisfying the Gossen conditions:

(4)

where and are sets of elements of housing services and other goods, respectively. We can also write this optimization problem as , or . This function can be solved with respect to when utility is at level . Furthermore, we use the simplification of Larsen and Sommervoll (2006), aggregating other goods into a single good and letting be a measured good with price equal to one. The demand for element , is a function of the utility level , income , price vector , and other elements, denoted , conditional upon the tenant type .

Freeman (2003) explains that tenant preferences can be mapped as tenant bid curves in the rent negotiation process. In accordance with general financial theory, these bid curves are concave, since we assume that individuals prefer more over less and that marginal utility is declining. These bid curves can vary across

different tenants and therefore outline the contour of a price function. Holding all other elements constant, we can write the tenant's bid curve for quality *j* as

(5)

where the bid curve for element is a function of the quantity of element , , conditional upon for other housing services, income, utility level, and tenant type.

However, the pricing of rental housing services is endogenous in a market consisting of both tenants and landlords. Following Freeman's framework, these profit-maximizing landlords produce curves for rental housing services using the quantity of element , , and the bundle price . These offer curves are convex and differ across landlords. We can write the offer curve for quality as

(6)

where represents the tenant's profit level and is a vector of the landlord's personal characteristics. The set contains different types of landlords, including small-scale individuals and large-scale businesses. However, as with the tenants, we assume that the landlords form a finite number of combinations of types, and the vector encompasses characteristics such as location of residence and scale of operations.

The equilibrium between the market price of rent and attributes of the different classes of housing services is then obtained from the tangencies of the landlord's offer curve and the tenant's bid curve. Together, these tangencies form a consistent system with agreed upon prices for elements of housing services and develop a common envelope function, which is the implicit price function. This function is frequently called the hedonic price function of rental housing services.

The remainder of this section introduces Larsen and Sommervoll's (2006) extension of the classical framework by implementing three categories of price determinants for rents. These categories, however, do not affect the purchasing prices in the owner market. Transactions in the housing owner market typically occur when a bid meets or exceeds the seller's reservation price in an auction process. This process is fairly uncommon in the rental market, where potential tenants typically consider a fixed rental price or enter into a negotiation process

regarding both rental terms and specific rent. It is assumed that landlords seek to maximize profit; however, in the rental market landlords are also exposed to risks such as vacancy periods, delayed payments, damage to property, and legal proceedings. This stimulates a selection process whereby the landlord considers various elements of price discrimination, which can result in rent reduction. Larsen and Sommervoll include these negotiation factors in the landlord's offer function,

(7)

where is a collection of elements that explains rent differences for otherwise identical dwellings, is the vector of rental object characteristics described earlier, and is a vector consisting of observed tenant characteristics such as marital status, number of people in the household, education, and income. The vector represents additional parameters that describe the tenant–landlord relationship and method of initial contact. Larsen and Sommervoll argue that excluding these variables can lead to an omitted variable bias when explaining variations of rent due to the significantly different negotiation processes in the renter's market compared to the owner's market.

Potential tenants are also exposed to a complex optimization procedure, since they consider a variety of heterogeneous housing services. Tenant willingness to bid for rental objects can be described by the following multivariate equation:

(8)

As with the landlord's offer function, the tenant's bid function also includes landlord characteristics and the relationship variables . Combining the tenant's bid function and the landlord's offer function results in the agreed upon monthly rent, compromised of not only the standard price determinants *x*, but also the rental specific elements included in , and .

4 Empirical approach

This section presents our model and the reasoning behind its use. It also briefly explains the different coefficients. Our model consists of varieties of the following standard hedonic log–log model. The reasoning behind its use is that the log–log linear form is the conventional default and relatively easy to infer. Note that this study uses the conventional notation *log* in the text, when, in fact, we mean the natural logarithm. We use the following model:

where the set contains the sample population of observations, where each of the 6,114 observations is denoted by the subscript *i*, and , , and correspond to the sets of location, hedonic, and tenure/landlord characteristics.

The regression includes an intercept and the location variables ; the hedonic variables, denoted ; and variables for tenure and landlord characteristics, denoted . We also present models based on interval data and continuous data, respectively, with the separate examinations exploring the effects of imputation on the interval data.

We use the logarithm of the dependent variable and some of the independent variables, including monthly rent, number of square meters, tenure length,[2] and floor level. These coefficient estimates are interpreted as representing the price elasticity of the demand for the different continuous elements. Our models also include a variety of dummy variables that can be interpreted as markups or markdowns in rental price due to the log relation. Before discussing the regressions, the next section reviews the expected signs and plausible magnitudes based on economic intuition and earlier findings.

[2] We use the logarithm of tenure length only in the submarket models.

5 Expected signs and plausible magnitudes

5.1 Location

When exploring variations in rent based on Norway's 19 different counties, we expect all coefficients to be negative, since the county Oslo is set as the default. We expect that price differences are heavily dependent on the county's population density and that high density counties such as Akershus, Rogaland, Hordaland, and Sør-Trøndelag will have relatively low markdown compared to counties such as Finnmark, Nordland, Nord-Trøndelag, and Hedmark. Due to the lack of more detailed location data, we expect the model to explain smaller variations than Larsen and Sommervoll (2006), whose study also contained data on peripheries and distance to an economic focal point or city center.

5.2 Hedonic variables

The earlier study of Larsen and Sommervoll (2006) includes four hedonic variables: dwelling size, the presence of a balcony, the standard of the dwelling, and whether or not it is furnished. We expand the model by including the following variables to better explain rental prices. Dwelling size being the major determinant of rental price, we include a variable that allows us to interpret the marginal effect of increased dwelling size. Our model therefore includes both the natural logarithm of the number of square meters in a residence and its squared results,[3] since we do not expect the rental price to have a linear relation with dwelling size but, rather, to marginally decline as size increases. We expect the size coefficient will be positive, but that the squared size will have an offsetting effect, with a negative coefficient.

With accordance with Gunterman and Norrbin (1987), the number of bedrooms included influences rent, but are strongly contingent on dwelling size. That is, an additional bedroom for a given dwelling size should result in increased rent as long as the dwelling is of sufficient size to accommodate a supplementary bedroom. To measure this effect, we construct dummy variables for the number of bedrooms and multiply the respective variables by the natural logarithm of size. Our expectation is that the supplementary bedroom increases rent, but that the effect decreases as the number of bedrooms increases.

[3] $(\ln(\text{square meters}))^2$.

Furthermore, we expand the model by including variables for the dwelling floor level and whether the tenant has access to an elevator, and an interaction of the two. Since light conditions and view are assumed to be positively correlated with floor levels, we expect a high floor level to have a positive impact on rent. We further expect that access to an elevator has a positive effect on rent and that the effect increases with the floor level.

The variable for high standard is a composite variable comprising the scaled logarithm of the sum of affirmative responses to questions about whether the dwelling has tiles or electric floor heating in the bathroom, a central vacuum cleaner, a fireplace, parquet flooring etc. Naturally, we expect that higher standards increase rent.

Finally the variable for electricity and heating is the scaled logarithm of the sum of scores on responses to questions regarding included electricity and heating, as for the variable for high standards. However, we expect that heating is only important when electricity is not included, and that electricity is only important when heating is not included. We therefore construct our variables so that we can examine this hypothesis.

5.3 Tenure and landlord characteristics

When modeling inferences from tenure and landlord characteristics, we employ seven variables describing their effects on rental prices. For the tenant, we employ binary variables for education, income, and marital status, all of which arguably have a positive or negative effect on rent. From the landlord's perspective, a tenant with a higher education and/or income should have a higher probability of meeting his or her obligation and treating the property well. This should motivate the landlord to discount the rent. On the other hand, tenants with a higher income and/or education are often able to afford larger dwellings with higher standards, resulting in increased rent. People with high incomes are also more likely to enter the owner's market, increasing the probability of vacancy. The variable for high income will be computed as a dummy, with a value of one if the tenant has an income of 300,000 NOK or more, and zero otherwise. We expect a high degree of multicollinearity between education and income and therefore test for this.

A priori, it also not clear in what direction the variable single (that is, only one person who contributes with rent payments) affects rent. Singles often host more social gatherings than couples, which can lead to more complaints from

neighbors and damage to the dwelling, implying a rent premium. On the other hand, with only one income, singles are often also forced to live in less expensive dwellings than, for example, couples. Singles can, however, cause less property depreciation, since there is only one person to produce wear and tear on the dwelling, leading the landlord to prefer a single tenant. We define the variable for singles as a dummy that equals one if the tenant lives alone, and zero otherwise. It would be interesting to know the number of occupants to explore this effect more carefully; however, this is not specified in the data.

We employ variables concerning the type of landlord and the characteristics of their relationship to the tenant. The different classifications are large-scale landlords, small-scale landlords, and relatives or friends. Since we set small-scale landlords as the default, we expect large-scale owners to mark up their rents due to the diversification effect and greater market knowledge mentioned earlier. We use a dummy variable to control for the possibility of an omitted variable bias concerning large-scale landlords deriving higher rents as a result of using professional agents. This market mediation dummy describes whether the tenant found the dwelling through such channels as advertisements, newspapers, the Internet, or professional agents and we expect it to have a positive impact on rent. For landlords who are relatives or friends of tenants, we expect a markdown, since the landlord has a prior relationship with the tenant, which intuitively reduces risk.

Regarding tenure length, Larsen and Sommervoll (2006) illustrated that, for example, a tenant with a one-year tenure is estimated to pay 6 percent less than a tenant who enters a new tenure with a similar dwelling. The authors calculated the natural logarithm of tenure length,[4] and their conclusion is consistent with the theory of reduced risk associated with the revelation of tenant type. It should be noted that the risk reduction is probably the result of refraining from nominal rental adjustments and not rewriting rental contracts. The magnitude of this bypass is surprising, since the consumer price index, which is used as a reference in most rental contracts, increased by 0.4 percent in 2004 and again by 1.6 percent in 2005.[5] We believe that the effect of tenure length is not log-linear and we therefore employ dummy variables associated with the number of years a tenant has lived in a dwelling, with intervals of two to five years, six to 10 years, 11 to

[4] That is, Ln(Tenure length + 1).
[5] Data from Statistics Norway.

15 years, and 16 to 20 years; the range of one year or less was set as the default. We expect the coefficients to all be negative but with different magnitudes.

6 Results

Table 6.0 summarizes our results and illustrates that the aggregate model captures 49% of the variation in rents. The next section discusses the results.

Variable	Interval data		Continuous data		Aggregate data	
	Coif.	*t-stat*	*Coif.*	*t-stat*	*Coif.*	*t-stat*
Intercept:	**3.948**	3.4	**5.510**	27.2	**5.442**	27.3
Location (Oslo default):						
Akershus	**-0.226**	-3.4	**-0.197**	-11.1	**-0.197**	-11.5
Aust-Agder	**-0.405**	-3.4	**-0.495**	-13.2	**-0.486**	-13.5
Buskerud	**-0.460**	-5.9	**-0.350**	-14.8	**-0.361**	-15.9
Finnmark	**-0.348**	-3.6	**-0.466**	-11.5	**-0.440**	-11.9
Hedmark	**-0.433**	-5.5	**-0.474**	-17.3	**-0.468**	-18.1
Hordaland	**-0.341**	-6.5	**-0.293**	-17.1	**-0.302**	-18.5
Møre og Romsdal	**-0.482**	-7.2	**-0.529**	-21.0	**-0.522**	-22.3
Nordland	**-0.455**	-6.3	**-0.432**	-15.7	**-0.436**	-17.1
Nord-Trøndelag	**-0.490**	-4.9	**-0.450**	-11.9	**-0.458**	-13.0
Oppland	**-0.479**	-7.4	**-0.433**	-15.1	**-0.452**	-17.6
Østfold	**-0.278**	-4.1	**-0.392**	-17.5	**-0.376**	-17.7
Rogaland	**-0.371**	-6.5	**-0.282**	-14.2	**-0.295**	-15.8
Sogn og Fjordane	**-0.510**	-5.5	**-0.610**	-15.6	**-0.591**	-16.5
Sør-Trøndelag	**-0.382**	-6.2	**-0.294**	-15.2	**-0.307**	-16.5
Telemark	**-0.463**	-5.4	**-0.488**	-15.3	**-0.481**	-16.2
Troms	**-0.403**	-4.3	**-0.388**	-15.6	**-0.389**	-16.2
Vest- Agder	**-0.419**	-4.2	**-0.299**	-10.3	**-0.312**	-11.1
Vestfold	**-0.301**	-4.3	**-0.344**	-14.6	**-0.337**	-15.0
Hedonic attributes (one-room default):						
Ln(square meters)	**2.186**	3.7	**1.413**	14.2	**1.448**	14.7
$(\text{Ln(square meters)})^2$	**-0.252**	-3.5	**-0.158**	-12.8	**-0.163**	-13.4
One bedroom*ln(size)	**0.018**	0.9**	**0.018**	2.9	**0.018**	3.0
Two bedroom*ln(size)	**0.032**	1.5**	**0.038**	5.5	**0.037**	5.6
Three bedrooms*ln(size)	**0.045**	1.9*	**0.063**	8.2	**0.061**	8.3
Four bedrooms*ln(size)	**0.096**	3.9	**0.081**	9.1	**0.084**	10.1
Five bedrooms*ln(size)	**0.100**	3.1	**0.096**	8.1	**0.096**	8.7
Six bedrooms*ln(size)	**0.111**	2.7	**0.097**	5.6	**0.102**	6.4
Ln(Floor level)	**0.087**	3.8	**0.058**	8.1	**0.063**	9.2
Elevator	**0.132**	1.2**	**0.124**	4.1	**0.131**	4.5
Ln(Elevator*Floor level)	**0.102**	1.7*	**0.062**	3.7	**0.069**	4.3
Balcony	**0.037**	1.2**	**0.070**	7.4	**0.064**	7.1
Furnished	**0.034**	1.0**	**0.065**	5.9	**0.061**	5.8
Ln(High standard)	**0.071**	2.4	**0.106**	11.2	**0.103**	11.4
Characteristics (private as default):						
High income	**0.051**	1.3**	**0.048**	4.2	**0.050**	4.5
Single	**-0.116**	-3.7	**-0.095**	-9.4	**-0.100**	-10.3
Multi-complex owner	**0.150**	3.7	**0.097**	8.7	**0.103**	9.6
Relative or friend	**-0.096**	-2.2	**-0.185**	-12.5	**-0.171**	-12.2
Market mediation	**0.152**	4.7	**0.136**	13.9	**0.142**	15.3
Tenure length 2–5 years	**-0.069**	-1.8*	**-0.065**	-5.7	**-0.066**	-6.1
Tenure length 6–10 years	**-0.151**	-3.2	**-0.154**	-10.1	**-0.154**	-10.6
Tenure length 11–15 years	**-0.044**	-0.7**	**-0.162**	-7.3	**-0.145**	-7.0
Tenure length 16–20 years	**-0.111**	-0.9**	**-0.117**	-3.8	**-0.111**	-3.7
Adjusted R^2	0.43		0.50		0.49	
Regression F-value	13.17		119.60		132.66	
RSS	73.89		473.24		553.34	
Included observations	675		4993		5668	

Table 6.0 Results from interval, continuous, and combined data. Here * and ** denote statistical significance at the 10% level and not significant, respectively.

