

# **Impact of energy and environmental factors in the decision to purchase or rent an apartment: The case of Sweden**

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## **Abstract**

This paper examines the importance of environmental factors in the residential property market. The paper presents results from a quasi-experimental study and survey responses from 733 occupants of green and conventional buildings. The study demonstrates that energy and environmental building performance factors have rather a minor impact on the purchasing or renting decision. Our findings indicate that when discussing the impact of energy and environmental factors on a customer purchase decision, the availability of information should be considered.

**Keywords:** residential buildings; green buildings; environment, energy, sustainability; purchasing decision

## Introduction

The greening of the built environment is a long process. The barriers decelerating green building development were often related to uncertainty and doubts about the financial feasibility and profitability of building green (Issa et al., 2009). Recent literature provides evidence against this skepticism, indicating that green labeled buildings transact higher prices on the commercial (Dermisi 2009; Miller et al., 2009, Eichholtz et al., 2010a, Eichholtz et al., 2010b, Fuerst and McAllister, 2011a; Fuerst and McAllister, 2011b, Kok and Jennen, 2012) and the residential market (Ott et al., 2006; Mandel and Wilhelmsson, 2011; Brounen and Kok, 2011; Addae-Dapaah and Su Jen Chieh, 2011).

However, there is some difficulty in separating “the green variable” from the other factors, such as building design, and consequently abstracting the impact that variables have on transaction prices. Moreover, it is also unclear whether the choice to purchase or rent a green building is the customer’s conscious choice related to a building’s green features. It is uncertain whether a potential buyer or tenant is being informed about green aspects of building and whether information about energy and building environmental performance is important to the customer.

Brounen and Kok (2011) concluded that customers take into account information extracted from the building energy certificate; however, a study conducted in New Zealand (Eves and Kippes, 2010) indicated that the public is generally aware of energy and environmental issues but these factors play a minor part in the final house purchase decision. Correspondingly, findings from studies in Germany, Singapore and Australia indicate that house buyers seldom consider information about building energy and environmental performance to be an important factor in their decision-making process (Addae-Dapaah and Su Jen Chieh, 2011; Amecke, 2012; Bryant and Eves, 2012). The research also shows that a potential apartment buyer (Addae-Dapaah and Su Jen Chieh, 2011) may be unaware of green building labeling or confused about the difference between label ratings.

The literature also indicates that environmental awareness may not be a sufficient argument to motivate making more environmentally friendly decisions (Raisbeck and Wardlaw, 2009). The research suggested that neither arguments about more individual aspects like “improved liveability”, “cost savings” or “other people opinion”, nor arguments of greater scale, such as “concern for future generations” can be considered significant enough to motivate investing in the construction of sustainable houses.

The focus of this paper is on examining how the impact of energy and environmental building features are being factored into decisions to rent or buy apartments. The analysis is based on over 730 survey responses collected during a quasi-experimental study among occupants of conventional and green multi-family buildings in Sweden. The paper presents results from a study conducted on the Swedish residential market and contributes to the international literature on customer attitudes towards building sustainability features. The

results contribute to the discussion on factors that may affect a prospective owner or tenant while they are searching for an apartment (Collen and Hoekstra 2001; Earnhart 2002; Jim C.Y. and Chen, 2007; Reed and Mills, 2007; Chau et al., 2010; Goodwin, 2011).

## **1. Background**

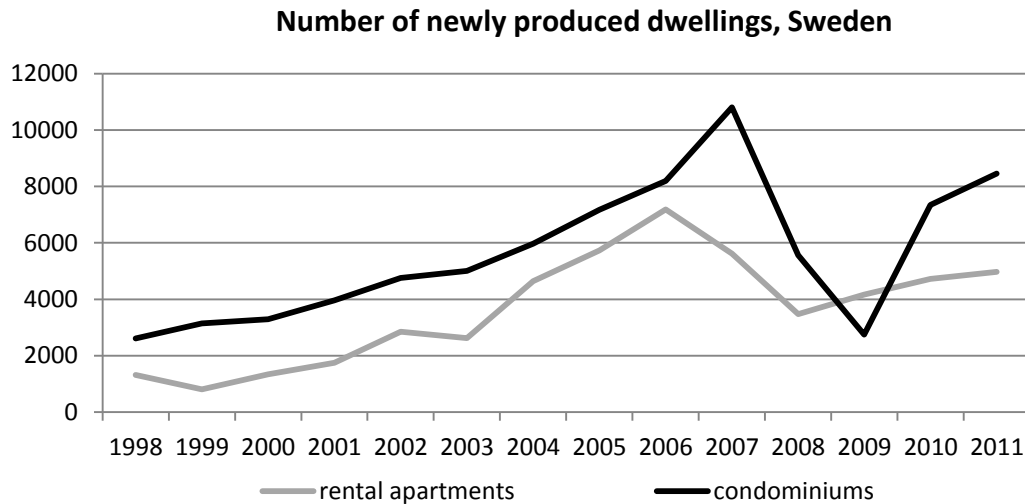
### **1.1. Brief characteristics of housing market in Sweden**

