

Does green building affect decision in apartment purchase? The case of Sweden

Agnieszka Zalejska - Jonsson¹

Abstract Title

The latest research indicates that green apartments and green commercial spaces yield higher prices; however it is not really certain whether the environmental factors contribute to the profit. This paper examines the importance of environmental factors on the residential market and investigates whether Swedish home-owners are prepared to pay more for green apartments. The paper presents results from a quasi-experimental study and a survey addressed to 600 apartment owners of both green and conventional residential buildings in Sweden. Survey results suggest that people are prepared to pay approximately five per cent more for low-energy buildings; however they are not equally willing to pay for a building with an environmental certificate.

Keywords: residential buildings, green buildings, willingness to pay

1. Introduction

Financial barriers have often been considered the greatest hindrance to green construction development. Developers have been concerned about high initial costs and uncertainty about return on investment (Issa et al., 2010). Considering, then, that a profit-maximizing company in the event of increased cost is seeking to increase its prices, the rational question is how much more the customer is prepared to pay for green building.

Research has put forward evidence that even though green buildings require higher initial cost (Zalejska-Jonsson et al, 2012), the labeled buildings can generate a price premium on the commercial (Miller et al., 2009, Eichholtz et al 2010, Fuerst and McAllister 2011) and the residential market (Ott et al 2006, Bloom et al, 2011; Brounen and Kok, 2011). The results from pricing models indicate that green properties can transact 3-12% higher prices than conventional buildings.

Furthermore, the latest research indicates that customers value sustainable features and are willing to pay the premium. For example, a positive willingness to pay for environmental attributes was found among households that purchased single-family houses in the Stockholm area of Sweden in 2000 (Mandel and Wilhelmsson, 2011). The analysis indicated that environmental awareness affects willingness to pay and the calculated non-marginal WTP for environmentally aware households was about 2-4% higher for energy efficient systems and 5-8% for water reducing technologies.

¹ KTH, Royal Institute of Technology, School of Architecture and the Built Environment, Real Estate and Construction Management; Brinellvägen 1 Stockholm, Sweden; agnes.jonsson@abe.kth.se

However, it is still unclear whether the potential buyer is being informed about green aspects of building and whether information about energy performance and building environmental impact is important to the customer. Brounen and Kok (2011) concluded that home buyers took into consideration information extracted from building energy certificates. However, a study conducted in Australia (Bryant and Eves, 2012) demonstrated that information about sustainable features of buildings was often not disclosed by home sellers and seldom proactively requested by home buyers. Moreover, previous studies suggest that occupants may be confused about the meaning of building certification (Addae-Dapaah and Su Jen Chieh 2011) and sometimes not even be aware that they are living in a green building (Chau and Chung 2010).

This paper investigates whether customers consider energy and environmental factors when making the decision to purchase an apartment and whether customers are willing to pay a premium for green dwellings. The analysis is based on 289 survey responses collected during a quasi-experimental study among occupants of cooperative green and conventional multi-family buildings in Sweden.

The paper contributes to the discussion on factors impacting a home-purchasing decision and on the extent to which environmental aspects are present to the prospective buyer (Reed and Mills, 2007; Carswell 2009; Eves and Kippes, 2010; Goodwin 2011;). The paper also relates to the literature on valuing sustainability aspects on the property market (Lorenz et al., 2006; Lorenz and Lutzkendorf, 2008, Runde and Thoyre, 2010), debating the importance and value of energy and building certification from the perspective of an apartment buyer.

2. Method and data collection

2.1 Study design

The study is based on a quasi-experimental method (Bohm and Lind, 1993), which was used to examine whether there is a significant difference between the decision to purchase green or conventional apartments. Moreover, the investigation aimed at capturing differences in overall satisfaction, indoor comfort and behavioral change. The research was designed as a multi-case study, in which green and conventional residential buildings were carefully selected and paired in such a way that building characteristics were comparable and only differed in energy and environmental performance. Only buildings with very low energy requirement (close to passive house standard) and buildings registered or certificated according to a building environmental scheme were considered as green. It was imperative that the controlled building i.e. conventional building was constructed according to current Swedish Building Regulations.

2.2 Data collection and questionnaire

The analysis and the results presented in this paper are based on a survey conducted in 2012 among co-operative condominiums in Sweden. Data collection was conducted in two periods: May-June and September-October.