6.1 Location

The results from Table 6.0 confirm our expectations of negative coefficients when Oslo is set as the default. This makes sense, since the county of Oslo consists mainly of the city of Oslo, leading to a high population density for the whole region. Being the capital and main economic city in Norway, Oslo has by far the highest immigration rate of both foreigners and Norwegians. With limited housing capacity and little building construction in recent years, simple demand–supply theory explains much of the markup.

It is clear that the coefficients for the county variables are related to counties' high-density cities. Examples of such counties are Hordaland, Rogaland, Sør-Trøndelag, and Vest-Agder. Hordaland, with the third largest coefficient, is the county of Bergen, the second largest city in Norway. Rogaland, the county of Stavanger, the fourth biggest city in Norway, also has a relatively high coefficient. Similar to the county of Oslo, Hordaland and Rogaland's high coefficients may be partly explained by their high immigration rates. According to Statistics Norway, in 2009 Bergen and Stavanger were the two cities with the highest immigration rates after Oslo.[6] The counties of Sør-Trøndelag and Vest-Agder have the fourth and fifth largest coefficients in our regression, respectively, which is consistent with our hypothesis since these counties houses the high-density cities Trondheim and Kristiansand. An exception to this relation is Akershus, a county without any major city but with the second highest coefficient of all the counties. This can, however, be explained by Akershus' immediate proximity to the city of Oslo, which enables its inhabitants to commute to the capital. On the opposite side of the spectrum, we have the county of Sogn og Fjordane, with the lowest coefficient. This finding is also consistent with our hypothesis of population density, since the county does not contain any big cities.

6.2 Hedonic variables

As Table 6.0 illustrates, the variables describing the objects' characteristics have an essential impact when describing housing rent. All coefficients are statistically significant and economically important. We also observe that all coefficients have their expected signs. Focusing on dwelling size, our results illustrate that the coefficient for the natural logarithm of the number of square meters is 1,448 in the

[6] Statistics Norway, http://www.ssb.no/vis/emner/02/02/20/innvutv/main.html.

total sample model. The square of the same variable has a coefficient -0.163. These results support our theory of marginal utility from increased dwelling size, as illustrated in Figure 6.2.

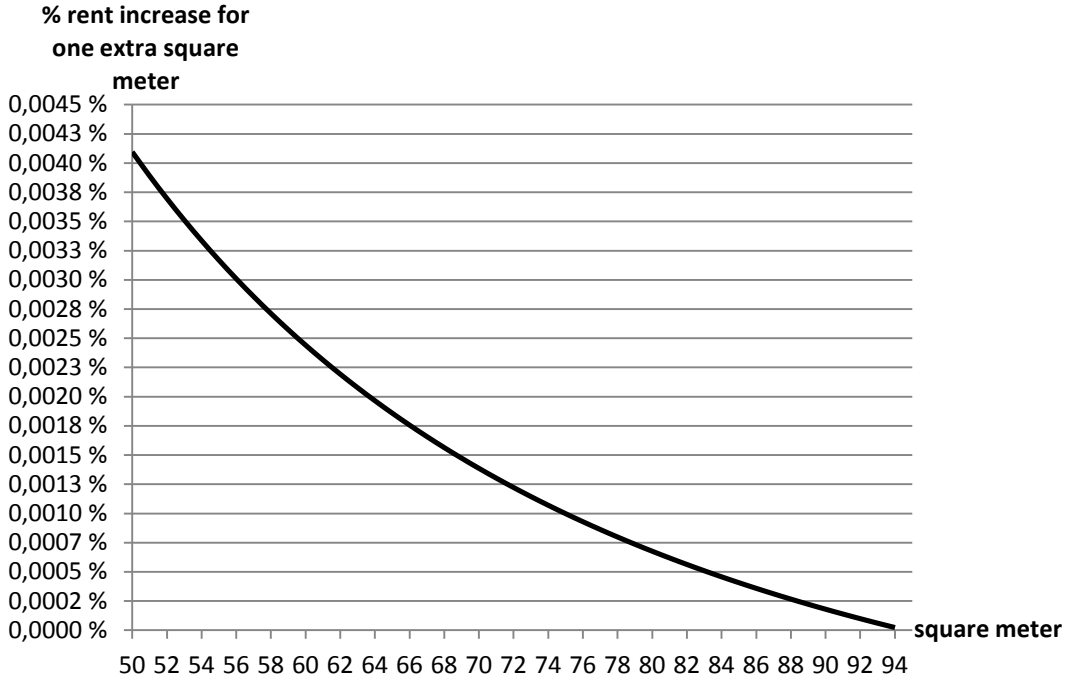

Figure 6.2 The percentage increase in monthly rent given an increase of one square meter from the base value (*x*-axis). Calculations are based on a two-bedroom apartment.

Figure 6.2 indicates that, all else being equal, an increase in dwelling size from 50 to 60 square meters is accompanied by a 3.34 percent[7] increase in rent, whereas an increase from 60 to 70 square meters implies an increase of 1.95 percent.[8]

Interestingly, our empirical results confirm the significance of a supplementary bedroom over the relevant size range. To illustrate, given a dwelling size of 80 square meters, moving from a two-bedroom to a three-

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bedroom apartment implies a monthly rent increase of 11.09 percent.[9] As expected, the effect is decreasing: A move from four to five bedrooms for a dwelling of 100 square meter results in a rent increase of 5.68 percent.[10]

The dwelling's location in a building has a positive effect, rising for each level above the ground, with a statistically significant coefficient of 0.063. This implies that a move from the second to the third floor, given no access to an elevator, is associated with a 1.83 percent[11] increase in monthly rent. Our results are consistent with explanations such as improved light conditions, better view, and less noise when living above the ground floor.

The coefficient for access to an elevator is positive and statistically significant, at 0.131. More interestingly, we observe that the probability of access to an elevator increases with the dwelling's floor level. According to our results, monthly rent increases by 3.87 percent[12] when a dwelling is located on the third floor with an elevator, compared to an identical dwelling located on the second floor. Moving from the second to the fourth floor implies a 6.97 percent[13] increase in monthly rent.

Our proxy for high standard illustrates a positive and statistically significant coefficient of 0.103 in the full model. For example, a dwelling including a fireplace, tiles and electric floor heating in the bathroom, and parquet flooring in other rooms increases monthly rent by 12.85 percent[14] when compared with a dwelling with only one of these elements. These findings are consistent with Larsen and Sommervoll's results from 2006. As expected, both the variables Balcony and Furnished have a positive impact on rent. Our results indicate that a balcony increases monthly rent by 6.61 percent,[15] while a furnished dwelling has a markup of 6.3 percent.[16]

When examining the effect of included electricity or heating, we find both variables to be not statistically significant. We also examine the relation using the sum of scores from the corresponding responses and find this variable to not be statistically significant. These findings are surprising, due to the substantial amount of such costs on a monthly basis. Due to the large number of right-hand side variables, the results are likely due to multicollinearity.

We also found the effect of designated parking facilities to not be statistically significant. This supports our hypothesis of correlation between access to parking facilities and a dwelling's decentralized location.

6.3 Characteristics

All of our tenant and landlord characteristic coefficients have the expected effect (sign) on rent and support the theory that landlord and tenant characteristics play a substantial role in rent variations. With private owners as the default, the results indicate that the anticipated effect of large-scale owners leads to higher rent. This is consistent with the theory that large-scale owners are less likely to institute a more substantial selection process. Our results indicate that large-scale owners

charge a markup of 10.85 percent.[17] These findings are controlled for in the market mediation described earlier, which has a coefficient of 0.142 in the full model. The market mediation coefficient indicate a markup of 15.3 percent[18] if the tenant found the dwelling through public channels such as the Internet, newspapers, and advertisements. The t-statistics show that the estimates are statistically significant.

It is important to note that the market mediation effect is net of the effects of the tenant–landlord relationship, which we control for with the variable Relative or friend. The coefficient for this variable is -0.171 in the full model, which implies that the rent of a dwelling is 15.7 percent[19] lower if it is rented through a relative or friend, whether market mediated or not. Again, the t-statistics show that the estimates are statistically significant.

Tenant characteristics are also important in rent negotiations, but, as mentioned, it is not always clear in what direction the variables influence the rent. Our results show that the variable for high education has a marginally but statistically insignificant negative coefficient in the full model. This can be interpreted as due to multicollinearity in our setup or an omitted variable bias. If the former, we cannot separate the education effect from, for example, object size and quality or from high income, which is likely to be correlated with education. The omitted variable effect may be as the result of variables affecting rent that are not observed or controlled for. The education variable is therefore excluded from the model.

Furthermore, our results support the theory that high income leads to higher rent, as illustrated in our full model, with a coefficient of 0.05 indicating an increase in the monthly rent of 5.13 percent.[20] The t-statistics illustrate that the variable is statistically significant.

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The variable for singles has a negative effect on rent, with a coefficient of -0.1, supporting the theory that landlords reduce rent for single tenants. The result implies a rent reduction of 9.52 percent.[21]

Finally, our results indicate that tenure length has a negative impact on rental prices. Our estimates provide statistically significant coefficients of tenure length, with -0.065 for a tenure length interval of two to five years, -0.154 for an interval of six to 10 years, -0.145 for 11 to 15 years, and -0.111 for 16 to 20 years. This indicates a discount of 6.4 percent for a tenure of between two and five years compared to the default of a one-year tenure. It follows that the discount is 14.3 percent for tenures of six to 10 years, 13.5 percent for 11 to 15 years, and 10.5 percent for 16 to 20 years. One possible explanation for the changes in discounts may be that the minimization of turnover and screening of good tenants lead to a higher discount during the initial ten years, while the discount decreases after this point as the landlord realizes the tenant has grown into the living unit and is thus less likely to move.

6.4 Parameter stability testing

The regression results embody the implicit assumption that parameters are constant for both the data collected between October 2009 and February 2010 and any subsequent period used for modeling rent variations in Norway. We test this assumption using the Chow test for parameter stability, with the null hypothesis

and

We utilize the same data used to estimate our previous regressions and include data collected in the period October 2005 to February 2006 from the previous Norwegian rental survey from 2006.[22] Variables are constructed in the same manner as the data from 2010, when possible.[23] The 2006 survey results have location variables on a regional level instead of the county level. We therefore construct a dummy variable for Oslo and Akershus, with other regions set as the default, to deal with the substantial rent premium associated with these regions.

[21]

[22] Only observations containing the exact size of the dwelling in square meters were included in the parameter stability test.

[23] Monthly rental prices were adjusted for inflation:

The absence of information regarding access to an elevator and the non-continuous coding of floor levels made us exclude these variables. The test statistic was obtained through the equation:

Comparing the test statistic with the critical value at the 5 percent level, we conclude that coefficients are not statistically equal in the two periods[24]; that is, the hypothesis of parameter stability through the different periods is rejected.

6.5 Rental submarkets

The Norwegian rental market consists of several submarkets. Our model estimates an aggregate hedonic rent model with the data containing different property types and regions. This may violate the basic assumption of the linear regression model, since the structural parameters that generate rent are not necessarily identical for different property types or regions, see Allen et al. (1973) for further details. The parameter estimates provided by ordinary least squares regression and the inferences drawn from them can therefore be inaccurate. This study acknowledges that tenants limit their choices of dwellings by property type and location, therefore only operating in specific submarkets, which results in a distinct function for each submarket.

The next section determines whether implicit rental prices differ across different property types and whether any regional differences exist. We estimate an ordinary least squares model for each submarket, as we did in the full model. Due to the lack of sufficient data, we reduce our model by transforming our geographic variables into a dummy variable for Oslo. We also remove variables concerning number of bedrooms, and the constructed dummy variables for tenure

[24] Here .

length as these variables were found insignificant in all submarket models. The statistical significance and relative sizes of the coefficients vary significantly across submarket models, confirming the presence of rental submarkets.

Property types

We apply our model to three different property types, with the empirical estimates illustrated in Table 6.5.a. All three models vary according to their explanatory power and in terms of the significance and magnitude of the estimated coefficients.

Variable	Studio		Apartments		Houses	
	Coefficient	***t-stat***	***Coefficient***	***t-stat***	***Coefficient***	***t-stat***
Intercept:	7.115	72.8	7.098	95.2	7.987	53.2
Location						
Dummy Oslo	0.228	10.3	0.302	24.5	0.270	7.1
Hedonic variables:						
Ln (square meters)	0.321	14.3	0.356	20.7	0.107	3.3
Ln (Floor level)	0.065	4.0	0.033	4.0	N/A	N/A
Elevator	0.217	1.9	0.066	2.2	N/A	N/A
Ln (Elevator*Floor level)	0.164	3.0	0.021	1.3	N/A	N/A
Balcony	0.022	1.1	0.054	4.5	0.051	1.8*
Ln (High standard)	0.108	5.3	0.094	7.6	0.174	6.8
Furnished	0.049	2.5	0.116	8.1	0.093	3.0
Characteristics (private landlord as default):						
High income	0.037	1.4	0.056	3.7	0.073	2.4
Single	-0.124	-6.3	-0.128	-9.8	-0.192	-7.0
Multi-complex owner	0.167	5.4	0.079	6.3	0.161	3.4
Relative or friend	-0.153	-5.3	-0.187	-8.2	-0.084	-2.5
Market mediation	0.094	4.8	0.127	10.0	0.251	9.1
Ln (Tenure length)	-0.078	-4.6	-0.085	-8.1	-0.11	5.2
Adjusted R^2	0.406		0.489		0.348	
Regression F-value	49.800		184.4		46.5	
Included observations	1036		2715		936	

Table 6.5.a Comparison of different property types. Here * indicates statistical significance at the 10% level.

The sub models have relatively good explanatory powers: The apartment model explains as much as 48.9 percent, followed by 40.6 percent for the studio model and 34.8 for the house model. As expected, all the submarkets have a markup for Oslo. Apartments have the highest markup, followed by houses and studios.

Students, who all have approximately the same economic premises, with student funding and possibly a part-time job, often rent studios. This phenomenon could set a ceiling on rent development for this property type, independent of city, as long as universities are present.

For all submarkets, dwelling size is significant and its coefficient illustrates that the size variable has the highest effect on rent. Floor level is also significant for studios and apartments and has a positive effect on rent.

Access to an elevator also has a positive effect on rent in both submarkets. The results for the studio market, however, are only significant at the 10 percent level. The additional effect from floor levels, given access to an elevator, is significant and contributes positively to rent for the studio market. For the apartment market, the effect is not significant.

The balcony variable has a positive effect on rent in all submarkets but is not significant for the studio model. A plausible explanation for this is that studios seldom have a balcony.

Our proxy for high standards is statistically significant for all three submarkets, with the coefficient for houses providing the highest markup, followed by those for studios and apartments. The difference between the different property types is, however, relatively small. The variable for furnished dwellings is significant in all submarkets and indicates that these units command a higher rent. The coefficients are, however, relatively small compared to furnishing costs, providing no incentive for landlords to furnish dwellings.

The effect of a high income, although not significant in the studio market, has a positive effect on rent in all submarkets. This is supported by the fact that individuals with high income seldom rent studios.

Being a single person has, as in the full model, a negative effect on rent in all submarkets. The effect is stronger for certain property types, being highest in the house market and lowest in the studio market. Our result is logical, since most singles live in either a studio or an apartment, both because they do not need the extra space and to avoid the extra expenses associated with renting a house.