The Swedish housing sector consists of about 4.5 million dwellings, approximately 55% of which are multi-family dwellings and 45% single-family dwellings. Most of the multi-family dwelling stock is made up of rental apartments (nearly 70%) owned by private and municipal organizations, while one third consists of owned dwellings, a Swedish form of condominium.

The rent system in Sweden is controlled and the annual charges in rents are the result of negotiations between the municipal housing companies and the Swedish Tenants' Union. The rent levels in the private sector are set comparably to those in the municipal sector (Svensson, 1998; Lind, 2003; Atterhög and Lind, 2004; Wilhelmsson et al., 2011). The utility fees are usually included in the rent (except for household electricity consumption). The fees for heating and water consumption tend to be calculated based on generally accepted norms, rather than related to actual consumption. By contrast, utility fees in condominiums are generally related to the household's real consumption.

The difference in housing tenure relates not only to size of financial investment, risk and profit or loss possibilities on the housing market, but also responsibility for and commitment to building operation and maintenance. In the case of condominium apartments in Sweden, the owners form an association, which is responsible for decisions regarding building services, maintenance and renovation. The tenant is relieved of these obligations, as maintenance and renovation services are included in the tenant contract and are the responsibility of the house owning company (Lind and Lindström, 2011).

Considering that the Swedish housing market is characterized by a strong rent regulation system (Lind, 2003) and an accompanying queuing system, the decline in newly constructed rental dwellings (figure 1) may affect the importance of factors impacting the decision to rent an apartment. It is possible that, in the case of low vacancy in housing stock and the limited availability of new dwellings, a potential tenant chooses an apartment because it is obtainable rather than because it satisfies needs and requirements. However, since the vacancy levels differ across Sweden (Klingborg, 2000; Wilhelmsson et al., 2003) the above scenario may apply only in some municipalities. Even though the local market analysis is outside the scope of this paper, we expect that the low availability of newly constructed dwellings may have an impact on customer decisions to rent.



**Figure 1.** Newly produced dwellings between 1998 - 2011, source SCB (<http://www.scb.se>)

## 1.2. The green residential market in Sweden

The increasing awareness of and focus on energy and environmental issues on the residential market is best demonstrated by the construction of very low-energy housing. Currently, the Swedish Building Regulations expect that space heating in a residential building constructed in southern Sweden (e.g. Stockholm) should not exceed 90 kWh/m<sup>2</sup> annually (Boverket, 2011). Very low-energy buildings are often constructed to passive house standard (the Swedish standard was introduced by *The Forum for Energy-Efficient Buildings, Swedish: Forum för energieffektiva byggnader - FEBY*) and are expected to have significantly lower energy demand for space heating, even down to 50% of the requirements stipulated by the Swedish Building Regulations. The Swedish Center for Zero Energy Buildings (Swedish: Sverige Centrum för Nollenergihus; <http://www.nollhus.se>) estimated that by the end of 2012, approximately 2000 highly energy-efficient residential buildings would be built and an additional 1320 buildings would be under construction. These figures, however, represent only a small percentage of total residential building production.

At present, no residential buildings in Sweden are certified according to internationally recognized environmental building schemes such as BREEAM; however, the Swedish scheme *Environmental building* (Swedish: Miljöbyggnad, <http://www.sgbc.se/certifieringssystem/miljoebyggnad>) has attracted a few developers and residential owners. The *Environmental building* (Miljöbyggnad) is a voluntary certification process. The building environmental evaluation focuses on three areas: energy, indoor environment and material (Malmqvist et al., 2011). The assessment process has adopted a rating system where different credits are assigned depending on which performance targets the building has achieved. Finally, the credits gained during the assessment are added

together and determine the *Environmental building* ((Miljöbyggnad) certification level. Depending on the energy and environmental goals achieved, the building can be granted brown, silver or gold certification. The *Environmental building* (Miljöbyggnad) has been developed and adjusted to Swedish norms and standards, enabling the relatively easy applicability of the *Environmental building* (Miljöbyggnad) requirements in a building construction process.