The survey questionnaire was divided into four sections. The first part investigated which factors impacted customer purchasing decision, the second part focused on occupants' overall satisfaction with their apartment and perception of indoor environment quality. The third part aimed at obtaining information about respondents' perception of building environmental certification and willingness to pay for buildings with an environmental profile. The final section asked a few background questions.

The examples of questions regarding factors impacting housing purchase decision and customers' willingness to pay for green buildings are presented in table 1. The questionnaire included closed questions but also offered respondents the possibility of commenting.

Table 1: Questions Example

question	possible answers
Which of the following factors contributed to your decision to purchase the apartment? Indicate the importance of the following on your decision: location, price, apartment size, apartment design, calculated low energy consumption, environmental factors (other than energy), accessibility to collective transport, limited choice of available apartments	decisive (4) important but not decisive (3) not very important (2) not important at all (1)
Are you willing to pay a higher purchasing price for a building with an environmental certificate? Are you willing to pay a higher purchasing price for a building with significantly lower energy consumption?	yes, approximately 10% (3) yes, approximately 5% (2) no (1)

The survey was sent by regular mail to all occupants of the selected buildings, who at the time of the survey were at least 21 years old. 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. Persons 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 worth 25-30 Swedish krona (SEK). Only respondents who submitted their contact details received a letter of appreciation with the gratuity enclosed. All participants were ensured that responses would be treated as anonymous. In order to fulfill this promise, all responses were coded.

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. Answers received in paper form were manually added to the database.

The survey was addressed to 603 persons and 289 responses were received, which gave a total response rate of 48%. Detailed information about the response rate for each case is presented in table 2.

Table 2: Response rate

green/conventional	case pair number	questionnaire sent	response	response rate
green	1	35	18	51%
conventional	1	91	38	42%
green	2	21	14	67%
conventional	2	47	28	60%
green	3	55	24	44%
conventional	3	63	38	60%
green	4	58	31	53%
conventional	4	85	33	39%
green	5	63	35	56%
conventional	5	85	30	35%
Total green		232	122	53%
Total conventional		371	167	45%
Sum		603	289	48%

2.3 Statistical analysis

In the first stage of the analysis, descriptive statistics were used. The statistical difference in responses from occupants of green and conventional buildings was tested by the Mann-Whitney test. The correlation between willingness to pay (WTP) and perception of environmental factors and building certification was conducted with a non-parametric Spearman rank correlation test.

3. Results

3.1 Description of respondents

There are certain differences in age distribution between respondents living in green and conventional buildings. The majority of the respondents in green apartments were between 31 and 40 years old (37%), whereas in conventional buildings, this group of occupants accounted for only 18%. The relative majority of respondents in conventional buildings were 61 years old and older. Approximately 55% of the respondents were females. The majority of the respondents in green buildings live in 3- or 4-room apartments, and in conventional buildings in 2- or 3-room apartments.

3.2 Factors impacting apartment purchasing decision

The analysis indicates that the most important factors considered in the respondents' purchase of an apartment were the apartment size, location, access to collective transport, and price. Considering that the search for a new apartment is often prompted by life style changes such as starting a family, divorce or changes in health, it is understandable that apartment size would have the highest importance: 40% of green building respondents and 47% of the occupants of conventional buildings indicated that dwelling size was the decisive factor in their apartment purchase decision.

The next most decisive factors were access to public transport (approx. 40% for both green and conventional buildings) and building location (approx. 40% for conventional buildings and 34% for green buildings). The location of the buildings relates not only to geographical location but also to the sense of familiarity, and social and family life.

Table 3: Factors impacting on apartment purchase decision, 1=unimportant, 2=very little importance, 3=important but not decisive, 4=decisive

factors	mean value standard div
apartment size	3.37 (.62)
location	3.34 (.56)
apartment design	3.21 (.65)
access to public transport	3.26 (.69)
price	3.27 (.58)
estimated energy consumption	2.76 (.82)
distance to work	2.46 (.99)
environmental factors (other than energy)	2.54 (.82)
limited choice of available apartments	2.22 (.97)
distance to school	1.97 (1.10)

Generally, energy and environment were ranked rather lower in importance than other factors (table 3). Interestingly, energy factors were indicated by 24% of green building respondents as decisive, whereas only 8% of the occupants of conventional buildings indicated the same. Other environmental factors than energy were ranked low: only 13% of green building occupants and only 6% of those in conventional buildings ranked environment as decisive to their apartment purchasing decision.