As in the full model, our results show that the effects of multi-complex owners lead to higher rent in all submarkets. The result for the house market is not significant, which is not surprising, since the portfolios of multi-complex owners often consist of mostly apartments and studios. As in the full model, these results control for market mediation. The market mediation coefficients are significant in

all submarkets and indicate a markup if the tenant found the dwelling through public channels. Our results indicate that the effect from market mediation is more than twice as large in the house market as in the studio market. Government and academic institutions dominate the market for studio housing. Multi-complex landlords typically price-discriminate according to certain criteria, such as against students or individuals on welfare.

Our results for the variable for being a relative or friend are consistent with those from the full model, with a rental discount in each submarket, whether market mediated or not. This result is significant in all three submarkets.

Finally, our results illustrate that tenure length has a negative impact on rental prices in all submarkets. Again, all the t-statistics are significant and the results are consistent with previous studies.

A factor we were not able to develop proxies for, and that intuitively may be valuable for the house segment, is the value of privacy. However, the lack of suitable variables covering this issue prevents us from examining this aspect further.

Regional differences

This section analyzes the different rent determinants at the regional level. We expect that market makers do not set the rental price the same way in all parts of Norway and that different regions can have non-observable regularities.

Variable	Oslo		Hordaland		Sør Trøndelag		Rogaland	
	Coefficient	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*
Intercept:	7.083	89.4	7.418	42.1	7.315	31.5	7.144	31.9
Hedonic variables:								
Ln (square meters)	0.444	24.0	0.264	7.0	0.241	4.8	0.288	5.9
Ln (Floor level)	0.021	2.3	0.140	4.8	0.191	5.5	0.117	2.8
Elevator	0.063	1.9	0.661	2.0	0.398	2.4	-0.350	-0.7
Ln (Elevator* Floor level)	0.036	2.0	0.299	1.9	0.183	2.2	-0.199	-0.7
Balcony	0.061	4.0	0.029	1.0	0.068	1.8	0.070	1.7
Ln (High standard)	0.081	4.9	0.095	3.1	0.171	4.4	0.216	5.5
Furnished	0.052	3.1	0.083	2.7	0.071	1.6	0.120	2.9
Characteristics (private landlord as default):								
High income	0.061	3.2	0.079	2.1	-0.036	-0.7	0.050	1.1
Single	-0.115	-6.7	-0.183	-5.7	-0.109	-2.6	-0.071	-1.8
Multi-complex owner	0.082	5.1	0.132	3.9	0.237	4.5	0.208	3.3
Relative or friend	-0.209	-7.4	-0.185	-3.9	-0.204	-3.5	-0.079	-1.4
Market mediation	0.140	8.7	0.149	4.9	0.131	3.3	0.125	3.0
Ln (Tenure length)	-0.087	-6.6	-0.136	-5.4	-0.122	-3.6	-0.118	-3.4
Adjusted R^2	0.49		0.43		0.40		0.40	
Regression F-value	124.26		29.32		17.97		18.37	
Included observations	1 671		529		365		378	

Table 6.5.b Comparison of different regions.

Table 6.5.b shows that all models are statistically significant, but only the coefficients for size in square meters, the proxy for standards, being single, having a multi-complex owner, market mediation, and tenure length are significant in all regional models. Our overall results are surprising due to our anticipation of price complexity in Oslo: With the exception of size, the existence of a balcony, and a small deviation from the effect of having a relative or friend as a landlord, the remaining coefficients imply a lesser influence in the Oslo model compared with

other regions. However, the results may be influenced by the large effect from the size coefficient or effects not captured by the model. The relatively small number of observations in some regions can also bias our results.

For all the regional models, larger dwellings imply higher rent. However, the size of the coefficients varies across models and is, as mentioned, more pronounced in the Oslo model. This high degree of variation indicates high parameter sensitivity.

We further observe that the rent increases with each floor above the ground. The coefficient for this variable varies from 0.191 in the Sør-Trøndelag model to 0.021 in the Oslo model, compared with the aggregate model, where the coefficient has a magnitude of 0.063. This finding can be interpreted as the price elasticity of higher floor levels being greater for Sør-Trøndelag than for the overall market. However, it should be noted that the aggregate model also includes variables excluded from the regional models.

Access to an elevator is statistically significant at the 5 percent level for the Sør-Trøndelag and Hordaland models, while a higher floor level, given access to an elevator, is significant in the Oslo and Sør-Trøndelag models. The effect from the interaction coefficient between the floor level and elevator access varies from 0.036 in the Oslo model to 0.183 in the Sør-Trøndelag model. These findings indicate that access to an elevator when the dwelling is on the fourth floor has a greater effect in Sør-Trøndelag than in Oslo.

The presence of a balcony is only statistically significant in the Oslo model and leads to a rental markup of 6.2 percent. The coefficient for furnished dwellings and the proxy for standards seem fairly stable throughout the models, with parameters in the range 0.051 to 0.083. It should be noted that the coefficient for furnished dwellings is not statistically significant in the Sør-Trøndelag model.

Variables concerning the tenant's income and relationship status have the expected signs in all models. However, high income is only statistically significant in the Oslo and Hordaland models, while being single leads to a statistically significant markdown in all models except Rogaland.

Adjusted for market mediation, markups for multi-complex landlords are in the range 0.08 to 0.23, and we note that having a friend or relative as a landlord leads to a markdown in all models except for Rogaland's, where the coefficient is not statistically significant.

Focusing on tenure length, we observe that while the effect of length of residence is fairly stable at 0.12–0.13 in the three models, the coefficient for Oslo is only 0.08. This finding is supported by the significant demand for housing services in Oslo, allowing landlords there to gradually adjust prices more so than in other regions. However, as mentioned, the coefficients seem rather high compared with the overall price index.

7 Summary and conclusions

Using data from the national rental survey of Statistics Norway, we conduct a thorough analysis of the Norwegian rental market, including substantial attributes and characteristics and their respective impact on monthly rental prices. Our analysis applies the standard hedonic log–log framework introduced by Freeman (2003), with the extensions of tenant and landlord characteristics contributed by Larsen and Sommervoll (2006) and our own additions. We find that geographic variables, hedonic qualities, and tenant–landlord characteristics explain 49 percent of variations in monthly rent. Our tests of parameter stability for the aggregate model demonstrate the inequality of parameters for different periods.

Although earlier studies have made significant contributions in explaining residential rent in Norway, our study further acknowledges that tenants limit their choices of housing services by property type and location, thereby operating in particular submarkets. The statistical significance and relative sizes of the variable coefficients vary significantly across property types, confirming the presence of rental submarkets. We also confirm that market makers do not set rental prices the same way in all parts of Norway and that different regions may have other non-observable irregularities.

Our analysis reveals that rent increases tend to be a function of population density. We find that counties with high population densities and immigration rates have significant rental markups compared to other regions, and with the limited building construction in recent years, simple demand–supply theory can explain much of these increases. We further support the theory of marginal rent contribution as a function of not only size but also the number of bedrooms: A supplementary bedroom implies a rent increase as long as the dwelling is of sufficient size.

A compelling finding concerning the hedonic qualities is the estimated effect of floor levels, given access to an elevator. Willingness to pay a premium

for living on a high floor can be estimated as a function of floor level, given access to an elevator. This effect varies and is statistically significant in three out of four examined regions in Norway.

Our tenant and landlord characteristics have a substantial impact on variations in rent. The findings are consistent with the theory that small-scale landlords are likely to institute a more critical selection process, favoring desirable tenants and leading to rental discounts.

The analysis of tenure length is also consistent with earlier studies on the Norwegian rental market, indicating the likelihood of a discount compared to entering a new contract of a similar dwelling. A proven track record can therefore be viewed as a sign of reduced risk, motivating landlords to lower their rent.

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Appendix

2.5 Descriptive Statistics

Intervall data:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
rent	777	1000.00	25000.00	5743.7619	2936.75727	8624543.282
countyOslo	777	.00	1.00	.2085	.40649	.165
countyAkers	777	.00	1.00	.0579	.23373	.055
countyAusta	777	.00	1.00	.0129	.11279	.013
countyBuske	777	.00	1.00	.0360	.18650	.035
countyFinnm	777	.00	1.00	.0219	.14638	.021
countyHedm	777	.00	1.00	.0373	.18967	.036
countyHorda	777	.00	1.00	.1017	.30241	.091
countyMorerom	777	.00	1.00	.0489	.21581	.047
countyNordlan	777	.00	1.00	.0438	.20469	.042
countyNordtron	777	.00	1.00	.0193	.13768	.019
countyOppl	777	.00	1.00	.0592	.23615	.056
countyOstf	777	.00	1.00	.0515	.22112	.049
countyRogal	777	.00	1.00	.0862	.28088	.079
countySognog	777	.00	1.00	.0219	.14638	.021
countySorTron	777	.00	1.00	.0656	.24781	.061
countyTelem	777	.00	1.00	.0322	.17658	.031
countyTromsr	777	.00	1.00	.0232	.15053	.023
countyVesta	777	.00	1.00	.0245	.15455	.024
countyVestf	777	.00	1.00	.0476	.21310	.045
sumkvm	777	25.00	130.00	72.6126	29.27048	856.761
soverom0	777	.00	1.00	.0425	.20179	.041
soverom1	777	.00	1.00	.3977	.48973	.240
soverom2	777	.00	1.00	.3166	.46545	.217
soverom3	777	.00	1.00	.1519	.35912	.129
soverom4	777	.00	1.00	.0695	.25446	.065
soverom5	777	.00	1.00	.0154	.12339	.015
soverom6	777	.00	1.00	.0064	.08001	.006
etasje	767	.00	15.00	2.3468	2.38734	5.699
Heismiss	777	.00	1.00	.0631	.24323	.059
Balkongegen	757	.00	1.00	.6301	.48309	.233
heldelmobl	762	.00	1.00	.2651	.44167	.195
lnhighstd	726	.00	1.61	.7749	.49458	.245
incomehigh	748	.00	1.00	.1430	.35036	.123
single	772	.00	1.00	.5440	.49838	.248
llprivate	753	.00	1.00	.4409	.49683	.247
llmulticomp	777	.00	1.00	.1493	.35661	.127

llrelfriend	777	.00	1.00	.1158	.32023	.103
mmediation	777	.00	1.00	.2806	.44957	.202
tlength1	777	.00	1.00	.1943	.39594	.157
tlength25	775	.00	1.00	.5497	.49785	.248
tlength610	775	.00	1.00	.1742	.37952	.144
tlength1115	775	.00	1.00	.0671	.25035	.063
tlength1620	775	.00	1.00	.0168	.12851	.017
Valid N (listwise)	663					

Continuous data:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
rent	5315	1000.00	25000.00	6527.5308	3007.99745	9048048.639
countyOstf	5315	.00	1.00	.0476	.21294	.045
countyAkers	5315	.00	1.00	.0837	.27700	.077
countyOslo	5315	.00	1.00	.3052	.46052	.212
countyHedm	5315	.00	1.00	.0294	.16880	.028
countyOppl	5315	.00	1.00	.0269	.16182	.026
countyBuske	5315	.00	1.00	.0410	.19835	.039
countyVestf	5315	.00	1.00	.0414	.19921	.040
countyTelem	5315	.00	1.00	.0214	.14489	.021
countyAusta	5315	.00	1.00	.0143	.11873	.014
countyVesta	5315	.00	1.00	.0263	.16016	.026
countyRogal	5315	.00	1.00	.0662	.24870	.062
countyHorda	5315	.00	1.00	.0926	.28985	.084
countySognog	5315	.00	1.00	.0132	.11401	.013
countyMorerom	5315	.00	1.00	.0363	.18708	.035
countySorTron	5315	.00	1.00	.0643	.24539	.060
countyNordtron	5315	.00	1.00	.0141	.11796	.014
countyNordlan	5315	.00	1.00	.0286	.16669	.028
countyTromsr	5315	.00	1.00	.0352	.18426	.034
countyFinnm	5315	.00	1.00	.0122	.10992	.012
sumkvm	5315	10.00	300.00	72.2864	36.70024	1346.908
soverom0	5315	.00	1.00	.0452	.20766	.043

soverom1	5315	.00	1.00	.4472	.49725	.247
soverom2	5315	.00	1.00	.3161	.46499	.216
soverom3	5315	.00	1.00	.1355	.34225	.117
soverom4	5315	.00	1.00	.0427	.20222	.041
soverom5	5315	.00	1.00	.0102	.10029	.010
soverom6	5315	.00	1.00	.0032	.05647	.003
etasje	5272	.00	20.00	2.8003	2.61588	6.843
Heismiss	5315	.00	1.00	.0944	.29248	.086
heldelmobl	5279	.00	1.00	.2453	.43031	.185
lnhighstd	5209	.00	1.61	.8953	.49485	.245
incomehigh	5164	.00	1.00	.1931	.39474	.156
single	5310	.00	1.00	.4401	.49645	.246
llprivate	5263	.00	1.00	.4515	.49768	.248
llmulticomp	5315	.00	1.00	.2190	.41361	.171
llrelfriend	5315	.00	1.00	.1138	.31763	.101
mmediation	5315	.00	1.00	.4218	.49390	.244
tlength1	938	.00	1.00	.0139	.11697	.014
tlength25	5302	.00	1.00	.5511	.49743	.247
tlength610	5302	.00	1.00	.1486	.35575	.127
tlength1115	5302	.00	1.00	.0517	.22140	.049

tlength1620	5302	.00	1.00	.0240	.15292	.023
Valid N (listwise)	868					

Aggregate data:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
rent	6092	1000.00	25000.00	6427.5655	3010.14550	9060975.950
countyOstf	6092	.00	1.00	.0481	.21399	.046
countyAkers	6092	.00	1.00	.0804	.27199	.074
countyOslo	6092	.00	1.00	.2928	.45510	.207
countyHedm	6092	.00	1.00	.0304	.17161	.029
countyOppl	6092	.00	1.00	.0310	.17340	.030
countyBuske	6092	.00	1.00	.0404	.19687	.039
countyVestf	6092	.00	1.00	.0422	.20103	.040
countyTelem	6092	.00	1.00	.0228	.14933	.022
countyAusta	6092	.00	1.00	.0141	.11798	.014
countyVesta	6092	.00	1.00	.0261	.15945	.025
countyRogal	6092	.00	1.00	.0688	.25310	.064
countyHorda	6092	.00	1.00	.0937	.29148	.085
countySognog	6092	.00	1.00	.0143	.11866	.014
countyMorerom	6092	.00	1.00	.0379	.19102	.036
countySorTron	6092	.00	1.00	.0645	.24568	.060
countyNordtron	6092	.00	1.00	.0148	.12065	.015
countyNordlan	6092	.00	1.00	.0305	.17206	.030
countyTromsr	6092	.00	1.00	.0337	.18034	.033
countyFinnm	6092	.00	1.00	.0135	.11524	.013
sumkvm	6092	10.00	300.00	72.3280	35.83648	1284.253
soverom0	6092	.00	1.00	.0448	.20691	.043
soverom1	6092	.00	1.00	.4409	.49654	.247
soverom2	6092	.00	1.00	.3162	.46501	.216
soverom3	6092	.00	1.00	.1376	.34446	.119
soverom4	6092	.00	1.00	.0461	.20978	.044
soverom5	6092	.00	1.00	.0108	.10353	.011
soverom6	6092	.00	1.00	.0036	.05999	.004
etasje	6039	.00	20.00	2.7427	2.59219	6.719
Heismiss	6092	.00	1.00	.0904	.28684	.082
Balkongegen	6023	.00	1.00	.5954	.49086	.241
heldelmobl	6041	.00	1.00	.2478	.43177	.186
lnhighstd	5935	.00	1.61	.8806	.49634	.246
incomehigh	5912	.00	1.00	.1867	.38973	.152
single	6082	.00	1.00	.4533	.49786	.248
llprivate	6016	.00	1.00	.4501	.49755	.248
llmulticomp	6092	.00	1.00	.2101	.40742	.166
llrelfriend	6092	.00	1.00	.1141	.31794	.101
mmediation	6092	.00	1.00	.4038	.49070	.241
tlength1	1096	.00	1.00	.0137	.11624	.014

tlength25	6077	.00	1.00	.5509	.49744	.247
tlength610	6077	.00	1.00	.1519	.35894	.129
tlength1115	6077	.00	1.00	.0536	.22533	.051
tlength1620	6077	.00	1.00	.0230	.15004	.023
Valid N (listwise)	1003					