Another environmental building scheme emerging on the residential market is Nordic Ecolabel *Svanen* (<http://www.svanen.se/en/>). The eco-labeling is determined through environmental analysis from a lifecycle perspective. The label is already known for eco-certifying various group products from appliances, through furniture to building material. The label recently introduced environmental certification for building and the scheme slowly gaining popularity among housing developers in Sweden.

## **2. Method and data collection**

### **2.1. Study design**

The data presented in this article are part of a four-year study aiming at capturing differences in the apartment purchasing and rental decision, overall satisfaction and perception of indoor environment among occupants living in green and conventional buildings. This paper focuses only on factors contributing to the purchasing and rental decision and the analysis; results regarding the remaining data are presented in other articles (Zalejska-Jonsson, 2012; Zalejska-Jonsson; 2013).

The research was designed as a quasi-experimental study (Bohm and Lind, 1993; Nyström 2008) in which green and conventional residential buildings were selected and paired in such a way that building characteristics were comparable and only differed in their energy and environmental performance. Care was taken to select cases that match as closely as possible in regard to building production year, building location, size and potential customer segment.

Firstly, we have chosen the green building objects. *Green building* was defined as a building designed and constructed with high energy efficiency or environmental goals. Only buildings with a very low energy requirement (calculated space heating lower than 60kWh/m<sup>2</sup> annually), and buildings registered or certified according to a building environmental scheme were considered. Secondly, we have selected conventional buildings i.e. the control buildings. It was imperative that the *control building* was constructed according to current Swedish Building Regulations, but did not aim at better environmental or energy performance. The study focused only on newly constructed multi-family buildings.

## **2.2. Data Collection**

Data collection was conducted in three rounds. The first data collection took place in 2010 and included three pairs of multi-family buildings. The data collection in 2012 was divided into collection periods: late spring (three pairs) and early autumn 2012 (four pairs). The studied cases included multi-family buildings with rental apartments (owned by municipal companies) and condominiums, with apartments owned by tenants.

## **2.3. Survey Design and Questionnaire**

The survey questionnaire was divided into four sections and consisted in total of 33 questions investigating factors affecting the decision to purchase or rent an apartment, respondents stated willingness to pay for green buildings, and occupants' satisfaction. In this section, we describe only the questions that are relevant to the article.

The first section examined the importance of different factors that could have an impact on occupants' decision to purchase or to rent the apartment. The factors were selected based on the extensive literature describing preferences in choice of residence. Respondents were asked to indicate how the following factors contributed to their apartment purchase or rental decision: location, price, apartment size, apartment design, calculated low energy consumption, environmental factors (other than energy), accessibility to public transport and limited choice of available apartments. Respondents could choose one of the following answers: decisive, important but not decisive, less important and unimportant.

In the second section, respondents were asked to indicate what information regarding building energy and environment performance they had received before purchasing or renting the apartment. Respondents were given a list that included items such as expected annual energy consumption, and environmental or climate certification. Respondents could also indicate other information in the comment box. Additionally, in the later part of the questionnaire, respondents were asked to indicate what they perceived as the meaning and value of building environmental certification. The final section of the questionnaire included demographic questions that are used to analyze the data.

A survey was addressed only to all adult occupants, i.e. occupants who at the time of the data collection were at least 21 years old. This constraint was imposed to ensure that the responses represent the choice of the individual rather than that of the parents or the guardian.

The survey was sent by regular mail. The envelope was addressed to individuals and included cover letter, survey questionnaire and return envelope. The particulars (name and address) were obtained from a publicly accessed online database. People invited to participate in the survey could submit their answers in paper form using the return envelope or answer online using the link indicated in the cover letter. All participants were offered a gratuity in the form of a scratchcard costing approx. EUR 0.3. Only respondents who submitted their

contact details received a letter of appreciation and a gratuity. All participants were ensured that responses would be treated as anonymous. In order to fulfill this promise, the names and other details were kept confidential and filed separately.

The participants were asked to answer the survey within 10 days. A reminder was sent to non-respondents two weeks after the first invitation letter. The survey was addressed to 1753 persons and 733 responses were received, which resulted in a 42% response rate. Detailed information about the response rate for each building and tenure is presented in table 1.