The difference in responses from occupants of green and conventional buildings was tested with a Mann-Whitney test. The results show that on a statistically significant level of $p \leq 0.05$, occupants' responses only differ with regard to the impact of three factors: distance to school, energy and environment (see table 4).

It is interesting that 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 green residences are more environmentally concerned and indicated more interest in those factors. Indeed, when respondents were asked to state their opinion on the importance of environmental certification for buildings, more than half of the respondents in green buildings stated that environmental certification is important and that it may have a positive impact on building value. This opinion was shared by approximately one third of the respondents living in conventional buildings. Only 10% of the occupants of green buildings indicated that "environmental certificate for buildings is unimportant", compared to 26% of the respondents in conventional buildings.

The findings demonstrate that environmental education may be correlated with extent to which customers value energy and environmental factors when purchasing an apartment. The Spearman correlation test shows that perception of environmental certificate for buildings is significantly correlated with perceived importance of energy and environmental factors (table 5).

The results also demonstrate that the quality of information provided to occupants about building performance may affect the importance of factors impacting purchase decision (table 5). It was clear from our study that ample information about building performance and environmental impact was presented to the prospective buyers. On the other hand, the same information was less likely to be given to customers of conventional buildings unless explicitly requested. Approximately two thirds of the respondents living in conventional buildings indicated 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 a green building remember being given information about expected energy consumption or building environmental impact.

3.3 Willingness to pay

In general, respondents are willing to pay more for low-energy buildings (mean 1.84) than for buildings with an environmental certificate (mean 1.52). This is an interesting result, suggesting that customers are willing to pay more for features they can understand. Customers can translate low-energy building features into a lower requirement for energy

and therefore lower operating cost. It is not as easy to find direct benefits from owning an apartment in a building with an environmental certificate.

The Spearman correlation test shows a statistically significant (0.21) correlation between information about energy and environmental performance and willingness to pay, indicating that a customer who receives energy and environmental information about the building is willing to pay more for these features. On the other hand, the Spearman correlation test indicates a statistically significant and relatively high correlation between personal opinion on the importance of building environmental certification and willingness to pay (0.44 for WTP for low-energy buildings and 0.67 for WTP for buildings with environmental certification). This suggests that a customer who perceives value in building certification is willing to pay a premium for a green building.

The majority of respondents living in conventional buildings are not prepared to pay more for a building with an environmental certificate, whereas green-building residents are willing to pay 5% extra. Respondents are willing to pay a 5% premium for low-energy buildings, regardless of which building they live in.

Table 4: Mann-Whitney test

Mann-Whitney test for difference in responses between green and conventional buildings	
[p, probability]	
FACTORS	
building location	0.63
apartment price	0.48
apartment size	0.46
apartment design	0.52
estimated energy consumption / cost	0.00*
environmental factors	0.00*
access to public transport	0.64
distance to work	0.44
distance to school	0.02**
limited choice of available apartments	0.85
CERTIFICATION	
importance of environmental certification for buildings	0.00*
AVOWED WILLINGNESS TO PAY	
WTP for low-energy buildings	0.00*
WTP for environmental certified buildings	0.07***

statistically significant *p≤0.01; **p≤0.05, ***p≤0.1

Table 5: Spearman correlation test

	information regarding building performance [coefficient (probability)]	perceived importance of building certificate [coefficient (probability)]
importance of energy factor	.23 (.0003)	.19 (.002)
importance of environmental factor (other than energy)	.24 (.0002)	.28 (.000)
avowed willingness to pay for low-energy building	.25 (.0001)	.44 (.000)
avowed willingness to pay for environmentally certified building	.19 (.001)	.68 (.000)

4. Conclusions

A quasi-experimental approach was chosen to study the impact of energy and environment factors on customer decisions to purchase an apartment and to investigate customers' willingness to pay for green buildings. The analysis is based on data collected by a survey questionnaire addressed to owners of green and conventional buildings in Sweden.

The results indicate that energy and environmental factors have a rather low impact on the apartment purchasing decision. The results lend support to studies conducted in Germany, New Zealand and Australia (Eves and Kippes, 2010; Amecke, 2012; Bryant and Eves, 2012). The energy and environmental factors influencing the decision to purchase a dwelling were found to be correlated to respondents' perception of the value of building environmental certification and the quality of information provided about building performance. An issue worthy of discussion is information asymmetry, as 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 information asymmetry has its consequences. Firstly, potential buyers are informed about how exceptional green buildings are, yet they do not know what they can expect from conventional buildings. Secondly, the generously given information creates specific expectations, which may have an impact on occupants' overall satisfaction.