6.0 Results

Aggregate data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 05/24/11 Time: 14:37
Sample (adjusted): 1 6085
Included observations: 5668 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.441519	0.199480	27.27850	0.0000
COUNTYAKERS	-0.197059	0.017181	-11.46951	0.0000
COUNTYAUSTA	-0.485512	0.035931	-13.51222	0.0000
COUNTYBUSKE	-0.360877	0.022676	-15.91459	0.0000
COUNTYFINNM	-0.440109	0.037131	-11.85272	0.0000
COUNTYHEDM	-0.467812	0.025906	-18.05776	0.0000
COUNTYHORDA	-0.301837	0.016282	-18.53852	0.0000
COUNTYMOREROM	-0.522253	0.023434	-22.28606	0.0000
COUNTYNORDLAN	-0.436460	0.025573	-17.06729	0.0000
COUNTYNORDTRON	-0.458397	0.035246	-13.00561	0.0000
COUNTYOPPL	-0.451642	0.025645	-17.61096	0.0000
COUNTYOSTF	-0.376051	0.021195	-17.74248	0.0000
COUNTYROGAL	-0.294571	0.018698	-15.75384	0.0000
COUNTYSOGNOG	-0.591143	0.035799	-16.51298	0.0000
COUNTYSORTRON	-0.306630	0.018569	-16.51336	0.0000
COUNTYTELEM	-0.481499	0.029800	-16.15785	0.0000
COUNTYTROMSR	-0.389290	0.024081	-16.16577	0.0000
COUNTYVESTA	-0.311689	0.028055	-11.10994	0.0000
COUNTYVESTF	-0.336505	0.022425	-15.00563	0.0000
LOGKVM	1.448133	0.098333	14.72689	0.0000
LOGKVMSQ	-0.162903	0.012124	-13.43693	0.0000
SOVEROM1*LOGKVM	0.018316	0.006081	3.012096	0.0026
SOVEROM2*LOGKVM	0.037436	0.006627	5.648851	0.0000
SOVEROM3*LOGKVM	0.060595	0.007260	8.345818	0.0000
SOVEROM4*LOGKVM	0.083647	0.008268	10.11700	0.0000
SOVEROM5*LOGKVM	0.096426	0.011082	8.701280	0.0000
SOVEROM6*LOGKVM	0.101598	0.015849	6.410237	0.0000
LNETASJE	0.062796	0.006831	9.192230	0.0000
HEISMISS	0.131016	0.029397	4.456721	0.0000
LNETASJEHEIS	0.068836	0.016139	4.265222	0.0000
BALKONGEGEN	0.064496	0.009100	7.087699	0.0000
HELDELMOBL	0.060609	0.010412	5.820979	0.0000
LNHIGHSTD	0.102665	0.009014	11.38915	0.0000
INCOMEHIGH	0.049830	0.010984	4.536590	0.0000
SINGLE	-0.099762	0.009656	-10.33108	0.0000
LLMULTICOMP	0.102971	0.010760	9.569835	0.0000
LLRELFRIEND	-0.171256	0.014049	-12.18999	0.0000
MMEDIATION	0.141961	0.009293	15.27539	0.0000
TLENGTH25	-0.066087	0.010885	-6.071457	0.0000
TLENGTH610	-0.153851	0.014555	-10.57053	0.0000
TLENGTH1115	-0.145396	0.020652	-7.040294	0.0000
TLENGTH1620	-0.111032	0.030157	-3.681786	0.0002

R-squared	0.491561	Mean dependent var	8.672763
Adjusted R-squared	0.487856	S.D. dependent var	0.438229
S.E. of regression	0.313615	Akaike info criterion	0.526082
Sum squared resid	553.3421	Schwarz criterion	0.575304
Log likelihood	-1448.916	Hannan-Quinn criter.	0.543224
F-statistic	132.6643	Durbin-Watson stat	1.867045
Prob(F-statistic)	0.000000		

Continuous data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 05/24/11 Time: 14:50
Sample: 1 5315
Included observations: 4993

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.509703	0.202218	27.24634	0.0000
COUNTYAKERS	-0.196609	0.017704	-11.10518	0.0000
COUNTYAUSTA	-0.495243	0.037532	-13.19507	0.0000
COUNTYBUSKE	-0.350187	0.023644	-14.81054	0.0000
COUNTYFINNM	-0.465849	0.040581	-11.47962	0.0000
COUNTYHEDM	-0.474457	0.027455	-17.28141	0.0000
COUNTYHORDA	-0.292509	0.017144	-17.06144	0.0000
COUNTYMOREROM	-0.528723	0.025164	-21.01149	0.0000
COUNTYNORDLAN	-0.432056	0.027529	-15.69456	0.0000
COUNTYNORDTRON	-0.449803	0.037806	-11.89754	0.0000
COUNTYOPPL	-0.433290	0.028655	-15.12079	0.0000
COUNTYOSTF	-0.392134	0.022367	-17.53146	0.0000
COUNTYROGAL	-0.282089	0.019895	-14.17920	0.0000
COUNTYSOGNOG	-0.610150	0.039189	-15.56934	0.0000
COUNTYSORTRON	-0.294447	0.019428	-15.15608	0.0000
COUNTYTELEM	-0.488318	0.031909	-15.30338	0.0000
COUNTYTROMSR	-0.387697	0.024818	-15.62187	0.0000
COUNTYVESTA	-0.298746	0.029115	-10.26091	0.0000
COUNTYVESTF	-0.344367	0.023647	-14.56253	0.0000
LOGKVM	1.413448	0.099766	14.16766	0.0000
LOGKVMSQ	-0.158443	0.012344	-12.83550	0.0000
SOVEROM1*LOGKVM	0.018399	0.006376	2.885513	0.0039
SOVEROM2*LOGKVM	0.038263	0.006973	5.486951	0.0000
SOVEROM3*LOGKVM	0.063133	0.007665	8.236901	0.0000
SOVEROM4*LOGKVM	0.080769	0.008869	9.106523	0.0000
SOVEROM5*LOGKVM	0.096110	0.011856	8.106323	0.0000
SOVEROM6*LOGKVM	0.096753	0.017426	5.552294	0.0000
LNETASJE	0.057777	0.007174	8.053146	0.0000
HEISMISS	0.123775	0.030492	4.059300	0.0000
LNETASJEHEIS	0.062366	0.016690	3.736727	0.0002
BALKONGEGEN	0.070254	0.009517	7.381798	0.0000
HELDELMOBL	0.064673	0.010982	5.889102	0.0000
LNHIGHSTD	0.106474	0.009480	11.23172	0.0000
INCOMEHIGH	0.048008	0.011436	4.197903	0.0000
SINGLE	-0.095296	0.010160	-9.379522	0.0000
LLMULTICOMP	0.096617	0.011131	8.679882	0.0000
LLRELFRIEND	-0.185483	0.014886	-12.46026	0.0000
MMEDIATION	0.135540	0.009738	13.91847	0.0000
TLENGTH25	-0.064876	0.011342	-5.720181	0.0000
TLENGTH610	-0.154381	0.015298	-10.09160	0.0000
TLENGTH1115	-0.161646	0.022019	-7.341361	0.0000
TLENGTH1620	-0.116547	0.030970	-3.763224	0.0002

R-squared	0.497601	Mean dependent var	8.687769
Adjusted R-squared	0.493441	S.D. dependent var	0.434387
S.E. of regression	0.309166	Akaike info criterion	0.498502
Sum squared resid	473.2356	Schwarz criterion	0.553311
Log likelihood	-1202.510	Hannan-Quinn criter.	0.517713
F-statistic	119.6028	Durbin-Watson stat	1.875548
Prob(F-statistic)	0.000000		

Intervall data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 05/24/11 Time: 14:55
Sample (adjusted): 3 776
Included observations: 675 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.948457	1.173301	3.365254	0.0008
COUNTYAKERS	-0.225569	0.065769	-3.429715	0.0006
COUNTYAUSTA	-0.404684	0.120288	-3.364300	0.0008
COUNTYBUSKE	-0.459703	0.077703	-5.916189	0.0000
COUNTYFINNM	-0.347519	0.097052	-3.580758	0.0004
COUNTYHEDM	-0.433153	0.078733	-5.501555	0.0000
COUNTYHORDA	-0.341256	0.052390	-6.513791	0.0000
COUNTYMOREROM	-0.482247	0.066787	-7.220669	0.0000
COUNTYNORDLAN	-0.455457	0.072108	-6.316362	0.0000
COUNTYNORDTRON	-0.490143	0.100774	-4.863798	0.0000
COUNTYOPPL	-0.478819	0.064510	-7.422420	0.0000
COUNTYOSTF	-0.277748	0.067903	-4.090350	0.0000
COUNTYROGAL	-0.371004	0.056743	-6.538302	0.0000
COUNTYSOGNOG	-0.509863	0.092557	-5.508658	0.0000
COUNTYSORTRON	-0.382393	0.061694	-6.198209	0.0000
COUNTYTELEM	-0.463313	0.085159	-5.440527	0.0000
COUNTYTROMSR	-0.402691	0.092819	-4.338463	0.0000
COUNTYVESTA	-0.418967	0.099552	-4.208538	0.0000
COUNTYVESTF	-0.301174	0.070655	-4.262593	0.0000
LOGKVM	2.185925	0.583921	3.743532	0.0002
LOGKVMSQ	-0.252485	0.071383	-3.537049	0.0004
SOVEROM1*LOGKVM	0.017807	0.020362	0.874504	0.3822
SOVEROM2*LOGKVM	0.032423	0.021806	1.486871	0.1375
SOVEROM3*LOGKVM	0.044845	0.023341	1.921239	0.0552
SOVEROM4*LOGKVM	0.096349	0.024940	3.863291	0.0001
SOVEROM5*LOGKVM	0.100301	0.032538	3.082592	0.0021
SOVEROM6*LOGKVM	0.111301	0.041094	2.708490	0.0069
LNETASJE	0.086504	0.022524	3.840477	0.0001
HEISMISS	0.131777	0.106032	1.242803	0.2144
LNETASJEHEIS	0.102226	0.060883	1.679071	0.0936
BALKONGEGEN	0.036598	0.030901	1.184369	0.2367
HELDELMOBL	0.034470	0.033262	1.036320	0.3004
LNHIGHSTD	0.070611	0.029542	2.390156	0.0171
INCOMEHIGH	0.050723	0.038400	1.320904	0.1870
SINGLE	-0.116017	0.031267	-3.710581	0.0002
LLMULTICOMP	0.149689	0.040276	3.716570	0.0002
LLRELFRIEND	-0.095637	0.043451	-2.201050	0.0281
MMEDIATION	0.152326	0.032478	4.690185	0.0000
TLENGTH25	-0.069091	0.037497	-1.842565	0.0659
TLENGTH610	-0.150788	0.047228	-3.192774	0.0015
TLENGTH1115	-0.043730	0.061561	-0.710360	0.4777
TLENGTH1620	-0.111273	0.121584	-0.915194	0.3604

R-squared	0.460360	Mean dependent var	8.561763
Adjusted R-squared	0.425407	S.D. dependent var	0.450720
S.E. of regression	0.341655	Akaike info criterion	0.750171
Sum squared resid	73.88884	Schwarz criterion	1.031086
Log likelihood	-211.1826	Hannan-Quinn criter.	0.858943
F-statistic	13.17082	Durbin-Watson stat	1.812768
Prob(F-statistic)	0.000000		

6.4 Parameter stability testing

Aggregate data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 06/12/11 Time: 10:03
Sample: 1 9557
Included observations: 9409

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.106846	0.152460	33.49640	0.0000
DUMMYOSLO	0.343359	0.007619	45.06714	0.0000
LNSIZE	1.395356	0.075784	18.41222	0.0000
LNSIZESQUARED	-0.148138	0.009349	-15.84545	0.0000
ONEBEDROOM*LNSIZE	0.020412	0.002899	7.041871	0.0000
TWOBEDROOM*LNSIZE	0.038326	0.002893	13.24668	0.0000
THREEBEDROOM*LNSIZE	0.056062	0.003439	16.30062	0.0000
FOURBEDROOM*LNSIZE	0.072946	0.004736	15.40212	0.0000
FIVEBEDROOM*LNSIZE	0.090417	0.007431	12.16742	0.0000
SIXBEDROOM*LNSIZE	0.077339	0.015131	5.111298	0.0000
BALKONG	0.041248	0.007812	5.279910	0.0000
FURNISHED	0.106040	0.008651	12.25787	0.0000
LOGHIGHSTD	0.147707	0.007873	18.76153	0.0000
SINGLE	-0.037054	0.007439	-4.981138	0.0000
MULTICOMPLEX	0.126173	0.009000	14.01938	0.0000
RELFRIEND	-0.269801	0.011053	-24.40884	0.0000
LENGTH25	-0.060332	0.011765	-5.128284	0.0000
LENGTH610	-0.183658	0.015342	-11.97086	0.0000
LENGTH1115	-0.176223	0.017205	-10.24275	0.0000
LENGTH1620	-0.010039	0.013645	-0.735720	0.4619

R-squared	0.407835	Mean dependent var	8.616692
Adjusted R-squared	0.406636	S.D. dependent var	0.444903
S.E. of regression	0.342709	Akaike info criterion	0.698256
Sum squared resid	1102.736	Schwarz criterion	0.713453
Log likelihood	-3264.946	Hannan-Quinn criter.	0.703416
F-statistic	340.3354	Durbin-Watson stat	1.630854
Prob(F-statistic)	0.000000		

2010 data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 06/11/11 Time: 22:56
Sample: 1 5315
Included observations: 5180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.184460	0.200786	25.82082	0.0000
DUMMYOSLO	0.329532	0.010083	32.68235	0.0000
LNSIZE	1.462182	0.100178	14.59585	0.0000
LNSIZESQUARED	-0.166723	0.012511	-13.32594	0.0000
ONEBEDROOM*LNSIZE	0.017398	0.006736	2.582703	0.0098
TWOBEDROOM*LNSIZE	0.036470	0.007338	4.970047	0.0000
THREEBEDROOM*LNSIZE	0.056791	0.008062	7.044558	0.0000
FOURBEDROOM*LNSIZE	0.077097	0.009342	8.252742	0.0000
FIVEBEDROOM*LNSIZE	0.097452	0.012412	7.851574	0.0000
SIXBEDROOM*LNSIZE	0.097946	0.018187	5.385496	0.0000
BALKONG	0.063417	0.009854	6.435606	0.0000
FURNISHED	0.105946	0.011262	9.407174	0.0000
LOGHIGHSTD	0.148766	0.009724	15.29838	0.0000
SINGLE	-0.119765	0.010579	-11.32094	0.0000
MULTICOMPLEX	0.144723	0.011533	12.54843	0.0000
RELFRIEND	-0.240370	0.015059	-15.96201	0.0000
LENGTH25	-0.062003	0.011586	-5.351794	0.0000
LENGTH610	-0.163754	0.015882	-10.31043	0.0000
LENGTH1115	-0.183614	0.023228	-7.904897	0.0000
LENGTH1620	-0.125852	0.032916	-3.823489	0.0001