Table 1. Response rate for the survey

pair number	green/ conventional	ownership/ rental	questionnaire sent	response	response rate	Survey date
1	Green	Condominium	35	18	51%	2012 spring
2	Green	Condominium	21	14	67%	2012 spring
3	Green	Condominium	55	24	44%	2012 spring
4	Green	Condominium	58	31	53%	2012 fall
5	Green	Condominium	63	35	56%	2012 fall
6	Green	Rental	175	63	36%	2012 fall
7	Green	Rental	53	14	26%	2012 fall
8	Green	Rental	180	94	52%	2010 fall
9	Green	Rental	44	19	43%	2010 fall
10	Green	Rental	91	42	46%	2010 fall
1	Conventional	Condominium	91	38	42%	2012 spring
2	Conventional	Condominium	47	28	60%	2012 spring
3	Conventional	Condominium	63	38	60%	2012 spring
4	Conventional	Condominium	85	33	39%	2012 fall
5	Conventional	Condominium	85	30	35%	2012 fall
6	Conventional	Rental	196	56	29%	2012 fall
7	Conventional	Rental	173	55	32%	2012 fall
8	Conventional	Rental	149	56	38%	2010 fall
9	Conventional	Rental	46	23	50%	2010 fall
10	Conventional	Rental	43	22	51%	2010 fall
	Conventional	Rental	607	212	35%	
	Green	Rental	543	232	43%	
	Conventional	Ownership	371	167	45%	
	Green	Ownership	232	122	53%	
	Total		1753	733	42%	

## **2.4. Statistical Analysis**

In the first stage of the analysis, descriptive statistics were used. In the second step, the statistical difference in responses from occupants of green and conventional buildings was tested by the Mann-Whitney (rank sum) test. Thirdly, statistical models were applied. The literature shows that the demographic factors may impact environmental behavior and perception of energy efficient measures (Barr et al., 2005; Nair et al., 2010). The statistical models applied to the data are described as a function of the following variables: age (age), gender (if women =1), whether the household was a family with children (family=1), number of occupants per dwelling (occupants), dwelling size described as number of rooms (room), apartment tenure (if condominium=1) and environmental profile (if green=1). The independent variables are importance of ENERGY factor for apartment choice (model 1) and importance of ENVIRONMENTAL factors for apartment choice (model 2).

The impact of individuals' characteristics on the importance of energy and environmental factors for the decision to purchase or rent an apartment was tested with logistic models. The ordered logistic regression was chosen due to the nature of the data, which has ordered categories measuring opinion and frequency using a rated scale so that responses are ordered (Borooah , 2001). A Brant Test for a parallel regression assumption was conducted for each regression. The proportional odds assumption was satisfied in both models and the use of ordinal logistic models was justified.

The results are reported in the form of odds ratios and are interpreted in this paper as the likelihood of energy or environmental factors being important in the decision to purchase or rent an apartment if the predictor variable is increased by one unit while other variables are kept constant.

The statistical analysis was performed in STATA. In order to test the internal consistency of the data, a Cronbach alpha test was conducted and the computed coefficient of 0.67 was considered satisfactory.

## **2.5. Limitations**

There are certain limitations in the presented study. The analysis is largely based on the stated personal opinion of respondents and consequently, the results may include errors related to the formulation of the questions, respondents' subjective opinion and their selective memory (Schwarz and Oyserman, 2001). Moreover, occupants responses might be affected by post-purchase rationalization, and therefore responses may inaccurately describe the impact of certain factors on the decision to purchase (or rent) an apartment.

Secondly, the quasi-experimental approach was introduced to ascertain the comparability between paired buildings; however, each property is unique, f in design or location, for example. Consequently, the uniqueness of each property imposed a certain limitation on the degree to which paired buildings could have been matched. In the result, the buildings are



paired best to the abilities, because certain compromises had to be made (for example in geographical location, size of the estate or number of dwellings).