It was shown that occupants in green buildings are generally more willing to pay extra for such buildings; however, respondents stated different willingness to pay for low-energy buildings and building with an environmental certificate. One explanation for this lower willingness to pay might be that occupants are not convinced that environmental certification translates into higher value. Customers are willing to pay a premium for features they understand and of which they can see potential benefits, such as low-energy consumption.

References

- Addae-Dapaah K and Su Jen Chieh (2011). "Green mark certification: does the market understand?" *Journal of Sustainable Real Estate* **3**(1):164-191
- Amecke H., 2012, The impact of energy performance certificates: A survey of German home owners. *Energy Policy*. **46**, 4-14
- Bloom B., Nobe M and Nobe M (2011) Valuing green home designs: A study of ENERGY STAR Homes; *Journal of Sustainable Real Estate* **3**(1): 109-126
- Bohm P. and Lind H. (1993) Policy evaluation quality. A quasi-experimental study of regional employment subsidies in Sweden. *Regional Science and Urban Economics* **23**, 51-65
- Bryant L. and Eves C.; 2012; Home sustainability policy and mandatory disclosure: A survey of buyer and seller participation and awareness in Qld; *Property Management*, 30: 1 29 - 51
- Brounen D. and Kok N. (2011). "On the economics of energy labels in the housing market". *Journal of Environmental Economics and Management* **62**:166-179
- Carswell A. (2009) "The greening of multifamily residential sector" *Journal of Engineering, Design and Technology* **7**(1):65-80
- Chau C.K., Tse M.S., Chung K.Y. (2010)" A choice experiment to estimate the effect of green experience on preferences and willingness-to-pay for green building attributes#. *Building and Environment*. **45**, 2553-2561
- Eichholtz, P., Kok, N., and Quigley, J. (2010). "Doing well by doing good? Green office buildings". *American Economic Review* **100**:2494-2511
- Eves, C. and Kippes, S. (2010), "Public awareness of green and energy efficient residential property: an empirical survey based on data from New Zealand", *Property Management*, **28** (3): 193-208
- Fuerst F., and McAllister P (2011). "Green Noise or Green Value? Measuring the Effects of Environmental Certification on Office Values". *Real Estate Economics* **39**:45-69
- Goodwin K. (2011). "The demand for green housing amenities". *Journal of Sustainable Real Estate* **3**(1):127-141
- Issa, M.H., Rankin, J.H. and Christian, A.J. (2010), "Canadian practitioners' perception of research work investigating the cost premiums, long-term costs and health and productivity benefits of green buildings", *Building and Environment*, 45: 7, 1698-711.

Lorenz, D.P., Truck, S., and Lutzkendorf, T. (2006), "Exploring the relationship between the sustainability of construction and market value", *Property Management* **25** (2): 119–149.

Lorenz, D., and Lutzkendorf, T. (2008), "Sustainability in property valuation: theory and practice", *Journal of Property Investment & Finance*, Vol. 26 No. 6, pp. 482–521.

Mandel S. and Wilhelmsson M.(2011) "Willingness to pay for sustainable housing". *Journal of Housing Research* **20**(1): 35-51

Miller, N., Spivey, J., and Florance, A. (2009). "Does green pay off?", available from *Journal of Sustainable Real Estate* at: <http://www.costar.com/josre/doesGreenPayOff.htm> (accessed 2 January 2010).

Ott, W., Baur, M., Jakob, M., 2006. Direkte und indirekte Zusatznutzen bei energieeffizienten Wohnbauten (Direct and indirect additional benefits of energy efficiency in residential buildings); publication 260001; Study by Econcept and CEPE ETH Zurich on Behalf of the Research Programme EWG (www.ewg-bfe.ch) of the Swiss Federal Office of Energy, Bern. January.

Reed, R. and Mills, A., 2007, Identifying the drivers behind housing preferences of first-time owners. *Property Management*, **25**: 3, 225-41.

Runde T. and Thoyre S. (2010). "Integrating sustainability and green building into the appraisal process". *Journal of Sustainable Real Estate* **2**(1):221-248

Zalejska-Jonsson A., Lind H. and Hintze S. (2012). "Low-energy versus conventional residential buildings: cost and profit". *Journal of European Real Estate Research*, **5**(3): 211 – 228