R-squared	0.425824	Mean dependent var	8.691120
Adjusted R-squared	0.423709	S.D. dependent var	0.437202
S.E. of regression	0.331897	Akaike info criterion	0.635869
Sum squared resid	568.4027	Schwarz criterion	0.661168
Log likelihood	-1626.900	Hannan-Quinn criter.	0.644720
F-statistic	201.4097	Durbin-Watson stat	1.894234
Prob(F-statistic)	0.000000		

2006 data:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 06/11/11 Time: 23:02
Sample: 1 4242
Included observations: 4228

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.771973	0.242701	19.66191	0.0000
DUMMYOSLO	0.338864	0.011686	28.99771	0.0000
LNSIZE	1.252372	0.116099	10.78706	0.0000
LNSIZESQUARED	-0.121071	0.014269	-8.484733	0.0000
ONEBEDROOM*LNSIZE	0.024858	0.004059	6.124517	0.0000
TWOBEDROOM*LNSIZE	0.036463	0.004149	8.787664	0.0000
THREEBEDROOM*LNSIZE	0.052292	0.005328	9.814523	0.0000
FOURBEDROOM*LNSIZE	0.068691	0.007764	8.847208	0.0000
FIVEBEDROOM*LNSIZE	0.079366	0.010790	7.355819	0.0000
SIXBEDROOM*LNSIZE	0.074354	0.036750	2.023224	0.0431
BALKONG	0.015123	0.012607	1.199530	0.2304
FURNISHED	0.078674	0.013214	5.953734	0.0000
LOGHIGHSTD	0.084060	0.016369	5.135228	0.0000
SINGLE	0.047264	0.011216	4.214118	0.0000
MULTICOMPLEX	0.098852	0.013942	7.090123	0.0000
RELFRIEND	-0.277432	0.015940	-17.40463	0.0000
LENGTH25	0.098067	0.075812	1.293556	0.1959
LENGTH610	0.117387	0.066744	1.758766	0.0787
LENGTH1115	0.189124	0.063253	2.989968	0.0028
LENGTH1620	0.355127	0.061508	5.773711	0.0000

R-squared	0.377668	Mean dependent var	8.426968
Adjusted R-squared	0.374858	S.D. dependent var	0.436671
S.E. of regression	0.345258	Akaike info criterion	0.715672
Sum squared resid	501.6076	Schwarz criterion	0.745707
Log likelihood	-1492.930	Hannan-Quinn criter.	0.726288
F-statistic	134.4033	Durbin-Watson stat	1.371825
Prob(F-statistic)	0.000000		

6.5.a. Property types

Studios:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 14:48
Sample (adjusted): 1 1114
Included observations: 1036 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.115076	0.097670	72.84816	0.0000
DUMMYOSLO	0.227711	0.022118	10.29513	0.0000
LOGKVM	0.321499	0.022455	14.31779	0.0000
LNETASJE	0.065433	0.016217	4.034739	0.0001
HEISMISS	0.217228	0.112045	1.938767	0.0528
LNETASJEHEIS	0.164494	0.054909	2.995761	0.0028
BALKONGEGEN	0.022140	0.019596	1.129863	0.2588
HELDELMOBL	0.049361	0.019558	2.523851	0.0118
LNHIGHSTD	0.107994	0.020318	5.315217	0.0000
INCOMEHIGH	0.036869	0.026109	1.412095	0.1582
SINGLE	-0.123714	0.019557	-6.325854	0.0000
LLMULTICOMP	0.167315	0.030913	5.412409	0.0000
LLRELFRIEND	-0.153474	0.029206	-5.254933	0.0000
MMEDIATION	0.093736	0.019580	4.787361	0.0000
LTLS	-0.078314	0.017076	-4.586209	0.0000

R-squared	0.405657	Mean dependent var	8.497423
Adjusted R-squared	0.397507	S.D. dependent var	0.371788
S.E. of regression	0.288583	Akaike info criterion	0.366707
Sum squared resid	85.02920	Schwarz criterion	0.438277
Log likelihood	-174.9542	Hannan-Quinn criter.	0.393862
F-statistic	49.77597	Durbin-Watson stat	1.197245
Prob(F-statistic)	0.000000		

Apartments:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 14:50
Sample (adjusted): 1 2866
Included observations: 2715 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.097848	0.074541	95.22048	0.0000
DUMMYOSLO	0.302030	0.012332	24.49220	0.0000
LOGKVM	0.356225	0.017170	20.74743	0.0000
LNETASJE	0.032739	0.008151	4.016361	0.0001
HEISMISS	0.065876	0.030111	2.187762	0.0288
LNETASJEHEIS	0.021193	0.016916	1.252825	0.2104
BALKONGEGEN	0.054209	0.012040	4.502269	0.0000
HELDELMOBL	0.115758	0.014331	8.077684	0.0000
LNHIGHSTD	0.093753	0.012368	7.580024	0.0000
INCOMEHIGH	0.055595	0.015178	3.662959	0.0003
SINGLE	-0.128393	0.013040	-9.845778	0.0000
LLMULTICOMP	0.079221	0.012660	6.257579	0.0000
LLRELFRIEND	-0.187440	0.022865	-8.197661	0.0000
MMEDIATION	0.127233	0.012756	9.974212	0.0000
LTLS	-0.084528	0.010377	-8.146099	0.0000

R-squared	0.488772	Mean dependent var	8.808228
Adjusted R-squared	0.486122	S.D. dependent var	0.416796
S.E. of regression	0.298781	Akaike info criterion	0.427300
Sum squared resid	241.0299	Schwarz criterion	0.459933
Log likelihood	-565.0602	Hannan-Quinn criter.	0.439098
F-statistic	184.3861	Durbin-Watson stat	1.184346
Prob(F-statistic)	0.000000		

Houses:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 07/06/11 Time: 18:01
Sample (adjusted): 1 985
Included observations: 936 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.986588	0.150002	53.24312	0.0000
DUMMYOSLO	0.270101	0.038059	7.096870	0.0000
LOGKVM	0.106899	0.032389	3.300493	0.0010
BALKONGEGEN	0.050663	0.028784	1.760125	0.0787
HELDELMOBL	0.093338	0.031103	3.000911	0.0028
LNHIGHSTD	0.174440	0.025568	6.822591	0.0000
INCOMEHIGH	0.072854	0.029854	2.440319	0.0149
SINGLE	-0.192104	0.027534	-6.976898	0.0000
LLMULTICOMP	0.161432	0.047701	3.384285	0.0007
LLRELFRIEND	-0.084031	0.033836	-2.483437	0.0132
MMEDIATION	0.251234	0.027665	9.081450	0.0000
LTLS	-0.110564	0.021106	-5.238609	0.0000

R-squared	0.356532	Mean dependent var	8.589562
Adjusted R-squared	0.348872	S.D. dependent var	0.468603
S.E. of regression	0.378127	Akaike info criterion	0.905566
Sum squared resid	132.1138	Schwarz criterion	0.967638
Log likelihood	-411.8051	Hannan-Quinn criter.	0.929234
F-statistic	46.54264	Durbin-Watson stat	1.955906
Prob(F-statistic)	0.000000		

6.5.b. Regional differences

Oslo:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 16:01
Sample: 1 1794
Included observations: 1671

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.082897	0.079245	89.37954	0.0000
LOGKVM	0.443891	0.018497	23.99794	0.0000
LNETASJE	0.021217	0.009327	2.274681	0.0231
HEISMISS	0.063262	0.032972	1.918657	0.0552
LNETASJEHEIS	0.036432	0.018437	1.976074	0.0483
BALKONGEGEN	0.061423	0.015415	3.984702	0.0001
HELDELMOBL	0.051816	0.016826	3.079552	0.0021
LNHIGHSTD	0.080535	0.016529	4.872279	0.0000
INCOMEHIGH	0.061091	0.019060	3.205235	0.0014
SINGLE	-0.114546	0.017020	-6.729989	0.0000
LLMULTICOMP	0.082360	0.016049	5.131768	0.0000
LLRELFRIEND	-0.208564	0.028109	-7.419907	0.0000
MMEDIATION	0.140469	0.016090	8.730059	0.0000
LTLS	-0.086845	0.013156	-6.600986	0.0000

R-squared	0.493646	Mean dependent var	8.927744
Adjusted R-squared	0.489674	S.D. dependent var	0.416620
S.E. of regression	0.297621	Akaike info criterion	0.422352
Sum squared resid	146.7743	Schwarz criterion	0.467772
Log likelihood	-338.8752	Hannan-Quinn criter.	0.439181
F-statistic	124.2628	Durbin-Watson stat	1.323427
Prob(F-statistic)	0.000000		

Hordaland:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 15:55
Sample: 1 571
Included observations: 529

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.418317	0.176247	42.09058	0.0000
LOGKVM	0.264344	0.037850	6.984020	0.0000
LNETASJE	0.139926	0.029442	4.752656	0.0000
HEISMISS	0.661428	0.325132	2.034337	0.0424
LNETASJEHEIS	0.298967	0.157270	1.900978	0.0579
BALKONGEGEN	0.029029	0.029124	0.996759	0.3193
HELDELMOBL	0.083294	0.030543	2.727125	0.0066
LNHIGHSTD	0.095099	0.030810	3.086620	0.0021
INCOMEHIGH	0.079497	0.038625	2.058185	0.0401
SINGLE	-0.182911	0.032314	-5.660515	0.0000
LLMULTICOMP	0.131767	0.033760	3.903061	0.0001
LLRELFRIEND	-0.184946	0.047729	-3.874927	0.0001
MMEDIATION	0.149142	0.030575	4.877884	0.0000
LTLS	-0.135501	0.025050	-5.409336	0.0000

R-squared	0.425332	Mean dependent var	8.663819
Adjusted R-squared	0.410826	S.D. dependent var	0.408859
S.E. of regression	0.313831	Akaike info criterion	0.546182
Sum squared resid	50.72218	Schwarz criterion	0.659214
Log likelihood	-130.4651	Hannan-Quinn criter.	0.590428
F-statistic	29.32077	Durbin-Watson stat	1.586389
Prob(F-statistic)	0.000000		

Sør Trøndelag:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 15:57
Sample: 1 393
Included observations: 365

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.314523	0.232095	31.51525	0.0000
LOGKVM	0.241452	0.050261	4.803926	0.0000
LNETASJE	0.191200	0.034673	5.514462	0.0000
HEISMISS	0.397926	0.165647	2.402246	0.0168
LNETASJEHEIS	0.182997	0.084013	2.178199	0.0301
BALKONGEGEN	0.068393	0.038655	1.769335	0.0777
HELDELMOBL	0.071192	0.043894	1.621921	0.1057
LNHIGHSTD	0.171018	0.038454	4.447293	0.0000
INCOMEHIGH	-0.036396	0.049066	-0.741792	0.4587
SINGLE	-0.108642	0.041127	-2.641602	0.0086
LLMULTICOMP	0.236560	0.052043	4.545430	0.0000
LLRELFRIEND	-0.204318	0.058938	-3.466661	0.0006
MMEDIATION	0.130717	0.039931	3.273534	0.0012
LTLS	-0.122310	0.033635	-3.636414	0.0003

R-squared	0.399585	Mean dependent var	8.608932
Adjusted R-squared	0.377348	S.D. dependent var	0.425981
S.E. of regression	0.336135	Akaike info criterion	0.694992
Sum squared resid	39.65829	Schwarz criterion	0.844577
Log likelihood	-112.8361	Hannan-Quinn criter.	0.754439
F-statistic	17.96891	Durbin-Watson stat	2.002085
Prob(F-statistic)	0.000000		

Rogaland:

Dependent Variable: LOGRENT
Method: Least Squares
Date: 04/11/11 Time: 15:59
Sample: 1 419
Included observations: 378

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.143990	0.223726	31.93185	0.0000
LOGKVM	0.287516	0.049133	5.851809	0.0000
LNETASJE	0.117396	0.041646	2.818881	0.0051
HEISMISS	-0.350225	0.485096	-0.721970	0.4708
LNETASJEHEIS	-0.198634	0.273314	-0.726758	0.4678
BALKONGEGEN	0.069888	0.041746	1.674127	0.0950
HELDELMOBL	0.120348	0.041710	2.885394	0.0041
LNHIGHSTD	0.215732	0.039468	5.466065	0.0000
INCOMEHIGH	0.049995	0.046988	1.063993	0.2880
SINGLE	-0.070728	0.040029	-1.766908	0.0781
LLMULTICOMP	0.208295	0.062681	3.323083	0.0010
LLRELFRIEND	-0.079189	0.057340	-1.381042	0.1681
MMEDIATION	0.124955	0.042263	2.956614	0.0033
LTLS	-0.118385	0.034723	-3.409419	0.0007

R-squared	0.396167	Mean dependent var	8.653148
Adjusted R-squared	0.374601	S.D. dependent var	0.463008
S.E. of regression	0.366156	Akaike info criterion	0.864822
Sum squared resid	48.80167	Schwarz criterion	1.010558
Log likelihood	-149.4513	Hannan-Quinn criter.	0.922662
F-statistic	18.37040	Durbin-Watson stat	1.800823
Prob(F-statistic)	0.000000		

Preliminary thesis

Studentnumber: **0815294**
: **0833429**

Preliminary Thesis

BI Norwegian School of Management

Valuation of housing attributes and the effect of tenant and landlord characteristics in the Norwegian rental market.

GRA 19002 – Preliminary thesis

Handed in:
17.01.2011

Place of study:
BI Nydalen

Table of Content

1.0 Introduction

Studies of the valuation of housing attributes have been conducted for numerous markets. However, empirical analyses of this nature for the Norwegian market are less common. Rental prices are made up of many characteristics, all of which may affect its value. This should be of importance to appraisers who make market-derived rent adjustments, property managers and developers who design real estate projects. From an investors perspective it will also be of great importance to know which attributes that can increase the rent compared to its cost, and thereby maximize the return of the investment.

There are several issues that affect the rent in the Norwegian rental market, and in this paper we will examine four issues. First of all we will employ attributes/characteristics with the physical units and properties of the physical surroundings in order to explain variation in rent. Second, the effect of landlord characteristics will be employed, focusing on the difference between small- scale landlords and large- scale landlords. It is expected that large- scale landlords set higher rents, as they are more able to diversify the risk and are likely to possess more knowledge of the market. Large- scale landlords are able to accept that some contracts may be problematic, allowing for a higher frequency of exit and/or damage to the property. They may therefore include premiums as an insurance against vacancy and depreciation in their offered rent. Small-scale landlords often have the tenant as a neighbor. This will stimulate a selection process not only motivated by revenue, but also of the tenants personality, giving the landlord incentive to give a discount in order to be more selective. Third, we will examine if the relationship between landlord and tenant has an affect on the rental price. If there is a relationship, either direct or indirect, it is expected to have a rent reduction effect. This is supported by basic risk- return theory, as previous knowledge of the tenant will reduce the risk and the landlord is therefore likely to give a discount. Finally, the length- of- residence might have an affect on the rent, and will be examined further. A tenant that has proven to pay rent on time and takes good care of the residence is more likely to be preferred over the risk associated with new tenants. Landlords might therefore be willing to reduce the rent through negotiations, or more likely, pass on the opportunity of nominal rent adjustments.