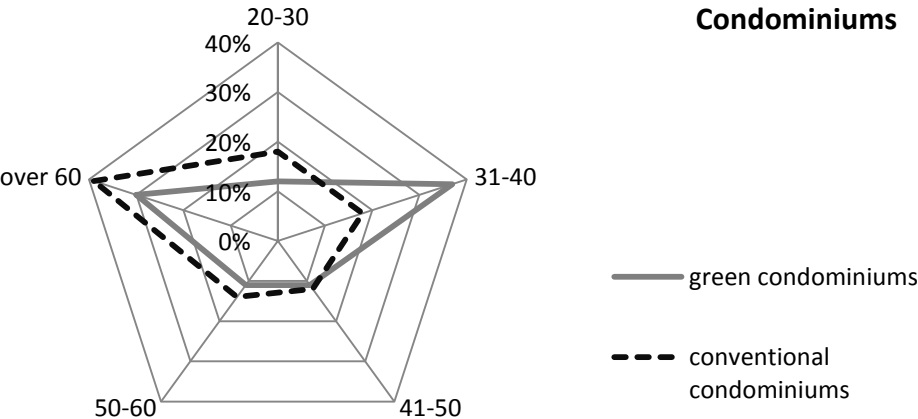
Finally, the information regarding participants’ income was not collected during the survey. Consequently, the financial status of the families was not included in the analysis, which may particularly affect the results computed from statistical models (omitted variables bias).

**3. Results**

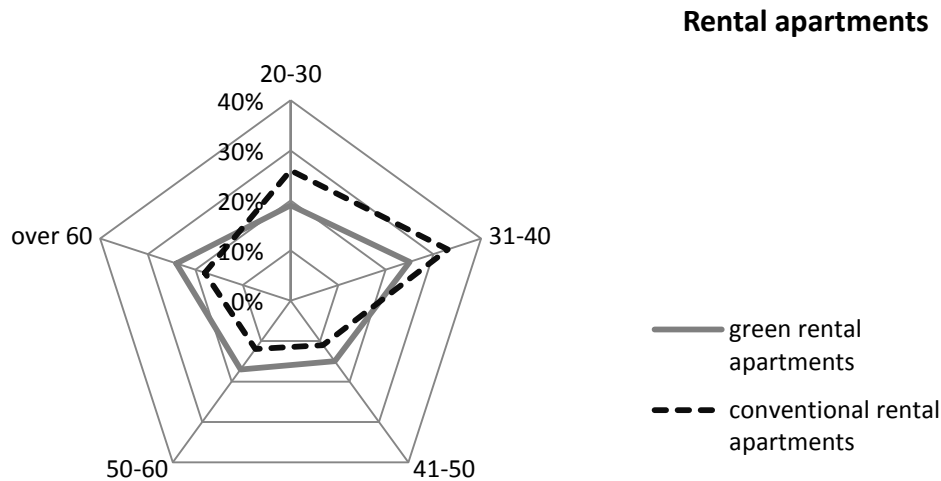
**3.1. Description of respondents**

Gender distribution is very similar in the sub-groups green and conventional owned dwellings and green and conventional rental apartments: approx. 55% respondents were females. There are certain differences in age distribution among respondents between the sub-groups (figure 2 and 3). The largest group of respondents in green owned apartments were between 31 and 40 years old (37%), whereas in conventional buildings, this group of occupants accounted for only 18%. There was a higher percentage of older respondents (over 60 years old) living in owned than rental apartments. The Mann-Whitney (rank sum) test indicated that there is a statistically significant difference in respondents’ age between condominiums and rental apartment, but no statistically significant difference was found between green and conventional buildings. The difference between building tenure groups may be related to various factors such as occupants’ financial status and financial security, family situation, or health.

Approximately 35% of the respondents living in rental apartments, both green and conventional, are families with children. The proportion of families with children in green owned apartments was found to be much higher (43%) than in conventional buildings (25%).



**Figure 2.** Respondents’ age distribution, occupants living in condominiums



**Figure 3.** Respondents' age distribution, occupants living in rental apartments

### 3.2. Factors impacting on the apartment purchasing or renting decision

The analysis reveals that the most important factors considered in the respondents' decision to purchase and rent were apartment size and location (table 2). Considering that the search for a new apartment is often prompted by lifestyle changes such as starting a family, going through a divorce or changes in health, it is understandable that apartment size would have the highest importance and it had the highest mean value among all responses (3.34), with 3.37 for owned apartments and 3.33 for rental apartments. Table 2 shows determinants for apartment purchase or rental, expressed as mean values and ranked from the most to least important.

The second most important factor was building location; however, the mean values for location and apartment size differ only marginally. The location of the buildings relates not only to geographical position but also to the sense of familiarity and social life. Many respondents indicated in their comments that their choice of apartment search area was strongly related to the fact that they wanted to stay close to family and friends.

The importance of factors which customers consider in the decision to buy (or rent) an apartment might be affected by the characteristics of the local market. Table 6 (appendix) presents mean values for factors as indicated by respondents living in the paired buildings. The results show that even though importance ranking of factors may vary, the top four factors affecting purchase/rental decision are the same i.e. dwelling size, design, location and accessibility. The energy and environmental factors still had a minor impact, ranked not higher than fifth place.