Hedonic regression analysis is typically used to estimate the marginal contribution of different characteristics. A hedonic regression that has been widely

employed rests upon the work of Freeman (1993). He again built his work on Rosen's (1974) two- stage method. Rosen defines hedonic prices as the implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them. In the first stage of Rosen's method we will estimate a hedonic price function for housing attributes and in the second stage we will estimate the inverse demand function for these attributes. Housing supply is assumed to be fixed, and all housing attributes are assumed to be continuous. Our study will utilize cross-sectional data from all of Norway, divided into eight geographical regions.

2.0 Background literature

In this section we will go through previous literature concerning our research questions. There have been conducted a variety of study`s regarding some of the research topics, while some topics is yet to be fully exploited.

The effect of property- specific characteristics and surroundings

There has been conducted numerous studies on the relationship between several groups of factors and market rent. Most of these studies measure the effect of physical characteristics.

Sirmans, Sirmans and Benjamins (1989) empirical results show in their examination of multifamily housing amenities, services and external factors that some amenities and services are consistently important determinants of the rent. Examples of external factors that affect the rent are traffic congestion and access to public transportation according to the study.

The results from a later study by Sirmans, Sirmans and Benjamin (1990) show that amenities such as designated parking, maid service and modern kitchen seem to be consistently valued by tenants, based on a linear model. Other characteristics, however, such as patios, playgrounds and boat/camper parking did not have significant effects on the rental price.

Gunterman and Norrbin (1987) ran a regression analysis of rent variations in a university submarket. The regression show that age and condition, common area amenities and extra bedrooms for a given apartment unit size have a significant affect on the rental price.

Marshall (1990) categorizes attributes into two groups, attributes preferred to be included during the construction phase and attributes that could be

added/changed after the construction phase. In his study of student rentals, Marshall find that number of bedrooms, swimming pool, distance from campus and complex size have a positive impact on the rental price. Pet restriction also had a positive effect while having a patio actually lowered rent.

Smith and Belloit (1987) identify 20 variables as important determinants of rent in their appraisal book. They find that amenities such as dish washer, tennis court, utilities included, sauna and furnished units have a significantly positive effect on rent. Coefficients for variables representing the number of bathrooms and bedrooms are also significantly positive, while coefficients such as leasing period, neighborhood quality and location convenience was significantly negative.

In the studies above, amenities, services, and physical characteristics have been proven to affect rent, but the data yield different estimates for the factors. This indicates that location may affect the estimates because different populations may have different preferences. Three studies that validate the indication of the importance of proximity to an economic focal point such as the city center or a campus are the studies of Jaffe and Bussa (1977), Marks (1984) and Prave and Ord (1987).

Location

Smith and Kroll (1988) combine market research with selected statistical techniques in a study where they demonstrate that marginal values on selected factors differ by different tenant profiles and geographic areas. In a later study, Smith and Kroll (1989) try to identify groups with a higher utility for selected project or unit amenities. The results show that constellations of distinctive demographic groups based on age and income variables do exist and that price elasticity varies across clusters in certain cases. This may allow an investor to optimize rental rate structures and thereby maximizing the value of an investment. The cost of providing the factors that is increasing rent in relationship to the additional rent collected, was investigated by Sirmans, Sirmans and Benjamin (1989). The authors also present a model for this comparison.

In a study by Ogur (1973) it was found that colleges and universities have a significant effect on rental markets, causing an increase in the rental prices in the nearby areas. This was also tested by Jaffe and Bussa (1975), who found that rent declined as distances from the university increased.

Length of Residence Discounts

Previous academic literature on rental contracts has predicted that landlords will attempt to minimize costs relating to turnover by giving discount to long-term tenants. Merrill (1977), Lowery (1980), and Marshall and Guasch (1983) all found a substantial discount associated between rents and tenure length. Contrary, Goodman and Kawai (1985) found that the transaction costs of moving, makes incentives for tenants to "grow into" a living unit, thereby allowing a rise of rent. This is backed by the study conducted by Barker in 2003 where he finds that residential with low turnover costs will charge long-term tenants higher rent than short-term tenants. He shows further that length-of-residence discounts are less common than discounts on the first month`s rent for new tenants

.

Small- scale versus large- scale landlords

There has not been a lot of research on the relationship between market rent and the size of the lessor, but Larsen and Sommervoll (2006) found in their analysis that small- scale landlords tend to set lower rents than large- scale landlords.

Relationship between landlord and tenant

The effect of the relationship between lessor and tenant on rent, are also not widely explored. Larsen and Sommervoll (2006) tested for this in their study and found indications for reduced rent if there where a direct or indirect relationship between the lessor and tenant. The authors explain the result with a hypothesis of reduced risk due to more information.

3.0 Hedonic theory

In this part of the paper we will introduce the theoretical aspects of hedonic analysis. Initially, we will discuss the hedonic model and its application for the housing rental market. Secondly, we will show that hedonic analysis is a natural point of departure when examining the relationship between price and attributes/characteristics.

In classical microeconomic consumer theory, the choice of the consumer is based upon maximization of the utility function specified in the quantities consumed as subject to a financial constraint (Kristensen 1984). This gives beautiful results, but has been criticized for the lack of realism. The hedonic hypothesis state that goods do not, per se, provide utility to the consumer, but are

instead valued for their utility- bearing attributes (Lancaster 1966). Such an extension renders possible studies of heterogeneous goods within the framework of the classical consumer theory, and will produce a direct link between the market price and attributes of a complex good such as housing.

Rosen presented in 1974 a framework for the study of differentiated products. Rosen`s point of departure is that a class of commodities can be described by n attributes or characteristics, . The components of z are assumed objectively measured in the sense that all consumers` perceptions of the characteristics embodied in each commodity are identical. It is further assumed that a sufficiently large number of differentiated products are available so that choice among various combinations of z is continuous for practical purposes.

Each differentiated commodity has a quoted market price and is associated with a fix value of the vector z which implicitly reveals a function relating prices and characteristics. The main objective for hedonic theory is therefore to explain how an equilibrium relationship is determined. In order to simplify, it is assumed that consumers are rational in the sense that, if two goods possess the same set of attributes, they will only consider the cheapest, and seller's identity is of no importance.

In the first step of explaining the determination of market equilibrium, Rosen (1974) assumes that the utility function of the household can be defined as , where x is a vector of all other commodities than the class of goods and , are the attributes for this class. represents a taste determining vector for the characteristics, hence differing between individuals. When further assuming separability between x and z_i, then constrained utility maximization leads to the bid function explaining the maximum amount residences would be willing to pay for different bundles of attributes at given level of utility: , where y represents the residential income. With accordance to general financial theory we assume that individuals prefer more to less , and that marginal utility are declining. .

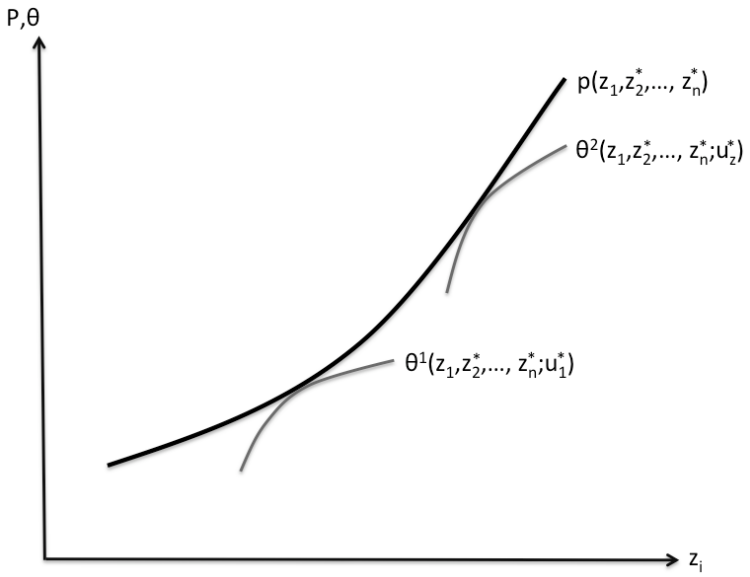

Figure 3.1 Households bid function

Symmetrically, Rosen (1974) defines the producer`s offer function by means of ordinary profit maximization to define the minimum price the producer is willing to accept for different bundles of attributes at a given level of profit: where M denotes the number of units produced by firm of designs offering. The shift parameter reflects the underlying variables in the cost minimization problem, namely, factor prices and production function parameters. It is assumed that , and .

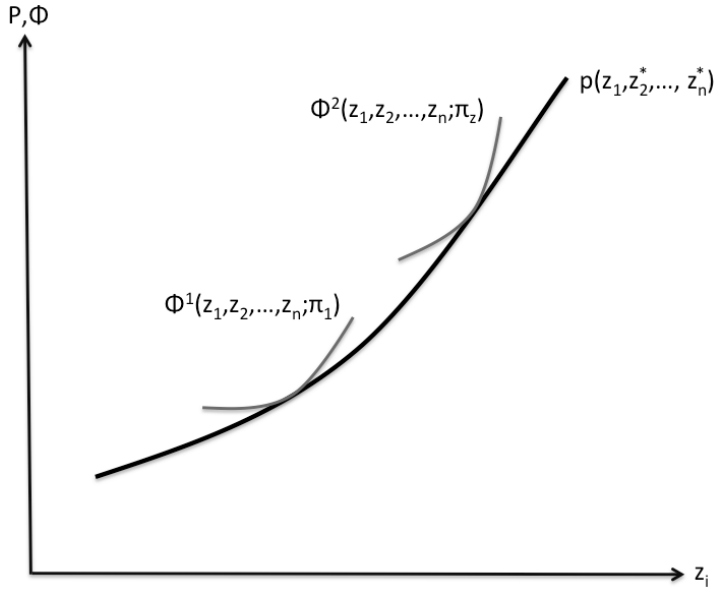

Figure 3.2 Producers offer function

The market equilibrium between the market prices and the attributes of the class of differentiated goods considered is then obtained from the tangency of the offer and bid functions. This tangency develops a common envelope function denoted , which is the implicit price function, or frequently called hedonic

price function illustrated in figure 3.3 below (Griliches 1971).

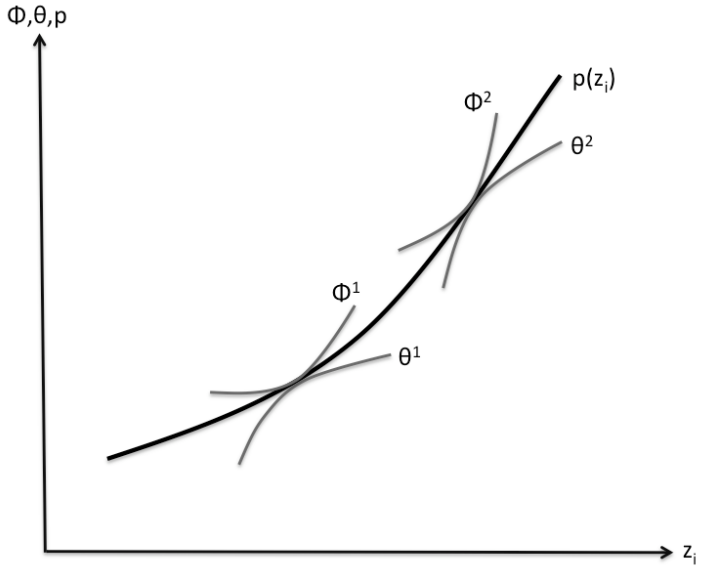

Figure 3.3 Hedonic price function

4.0 The Sample

The sample used to estimate the price functions consist of observations on 13.039 residential rentals in Norway for the period October 2009 to February 2010, and is collected by Statistics of Norway through their yearly rental market survey. Statistics of Norway use the collected data to prepare statistics and further research for the Norwegian rental market since 2005.

The population is residential rentals in Norway. Unfortunately, it does not exist any absolute index of such rentals. A combination of different governmental registers contained by Statistics of Norway is therefore used as basis, in order to establish a sample that maximize the share of residences. In 2010 Statistics of Norway used the following procedure for sample allocation:

- Owner Information from Statistics of Norway's Ground Parcel, Address and Building Register (GAB) was connected to the information from the Central Population Register in order to remove freehold residential.
- Information on the organizational structure from Statistics of Norway`s Corporate and Business Register (BOF) was match to the residential register to remove co-operative shareholders and certain institutions.

The majority of the sample consisted of 20 000 residences where Oslo was oversampled, i.e. a sample of 18 000 observation was based on the Norwegian population, while adding 2 000 residences from Oslo. The reasoning behind this weighting is the significant attention for the Oslo residential rental market and the volatility in rental prices across Oslo`s submarkets. Furthermore, 8 000 observations from residences age 20 to 29 was added stochastically from all municipalities in Norway. This was initiated in order to increase the allocation from this segment, and thereby cope with problems concerning students registered at ancestors' residence while living elsewhere. As around 50 percent of this segment lives in residential rentals[25], age is a criterion in order to reach the segment. The region share of the segment corresponds to the proportion of the population in this age group through the different regions.

Withdrawals

Of the 28 000 residences that constituted the original sample 31 was removed as

[25] Statistics of Norway Report 2004/28

the residential was owned by an institution, destroyed by fire, or was condemned. In addition, residences were dismissed as they did not want or were prevented from participating in the survey. There was also a share that was unreachable. The total withdrawals amounted to 14 961 residences, 53,4 percent of the total sample, and is illustrated on region-, age-, and education- level in table below.

	Interviewed	Refusal	Prevented	Not sent	Not attempt	Other withdrawals	Number
Total	46,5	7,8	1,5	29,6	8,6	6	27969
County							
Oslo	48,7	5,4	1,9	30,9	7,8	5,2	6324
Akershus	45,2	7,3	1,7	31,8	8,4	5,6	2062
Hedmark and Oppland	44,4	9,4	1,5	28,4	10	6,3	1717
Østlandet	42,6	8,7	1,4	31,1	10,2	6	4498
Agder and Rogaland	49,7	9,3	1,5	26,7	7,3	5,5	4473
Vestlandet	47,2	8,9	1,3	28	8,4	6,2	4208
Midt-Norge	46,6	7,3	0,9	29,6	9	6,6	2286
Nord-Norge	43,2	7	1,7	30,4	9,7	8	2401
Age							
Below 25	36	4,9	0,4	40,7	9,1	7,9	5273
25 - 34	47,5	6,3	1	29,5	9,4	6,2	11369
35 - 44	46,2	7,7	1,9	28,6	9,6	6	4365
45 - 66	51,4	10,5	2,4	23,8	7,6	4,4	4984
67 and older	54,6	16,9	4,4	17,3	3,4	3,4	1978
Education							
Compulsary school	37,6	9,3	1,5	34,6	10,5	6,5	9060
High School	54,6	7,7	0,6	24,4	7,5	5,3	16145
Higher education	59,5	11,9	2,4	11,9	4,8	9,5	42
Unresigned	28,2	3,2	7,2	44	9,3	8,3	2722

Table 4.1 Response rate and withdrawals by region, age, and education of basis sample

From the table we observe that withdrawals were mainly caused by problems related to contacting the residences. These withdrawals amounted to 29,6 percent of the gross sample, or 55,3 percent of the total withdrawals. Refusal as cause of withdrawal did not constitute to any major problem. However, some segments stands out. For the oldest segment, especially those aged 66 or older had a refusal rate of 16,9 percent while the average refusal rate was 6,9 percent. Furthermore, the segment with higher educational background had a refusal rate of 11,9 percent while 7,2 percent listed with unknown education were prevented from participating. Interestingly, we observe that the group aged 25 or younger had a response rate of only 36,9 percent although the refusal rate is low.

5.0 The Model and Data

To determine the extent to which certain locational, physical, amenity, service, tenant/landlord, and contract factors influence residential rent, the following model is utilized:

and

where

= the observed rent on the *i*th residential unit

= a set of location variables distinguishing different regions in Norway specifying the location of the *i*th residential based on census tracts.

= a set of *j* physical characteristics for the *i*th residential. These characteristics include:

a) The type of residential (a series of dummy variables is used to indicate detached house, apartment, lodging, etc.)
b) The type of surroundings (a series of dummy variables is used to indicate single houses, pure residential buildings, agriculture area etc.)
c) size of the residential unit
d) the number of rooms
e) the number of bedrooms
f) the number of bathrooms
g) the type of furnishing (a series of dummy variables is used to indicate totally furnished, partly furnished or not furnished)
h) the access kitchen (a series of dummy variables is used to indicate own kitchen, access to kitchen)
i) tiled bathroom
j) balcony, patio, garden, or porch (a series of dummy variables is used to indicate own, or access to)

k) storage room (a series of dummy variables is used to indicate location of storage room)
l) fire place
m) wheelchair accessibility throughout the residential

= a set of amenities of size j for the ith residential. These amenities are:

a) view from residential (fjord, ocean, city, mountains, woodland, etc.)
b) sight from living room (more than 200 meters)
c) covered parking (a series of dummy variables is used to indicate own garage, common garage, or parking space)
d) washing machine (a series of dummy variables is used to indicate socket, or access to washing machine/ laundry room)

= a set of services of size j for the ith residential. These services include:

a) electricity
b) heating
c) hallway wash
d) cable television
e) broad band

= a set of *j* tenant and landlord characteristics for the *i*th residential. These characteristics include:

a) rental sharing (a series of dummy variables is used to indicate cohabitant, spouse, partner)
b) the number of children
c) the type of landlord
d) the number of rent contributors
e) Residence or institution paying the rent
f) the employment status (a series of dummy variables is used to indicate employed, self-employed, unemployed, student, receives unemployment benefits)

= a set of j contract characteristics for the *i*th residential

g) the amount for deposit
h) the length of contract
i) the tenure length
j) the contract date
k) the rental starting date

Before a reliable model can be estimated, two preliminary issues should be resolved. The first issue concerns heteroscedasticity resulting from the use of cross-section data. This issue was resolved in a similar study by Guntermann and Norrbin (1987) who used a log-linear specification. All continuous variables will therefore appear in logged form.

The second issue concerns the large amount of variables used to explain the rent. With a large number of variables, the model is likely to have a high degree of multicollinearity. The result would be an estimated equation that is biased in which terms that are important and we might not get the market value of the singular attributes. For this reason, Guntermann and Norrbin (1987) used several different specifications of facility or amenity indexes in subsequent estimation of the models, including a principal component analysis.

6.0 Thesis Progression Plan

20th of January to 15th of February: Preparation for presentation of preliminary thesis.

15th of February to 25th of March: Revise thesis based on feedback from presentation.

25th of March to 10th of April: Initiate regressions based on research questions and objectives of the thesis.

10th of April to 10th of June: Complete thesis draft and delivery to supervisor for feedback.

1th of July to 1th of August: Revise thesis based on feedback from supervisor.

1th of August: Delivery of final thesis.

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8.0 Appendix

Variable coding

VALUE TE_6F

1 - 1 = 'Ja'

2 - 2 = 'Ja, men ektefelle, samboer eller partner svarer for IO'

3 - 3 = 'Nei'

4 - 4 = 'Finner ikke ny beboer'

5 - 5 = 'Tom bolig'

6 - 6 = 'Sendt inn postalt skjema'

7 - 7 = 'Annet'

OTHER = 'Uoppgitt'

;

VALUE TE_7F

1 - 1 = '16-24 år'

2 - 2 = '25-44 år'

3 - 3 = '45-66 år'

4 - 4 = '67-79 år'

5 - 5 = '80- år'

OTHER = 'Uoppgitt'

;

VALUE TE_4F

1 - 1 = 'Mann'

2 - 2 = 'Kvinne'

OTHER = 'Uoppgitt'

;

VALUE TE_5F

1 - 1 = 'Akershus og Oslo'

2 - 2 = 'Hedmark og Oppland'

3 - 3 = 'Østlandet ellers'

4 - 4 = 'Agder og Rogaland'

5 - 5 = 'Vestlandet'

6 - 6 = 'Trøndelag'

7 - 7 = 'Nord-Norge'

OTHER = 'Uoppgitt'

```
  ;
 VALUE TE_8F
  1  -  1 = 'frittliggende enebolig,'
  2  -  2 = 'våningshus, kårbolig eller annet hus tilknyttet gårdsbruk,'
  3  -  3 = 'kjedet enebolig, rekkehus, tomannsbolig eller generasjonsbolig,'
  4  -  4 = 'leilighet i blokk, i bygård, i firemanns- eller seksmannsbolig, i
terrassehus eller i annet flerbolighus,'
  5  -  5 = 'hybel eller hybelleilighet med egen inngang,'
  6  -  6 = 'hybel eller hybelleilighet uten egen inngang,'
  7  -  7 = 'annen type hus eller leilighet?'
  OTHER = 'Uoppgitt'
  ;
 VALUE TE_1F
  1  -  1 = 'Ja'
  2  -  2 = 'Nei'
  OTHER = 'Uoppgitt'
  ;
 VALUE TE_9F
  1  -  1 = 'en leilighet,'
  2  -  2 = 'en hybel eller hybelleilighet med egen inngang eller,'
  3  -  3 = 'en hybel eller hybelleilighet uten egen inngang?'
  4  -  4 = 'Annen type bolig'
  OTHER = 'Uoppgitt'
  ;
 VALUE TE_10F
  1  -  1 = 'Selveier alene eller gjennom sameie'
  2  -  2 = 'Borettslag, boligaksjeselskap'
  3  -  3 = 'Annet'
  OTHER = 'Uoppgitt'
  ;
 VALUE TE_11F
  1  -  1 = 'Leier'
  2  -  2 = 'Disponerer på annen måte'
  OTHER = 'Uoppgitt'
  ;
```

```
VALUE TE_12F
 1  -  1 = 'slektninger,'
 2  -  2 = 'venner,'
 3  -  3 = 'en annen privatperson,'
 4  -  4 = 'en privat gårdeier eller et gårdselskap,'
 5  -  5 = 'kommunen'
 6  -  6 = 'gjennom arbeidet'
 7  -  7 = 'Studentsamskipnaden/en studentboligstiftelse'
 8  -  8 = 'eller andre?'
 OTHER = 'Uoppgitt'
 ;
VALUE TE_13F
 1  -  1 = 'Ja'
 2  -  2 = 'Vet Ikke'
 OTHER = 'Uoppgitt'
 ;
VALUE TE_14F
 1  -  1 = 'Under 20 kvadratmeter,'
 2  -  2 = '20 - 39 kvadratmeter,'
 3  -  3 = '40 - 59 kvadratmeter,'
 4  -  4 = 'eller 60 - 79 kvadratmeter'
 5  -  5 = '80 - 99 kvadratmeter,'
 6  -  6 = '100 - 119 kvadratmeter,'
 7  -  7 = 'eller 120 kvadratmeter eller mer'
 OTHER = 'Uoppgitt'
 ;
VALUE TE_15F
 1  -  1 = 'Kjeller/sokkel/underetasje'
 2  -  2 = '1. etasje'
 3  -  3 = '2. etasje'
 4  -  4 = '3. etasje'
 5  -  5 = '4. etasje'
 6  -  6 = '5. etasje eller høyere'
 7  -  7 = 'over flere etasjer'
 OTHER = 'Uoppgitt'
```

```
  ;
 VALUE TE_16F
   1   -   1 = 'enslige hus, ingen hus innen 200 meter,'
   2   -   2 = 'ren boligbebyggelse,'
   3   -   3 = 'landbruksområde,'
   4   -   4 = 'blandet bolig- og landbruksområde,'
   5   -   5 = 'blandet bolig-, forretnings- eller industristrøk,'
   6   -   6 = 'annet'
   OTHER = 'Uoppgitt'
   ;
 VALUE TE_17F
   1   -   1 = 'Møblert - kunne ha bodd der uten noen egne møbler og hvitevarer'
   2   -   2 = 'Delvis møblert - må ha noen egne møbler og/eller hvitevarer for å bo
der'
   3   -   3 = 'Umøblert'
   OTHER = 'Uoppgitt'
   ;
 VALUE TE_18F
   1   -   1 = 'Annonse, aviser, Internett, profesjonelle byråer'
   2   -   2 = 'familie,venner'
   3   -   3 = 'kolleger, arbeidsforhold'
   4   -   4 = 'eller på annen måte?'
   OTHER = 'Uoppgitt'
   ;
 VALUE TE_19F
   1   -   1 = 'Oktober'
   2   -   2 = 'November'
   3   -   3 = 'Desember'
   4   -   4 = 'Januar'
   5   -   5 = 'Februar'
   6   -   6 = 'Mars'
   OTHER = 'Uoppgitt'
   ;
 VALUE TE_20F
   1   -   1 = 'Heltid'
```

```
  2   -   2 = 'Deltid'
  OTHER = 'Uoppgitt'
  ;
 VALUE TE_21F
  1   -   1 = 'januar'
  2   -   2 = 'februar'
  3   -   3 = 'mars'
  4   -   4 = 'april'
  5   -   5 = 'mai'
  6   -   6 = 'juni'
  7   -   7 = 'juli'
  8   -   8 = 'august'
  9   -   9 = 'september'
  10   -   10 = 'oktober'
  11   -   11 = 'november'
  12   -   12 = 'desember'
  OTHER = 'Uoppgitt'
  ;
 LABEL
   IO_Numme  = 'IOs id-nummer innafor skjemaet'
   Delutval  = 'IO tilhører delutvalg'
   Resultat  = 'Resultat'
   BorDu     = 'Bor du på adressen:'
 /* IOs_Alde  = 'IOs alder på intervjutidspunktet' */
   AldGrupp  = 'IOs aldersgruppe'
   IOs_Kjon  = 'IOs kjønn'
   IOs_Komm  = 'IOs bokommune ved intervjuet'
   Landsdel  = 'Landsdel'
   Spm1      = 'Hva slags hus eller leilighet bor du i?'
 /* Spm1_Tek  = 'Her står det noe, blank = blank' */
   Spm1sps   = 'Hva slags hus eller leilighet du bor i'
   Spm1a     = 'Er boligen en type leilighet'
   Spm2      = 'Er det innredet ekstra bolig i kjeller/loft'
   Spm3      = 'Bor i hoveddel av huset'
   Spm4      = 'Er den delen av huset du bor i ...'
```

```
Spm5      = 'Eier boligen du bor i'
Spm6      = 'Eier boligen som selveier/gj borettslag/boligaksjeselskap'
Spm7      = 'Deler boligen med noen'
Spm8a     = 'Bor sammen med samboer/ektefelle/partner'
Spm8b     = 'Bor sammen med barn under 16 år'
Spm8c     = 'Bor sammen med barn 16 år og oppover'
Spm8d     = 'Bor sammen med venner/kollektiv'
Spm8e     = 'Bor sammen med foreldre'
Spm8f     = 'Bor sammen med søsken'
Spm8g     = 'Bor sammen med andre'
Spm8h     = 'Antall barn under 16 år i boligen'
Spm9      = 'Eier noen av de du bor sammen med boligen'
Spm10a    = 'Samboer/ektefelle eier boligen'
Spm10b    = 'Barn under 16 år eier boligen'
Spm10c    = 'Barn 16 år og oppover eier boligen'
Spm10d    = 'Søsken eier boligen'
Spm10e    = 'Andre eier boligen'
Spm11     = 'Leier du boligen eller disponerer du den'
/* Spm11Tek  = 'Her står det noe, blank = blank' */
Spm11Sps  = 'På hvilken måte disponerer du boligen?'
Spm12     = 'Leier du boligen av ...'
/* Spm12Tek  = 'Her står det noe, blank = blank' */
Spm12sps  = 'Hvem leier du av'
Spm13     = 'Bor du i samme bygning som eier'
Spm14ja   = 'Har oppgitt areal'
Spm14     = 'Omtrent hvor mange kvadratmeter er boligen'
Spm15a_b  = 'Plassere boligen i et av følgende arealintervall'
Spm16     = 'Hvor mange rom med vindu har boligen'
Spm17     = 'Hvor mange rom med badekar/dusj i boligen du leier'
Spm18     = 'Har boligen tilgang på bad med dusj/badekar'
Spm19     = 'Antall toalett i boligen'
Spm20a    = 'Har boligen eget kjøkken/kjøkkenkrok med vannkran'
Spm20b    = 'Har boligen tilgang til kjøkken'
Spm20c    = 'Har bod i boligen'
Spm20d    = 'Har boligen bod på loft, kjeller eller andre steder'
```

Spm20e = 'Har boligen uttak for egen vaskemaskin'

Spm20f = 'Har boligen tilgang til vaskemaskin'

Spm20g = 'Har boligen egen balkong/terrasse/veranda/hage'

Spm20h = 'Har boligen tilgang på balkong/terrasse m.m'

Spm20i = 'Har boligen egen garasje eller garasjeplass'

Spm20j = 'Har boligen garasje i fellesgarasje'

Spm20k = 'Har boligen egen biloppstillingsplass'

Spm20l = 'Har boligen egen inngang'

Spm20m = 'Har boligen kabel-TV/parabol'

Spm20n = 'Har boligen varmekabler på bad'

Spm20o = 'Har boligen parkett/tregulv i stue'

Spm20p = 'Har boligen flislagt bad'

Spm20q = 'Har boligen bredbånd'

Spm20r = 'Har boligen åpen eller lukket peis for ved'

Spm21 = 'I hvilken etasje ligger boligen'

Spm22 = 'Hvor mange soverom med vindu har boligen'

Spm23 = 'Hvor mange andre oppholdsrom med vindu har boligen'

Spm24 = 'Hvor mange rom med badekar eller dusj er det i boligen'

Spm25 = 'Hvor mange toalett er det i boligen'

Spm26a = 'Har boligen kjeller'

Spm26b = 'Har boligen loft'

Spm26c = 'Har boligen garasje'

Spm26d = 'Har boligen sentralstøvsuger'

Spm26e = 'Har boligen kabel-TV/parabol'

Spm26f = 'Har boligen varmekabler på bad'

Spm26g = 'Har boligen parkett i stue'

Spm26h = 'Har boligen flislagt bad'

Spm26i = 'Har boligen bredbånd'

Spm26j = 'Har boligen åpen eller lukket peis for ved'

Spm27 = 'Har boligen mer enn ca. 200 m. fri sikt fra stuevinduet'

Spm28a = 'Har boligen utsikt til fjord'

Spm28b = 'Har boligen utsikt til hav'

Spm28c = 'Har boligen utsikt til by eller bygd'

Spm28d = 'Har boligen utsikt til fjell'

Spm28e = 'Har boligen utsikt til åker'

Spm28f = 'Har boligen utsikt til skog'

Spm28g = 'Har boligen utsikt til industriområde'

Spm28h = 'Har boligen utsikt til trafikkert vei'

Spm28i = 'Har boligen utsikt til jernbanelinje'

Spm28j = 'Har boligen utsikt til annet'

Spm28sps = 'Hvis annet spesifiser'

Spm29 = 'Hva slags bebyggelse er det i nabolaget'

Spm30 = 'Leier du boligen møblert, delvis møblert'

Spm31 = 'Avtale med utleier om å utføre ulike typer arbeidsoppgaver'

Spm32a = 'HAGEARBEID F.EKS. KLIPPE OG/ELLER VANNE PLEN'

Spm32b = 'MÅKE SNØ, RYDDE INNKJØRSEL O.L.'