Table 2. Mean values for factors impacting purchase and rental decision

factors	mean value for all buildings [mean; (std.dev); no observation]	mean value for condominium	mean value for rental apartments
apartment size	3.34 (.63) 704	3.37 (.62) 281	3.33 (.64) 423
location	3.28 (.60) 711	3.34 (.56) 282	3.24 (.63) 429
apartment design	3.08 (.71) 692	3.21 (.65) 276	3.00 (.744) 416
access to public transport	3.11 (.77) 695	3.26 (.69) 276	3.01 (.80) 419
price / rent	3.00 (.69) 700	3.27 (.58) 281	2.81 (.69) 419
estimated energy consumption	2.61 (.86) 687	2.76 (.82) 275	2.52 (.88) 412
distance to work	2.58 (.94) 659	2.46 (.99) 261	2.66 (.90) 398
environmental factors (other than energy)	2.51 (.85) 680	2.54 (.82) 270	2.50 (.874) 410
limited choice of available apartments	2.43 (1.03) 657	2.223 (.97) 257	2.562 (1.04) 400
distance to school	1.96 (1.08) 636	1.97 (1.10) 251	1.96 (1.07) 385

For purpose of analysis factors are ranked from highest to lowest impact; 4= decisive, 3= important but not decisive, 2= not very important, 1= unimportant

The Mann-Whitney test was conducted to examine the difference in responses received from occupants living in condominiums and rental apartments. The results indicate that responses between occupants differ significantly in many respects (table 3). Not surprisingly, the price had a more decisive impact on the decision when purchasing compared to renting an apartment: 35% of apartment owners indicated that price played a decisive part in their apartment choice; only 11% of tenants indicated the same. Energy consumption was found on a statistically significant level to be more important for owners than for tenants. Again, this is not surprising, considering that energy consumption relates to space heating, which is often included in the rental fee in Sweden. Interestingly, environmental factors have an equal and relatively low impact on the decision to buy or to rent an apartment.

The apartment design value seems to be more important when purchasing than when renting an apartment, the difference being statistically significant at  $p \leq 0.01$  (table 3). One third (33%) of apartment owners indicated apartment design as having a crucial impact on their decision to buy an apartment, compared with 24% responses among tenants.

As expected, the analysis indicated a statistically significant difference in opinion regarding the importance of availability of dwellings (table). The rental control, shortage of newly constructed apartments and queuing system may explain the difference in responses.

Table 3. Differences in responses between occupants living in owned and rented apartments

	Mann-Whitney test for difference between condominium and rental apartments [p, probability]
<b>FACTORS</b>	
building location	0.0454**
apartment price	0.0001*
apartment size	0.479
apartment design	0.0003*
estimated energy consumption / cost	0.0004*
environmental factors	0.455
access to public transport	0.0001*
distance to work	0.026**
distance to school	0.938
limited choice of available apartments	0.0001*
<b>CERTIFICATION</b>	
importance of environmental certification for buildings	0.314

Results marked in the tables as \*indicate statistically significant at  $p \leq 0.01$  and with \*\* statistically significant at  $p \leq 0.05$

The local context may also provide a better explanation for statistically significant differences between responses of occupants living in condominiums and rental apartments (table) and between occupants of green and conventional buildings (table). The results of the Mann-Whitney test conducted on responses of occupants living in the paired buildings

are presented in table 7 (appendix). The results confirm that the purchase of an apartment is a very careful decision that depends on customers' specific needs and requirements. The results indicate a difference in opinion regarding energy and environmental factors.

One of the limitations of the study is the difference in geographical location of paired buildings, as the green and the conventional building are not always situated in close proximity to each other. This is a case in pairs 3, 5 and 10, which may explain the statistical difference in opinion regarding the importance of distance to school. In the mentioned cases, green buildings were located in newly developed areas of the city.

### 3.2.1. Difference between green and conventional buildings

We tested separately the difference between green and conventional building occupants' responses within a particular tenure group i.e. among occupants living in condominiums and rental apartments. According to the Mann-Whitney test, only energy, environmental factors ( $p \leq 0.01$ ), and distance to school ( $p \leq 0.05$ ) are statistically different between the two sub-groups, green and conventional condominium (table 4). For rental apartment buildings, a statistically significant difference was found only for energy and environmental factors.