Spm32c = 'VASKE FELLESAREAL F.EKS. OPPGANG, TRAPP'

Spm32d = 'PASS AV BARN'

Spm32e = 'PASS AV HUND/KATT'

Spm32f = 'OPPUSSING/OPPGRADERING AV STANDARDEN TIL BOLIGEN'

Spm32g = 'FOREFALLENDE HÅNDVERK, ELEKTRISKE JUSTERINGER'

Spm32h = 'RENGJØRING'

Spm32i = 'ANNET FOREFALLENDE ARBEID'

Spm33 = 'Hvordan fikk du tak i boligen'

/* spm33tek = 'Her står det noe, blank = blank' */

spm33sps = 'Hvilken annen måte'

Spm34 = 'Husleie for boligen'

Spm34a = 'For hvilken måned gjelder husleien'

Spm35 = 'Hva er din andel av husleien'

Spm36 = 'Hvor mange bidrar til å betale husleien'

Spm37 = 'Mottar du/dere støtte for å betale husle'

Spm38a_1 = 'kommunen betaler støtten'

Spm38a_2 = 'arbeidsgiver betaler støtten'

Spm38a_3 = 'andre betaler støtten'

Spm39 = 'Har du for tiden inntektsgivende arbeid'

Spm40 = 'Jobber du heltid eller deltid'

Spm41a = 'Er ansatt eller selvstendig næringsdrivende'

Spm41b = 'Er arbeidsledig og jobbsøkende'

Spm41c = 'Er på arbeidsmarkedstiltak'

Spm41d = 'Er student eller skoleelev'

Spm41e = 'Er trygdet/underattføring eller på overgangsstønad'

Spm41f = 'Er annet'

Spm42a = 'Er arbeidsledig'

Spm42b = 'Er på tiltak eller arbeidssøkende'

Spm42c = 'Er student eller skoleelev'

Spm42d = 'Er hjemmearbeidende'

Spm42e = 'Er trygdet/under attføring eller har overgangsstønad'

Spm42f = 'Er annet'

Spm43a = 'Omfatter den oppgitte husleien strøm'

Spm43b = 'Omfatter den oppgitte husleien oppvarming'

Spm43c = 'Omfatter den oppgitte husleien bruk av vaskemaskin'

Spm43d = 'Omfatter den oppgitte husleien biloppstillingsplass/garasje'

Spm43e = 'Omfatter den oppgitte husleien kabel-tv'

Spm43f = 'Omfatter den oppgitte husleien gangvask'

Spm43g = 'Omfatter den oppgitte husleien snømåking'

/* Spm43tek = 'Her står det noe, blank = blank' */

Spm43h = 'Omfatter den oppgitte husleien annet'

Spm43j = 'Hva annet'

Spm44 = 'Har du/dere betalt depositum'

Spm45 = 'Hvor stort er depositumet for boligen'

Spm46_aa = 'Når startet leieforholdet, år'

Spm46_mn = 'Når startet leieforholdet måned'

Spm47 = 'Er det inngått skriftelig leiekontrakt'

Spm48 = 'Hindringer i boligen som gjør det vanskelig for rullestolbruker'

Descriptive statistics

	Number of obs.	Minimum	Maximum	Mean	Std. Dev.
BorDu Bor du på adressen:	12155	1	2	1,4	0,489
IOs_Alde IOs alder på intervjutidspunktet	12899	18	80	37,95	15,546
AldGrupp IOs aldersgruppe	12899	1	5	2,21	0,798
IOs_Kjon IOs kjønn	12899	1	2	1,47	0,499
Landsdel Landsdel	12899	1	7	3,23	1,501
Spm1 Hva slags hus eller leilighet bor du i?	12597	1	9	2,99	1,604
Spm1a Er boligen en type leilighet	52	1	2	1,15	0,364
Spm2 Er det innredet ekstra bolig i kjeller/loft	7269	1	9	1,75	0,506
Spm3 Bor i hoveddel av huset	2818	1	9	1,55	0,606
Spm4 Er den delen av huset du bor i ...	1786	1	9	1,33	0,756
Spm5 Eier boligen du bor i	12624	1	9	1,63	0,5
Spm6 Eier boligen som selveier/gj borettslag/boligaksjeselskap	4704	1	9	1,42	0,645
Spm7 Deler boligen med noen	8641	1	9	1,42	0,52
Spm8a Bor sammen med samboer/ektefelle/partner	8164	1	2	1,58	0,494
Spm8b Bor sammen med barn under 16 år	8166	1	2	1,76	0,427
Spm8c Bor sammen med barn 16 år og oppover	8166	1	2	1,95	0,224
Spm8d Bor sammen med venner/kollektiv	8166	1	2	1,93	0,248
Spm8e Bor sammen med foreldre	8166	1	2	1,98	0,128
Spm8f Bor sammen med søsken	8166	1	2	1,98	0,143
Spm8g Bor sammen med andre	8166	1	2	1,98	0,126
Spm8h Antall barn under 16 år i boligen	2009	1	7	1,57	0,827
Spm9 Eier noen av de du bor sammen med boligen	4632	1	9	1,9	0,318
Spm10a Samboer/ektefelle eier boligen	515	1	2	1,07	0,252
Spm10b Barn under 16 år eier boligen	132	1	2	1,57	0,497
Spm10c Barn 16 år og oppover eier boligen	133	1	2	1,41	0,493
Spm10d Søsken eier boligen	103	1	2	1,65	0,479
Spm10e Andre eier boligen	437	1	2	1,17	0,373
Spm11 Leier du boligen eller disponerer du den	7475	1	9	1,08	0,347
Spm12 Leier du boligen av ...	6930	1	8	3,61	1,604
Spm13 Bor du i samme bygning som eier	4581	1	9	1,63	0,495
Spm14ja Har oppgitt areal	1764	1	9	1,28	0,599
Spm14 Omtrent hvor mange kvadratmeter er boligen	6502	3	999	130,27	225,54
Spm15a_b Plassere boligen i et av følgende arealintervall	1356	1	9	4,12	1,503
Spm16 Hvor mange rom med vindu har boligen	5084	0	99	2,73	2,302

Spm17 Hvor mange rom med badekar/dusj i boligen du leier	4589	0	98	1,09	2,062
Spm18 Har boligen tilgang på bad med dusj/badekar	462	1	8	1,11	0,53
Spm19 Antall toalett i boligen	4799	0	98	1,09	2,005
Spm20a Har boligen eget kjøkken/kjøkkenkrok med vannkran	5082	1	8	1,03	0,207
Spm20b Har boligen tilgang til kjøkken	436	1	9	1,19	0,529
Spm20c Har bod i boligen	4913	1	9	1,56	0,564
Spm20d Har boligen bod på loft, kjeller eller andre steder	4899	1	9	1,31	0,596
Spm20e Har boligen uttak for egen vaskemaskin	5004	1	9	1,19	0,506
Spm20f Har boligen tilgang til vaskemaskin	1233	1	9	1,12	0,443
Spm20g Har boligen egen balkong/terrasse/veranda/hage	4996	1	9	1,42	0,55
Spm20h Har boligen tilgang på balkong/terrasse m.m	2255	1	9	1,56	0,544
Spm20i Har boligen egen garasje eller garasjeplass	4907	1	9	1,83	0,519
Spm20j Har boligen garasje i fellesgarasje	4311	1	9	1,92	0,351
Spm20k Har boligen egen biloppstillingsplass	4864	1	9	1,52	0,678
Spm20l Har boligen egen inngang	4702	1	9	1,26	0,54
Spm20m Har boligen kabel-TV/parabol	4991	1	9	1,3	0,54
Spm20n Har boligen varmekabler på bad	4785	1	9	1,41	0,577
Spm20o Har boligen parkett/tregulv i stue	4969	1	9	1,48	0,649
Spm20p Har boligen flislagt bad	4758	1	9	1,51	0,651
Spm20q Har boligen bredbånd	4918	1	9	1,46	0,692
Spm20r Har boligen åpen eller lukket peis for ved	4951	1	9	1,7	0,55
Spm21 I hvilken etasje ligger boligen	5057	1	9	2,9	1,735
Spm22 Hvor mange soverom med vindu har boligen	2439	0	98	2,42	2,253
Spm23 Hvor mange andre oppholdsrom med vindu har boligen	2398	0	99	1,87	4,14
Spm24 Hvor mange rom med badekar eller dusj er det i boligen	2416	0	99	1,23	2,84
Spm25 Hvor mange toalett er det i boligen	2423	0	99	1,32	2,839
Spm26a Har boligen kjeller	2389	1	9	1,36	0,585
Spm26b Har boligen loft	2352	1	9	1,45	0,657
Spm26c Har boligen garasje	2348	1	9	1,6	0,574
Spm26d Har boligen sentralstøvsuger	2310	1	9	1,96	0,446
Spm26e Har boligen kabel-TV/parabol	2378	1	9	1,42	0,555
Spm26f Har boligen varmekabler på bad	2368	1	9	1,46	0,575
Spm26g Har boligen parkett i stue	2337	1	9	1,45	0,707

Spm26h Har boligen flislagt bad	2330	1	9	1,67	0,738
Spm26i Har boligen bredbånd	2308	1	9	1,53	0,723
Spm26j Har boligen åpen eller lukket peis for ved	2336	1	9	1,36	0,56
Spm27 Har boligen mer enn ca. 200 m. fri sikt fra stuevinduet	7042	1	9	1,4	0,665
Spm28a Har boligen utsikt til fjord	8069	1	2	1,84	0,363
Spm28b Har boligen utsikt til hav	8070	1	2	1,93	0,259
Spm28c Har boligen utsikt til by eller bygd	8070	1	9	1,68	0,475
Spm28d Har boligen utsikt til fjell	8070	1	9	1,78	0,421
Spm28e Har boligen utsikt til åker	8070	1	9	1,88	0,34
Spm28f Har boligen utsikt til skog	8070	1	9	1,74	0,447
Spm28g Har boligen utsikt til industriområde	8070	1	2	1,93	0,261
Spm28h Har boligen utsikt til trafikkert vei	8070	1	2	1,74	0,437
Spm28i Har boligen utsikt til jernbanelinje	8070	1	2	1,96	0,197
Spm28j Har boligen utsikt til annet	8070	1	2	1,91	0,289
Spm29 Hva slags bebyggelse er det i nabolaget	7058	1	9	3,04	1,636
Spm30 Leier du boligen møblert, delvis møblert	7016	1	9	2,74	0,622
Spm31 Avtale med utleier om å utføre ulike typer arbeidsoppgaver	7008	1	9	1,75	0,571
Spm32a Hagearbeid f.eks klippe og/eller vanne plen	6590	1	2	1,86	0,344
Spm32b Måke snø, rydde innkjørsel o.l.	6590	1	2	1,82	0,387
Spm32c Vaske fellesareal f.eks. oppgang, trapp	6590	1	2	1,87	0,338
Spm32d Pass av barn	6590	1	2	2	0,056
Spm32e Pass av hund/katt	6590	1	2	2	0,064
Spm32f Oppussing/oppgradering av standarden til boligen	6590	1	2	1,97	0,172
Spm32g Forefallende håndverk, elektriske justeringer	6590	1	2	1,98	0,135
Spm32h Rengjøring	6590	1	2	1,95	0,221
Spm32i Annet forefallende arbeid	6590	1	2	1,96	0,194
Spm33 Hvordan fikk du tak i boligen	6924	1	9	2,07	1,166
Spm34 Husleie for boligen	6934	0	999999	12690,37	86702,51
Spm34a For hvilken måned gjelder husleien	5524	1	9	3,59	1,428
Spm35 Hva er din andel av husleien	3592	0	999999	11668,84	89205,74
Spm36 Hvor mange bidrar til å betale husleien	2695	0	99	2,01	4,042
Spm37 Mottar du/dere støtte for å betale husle	6886	1	9	1,88	0,557

Spm38a_1 kommunen betaler støtten	6181	1	2	1,88	0,322
Spm38a_2 arbeidsgiver betaler støtten	6181	1	2	1,99	0,101
Spm38a_3 andre betaler støtten	6180	1	2	1,95	0,214
Spm39 Har du for tiden inntektsgivende arbeid	7000	1	9	1,34	0,582
Spm40 Jobber du heltid eller deltid	4810	1	9	1,26	0,488
Spm41a Er ansatt eller selvstendig næringsdrivende	6231	1	2	1,86	0,35
Spm41b Er arbeidsledig og jobbsøkende	6231	1	2	1,98	0,141
Spm41c Er på arbeidsmarkedstiltak	6231	1	2	1,99	0,082
Spm41d Er student eller skoleelev	6231	1	2	1,92	0,278
Spm41e Er trygdet/underattføring eller på overgangsstønad	6231	1	2	1,94	0,239
Spm41f Er annet	6231	1	2	1,97	0,163
Spm42a Er arbeidsledig	6802	1	2	1,96	0,193
Spm42b Er på tiltak eller arbeidssøkende	6802	1	2	1,97	0,18
Spm42c Er student eller skoleelev	6801	1	2	1,94	0,243
Spm42d Er hjemmearbeidende	6802	1	2	1,99	0,102
Spm42e Er trygdet/under attføring eller har overgangsstønad	6802	1	2	1,81	0,394
Spm42f Er annet	6802	1	2	1,95	0,223
Spm43a Omfatter den oppgitte husleien strøm	6942	1	9	1,86	0,52
Spm43b Omfatter den oppgitte husleien oppvarming	6895	1	9	1,79	0,583
Spm43c Omfatter den oppgitte husleien bruk av vaskemaskin	4231	1	9	1,75	0,513
Spm43d Omfatter den oppgitte husleien biloppstillingsplass/garasje	5461	1	9	1,45	0,622
Spm43e Omfatter den oppgitte husleien kabel-tv	5899	1	9	1,55	0,647
Spm43f Omfatter den oppgitte husleien gangvask	6823	1	9	1,8	0,671
Spm43g Omfatter den oppgitte husleien snømåking	3843	1	9	1,7	0,95
Spm43h Omfatter den oppgitte husleien annet	8226	1	2	1,44	0,496
Spm44 Har du/dere betalt depositum	6992	1	9	1,59	0,852
Spm45 Hvor stort er depositumet for boligen	3371	0	999999	32949,13	134189,955
Spm46_aa Når startet leieforholdet, år	4011	109	2020	2002,14	32,234
Spm46_mn Når startet leieforholdet måned	3928	1	12	6,66	3,128
Spm47 Er det inngått skriftelig leiekontrakt	7025	1	9	1,19	0,719
Spm48 Hindringer i boligen som gjør det vanskelig for rullestolbruker	7070	1	9	1,3	0,718

sp26_1 Utført utbedring/oppussing etter innflytting	12232	1	2	1,74	0,439
inntekt Inntekt	12834	1	5	2,47	0,915