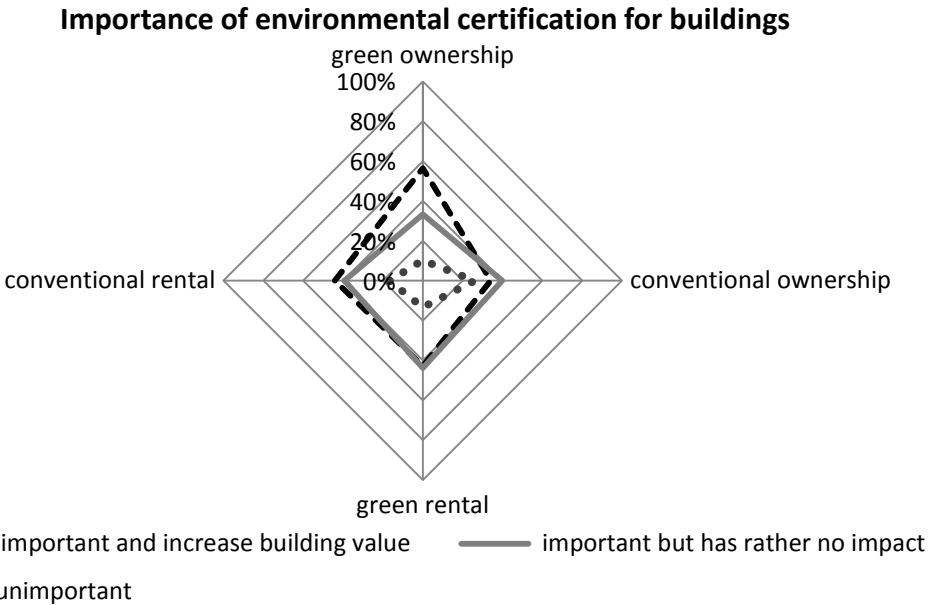
Table 4. Mann-Whitney test for sub-groups owned and rental apartments

Variable	Mann-Whitney test for difference between green and conventional buildings , condominiums [p, probability]	Mann-Whitney test for difference between green and conventional buildings, rental apartments [p, probability]
<b>FACTORS</b>		
building location	0.636	0.175
apartment price	0.485	0.267
apartment size	0.461	0.281
apartment design	0.525	0.693
estimated energy consumption / cost	0.0001*	0.0003*
environmental factors	0.0001*	0.0001*
access to public transport	0.643	0.561
distance to work	0.444	0.522
distance to school	0.026**	0.699
limited choice of available apartments	0.859	0.132
<b>CERTIFICATION</b>		
importance of environmental certification for buildings	0.0006*	0.880

Results marked in the tables as \*indicate statistically significant at  $p \leq 0.01$  and with \*\* statistically significant at  $p \leq 0.05$

The aspects related to building energy and environmental performance had greater importance for people living in green buildings. This may be related to the fact that people

who choose to live in a green residence are more environmentally conscious and indicate more interest in those factors. Indeed, when respondents were asked to indicate their opinion on the importance of environmental certification for buildings, more than half of the respondents in green owned apartments (56%) responded that environmental certification is important and that it may have a positive impact on building value (figure 4). This opinion was shared by approximately one third of the respondents living in conventional buildings (36%). A statistically significant difference in opinions was confirmed by the Mann-Whitney test ( $p < 0.001$ ). On the other hand, there is no significant difference in responses received from occupants in rental apartments. Just over 40% of respondents living in green and conventional rental apartments believe that environmental certification for buildings is important and has an impact on building attractiveness (figure 4).



**Figure 4.** Importance of environment certification for buildings

However, it is important to distinguish between environmental literacy or environmental education (Stables and Bishop, 2001) and asymmetry of market information. The first concepts relate to ecological awareness (David, 1974), understanding of, and taking action on, environmental issues. The latter refers to a situation where people’s access to information is "uneven". It was clear from the study that information about building performance and environmental impact was generously presented to the prospective buyers of green buildings. On the other hand, the same information was less likely to be given to buyer and tenants of conventional buildings, unless explicitly demanded. Approximately two thirds of the respondents who owned apartments in conventional condominiums indicate

that they “do not know”, “do not remember” or “did not receive” any information about building energy or environmental performance. However, about 90% of the respondents living in green buildings remember being given information about expected energy consumption or building environmental impact. Approximately 60% of occupants living in rental green apartments remember receiving information about building energy or environmental performance, whereas 85% respondents living in conventional rental apartments “do not remember” or “did not received” such information.

This results are in line with findings from a study by Bryant and Eves (2012) suggesting that availability of information on building environmental features and the sellers’ attitude increases the likelihood of the buyers’ interest in this information.

### **3.2.2. Effect of individuals’ characteristics on importance of energy and environmental factors**

The ordered logistic models were fit to the data to test the impact that individuals’ characteristics may have on the importance of environmental and energy factors in apartment purchase and rental decisions.

The results reveal a 2.40 odds probability that energy is a more important factor for occupants of green buildings than conventional buildings (table 5), suggesting that if people perceive energy as an important factor, they are more likely to purchase or rent a green dwelling (odds ratio the for environment is 2.42). The results indicate that energy factors are more important for those who live in condominiums than those who rent (1.85 odds probability). The results are not surprising considering that owners have full responsibility for energy consumption bills. On the other hand, in the case of tenants, the space heating costs may be included in the rental fee and are often calculated as a fixed fee rather than related to actual consumption.

The analysis reveals that individual characteristics may have an impact on the importance of energy and environmental factors in the decision to purchase or rent an apartment. The analysis shows that the energy and environmental factors are more important for female than male respondents (odds ratio 1.36).The results reveal that the importance of energy and environmental factors increases for the older groups of respondents. The group of oldest respondents (50-60 and over 60 years old) are most likely to consider energy and environmental factors to be important in their decision to rent or purchase an apartment. The findings are in line with results of the study conducted in New Zealand, which revealed that older housing buyers were most aware of the importance of energy and environmental aspects in the house purchasing decision (Eves and Kippes, 2010).

Table 5. Ordinal logistic regressions: importance of energy and environment factors

	importance of ENERGY factor, model 1			importance of ENVIRONMENTAL factors , model 2		
	odds ratio	p, probability	conf. interval (CI 95%)	odds ratio	p, probability	conf. interval (CI 95%)
number of rooms	1.11	.335	.89-1.39	.88	.300	.71-1.11
occupants	.97	.839	.76-1.24	1.11	.382	.87-1.41
older: 31-40	1.17	.490	.74-1.84	1.36	.163	.86-2.16
older: 41-50	1.65	.077***	9.94-2.89	2.60	.001*	1.46-4.62
older: 51-60	5.60	.000*	3.14-9.98	4.11	.000*	2.35-7.17
older: over 60	4.87	.000*	2.90-8.17	4.01	.000*	2.41-6.65
woman	1.36	.047**	1.01-1.85	1.81	.000*	1.33-2.46
family	.88	.631	.52-1.47	1.13	.630	.68-1.85
condominium	1.85	.000*	1.34-2.55	1.15	.362	.84-1.58
green building	2.40	.000*	1.75-3.29	2.42	.000*	1.77-3.30
No of observations	616			609		
Pseudo R2	.094			.065		

Results marked in the tables as \*indicate statistically significant at  $p \leq 0.01$ , with \*\* statistically significant at  $p \leq 0.05$  and with \*\*\* statistically significant at  $p \leq 0.1$



#### **4. Summary and conclusions**

A quasi-experimental approach and results from a survey among occupants of green and conventional buildings were used to study the impact of energy and environmental factors on customer decisions to purchase and to rent an apartment.

It was demonstrated that apartment size and location have the greatest effect on the decision to purchase or rent an apartment. The analysis indicates that perception of the importance of energy and environmental factors differs depending on apartment tenure and whether the respondent was living in a green or a conventional building.

Generally, the energy and environmental factors were found to have rather a minor impact on the purchasing or renting decision. The findings are in line with results from studies conducted in Germany (Amecke, 2012) and New Zealand (Eves and Kippes, 2010). The analysis also indicates that individual characteristics may have an effect on the impact of energy and environmental factors on apartment purchasing or rental decisions.

Our findings indicate that when discussing the impact of energy and environmental factors on a customer's decision to purchase, information availability should be considered. Developers are more likely to inform prospective buyers about building environmental performance when the energy or environmental impact gives a positive signal and may increase selling value. The market information asymmetry has consequences. Firstly, potential buyers are informed of how exceptional green buildings are, yet they do not know what they can expect of conventional buildings. Secondly, the generously provided information creates specific expectations, which may have an impact on occupants' overall satisfaction. Finally, since the environmental benefits are not observable directly and even questioned by earlier research, the customer may have reservations about environmentally profiled buildings. Customer scepticism may be reflected in the perception of a higher investment risk and lower willingness to pay.

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