Willingness to Pay for Green Buildings: Empirical Evidence from Switzerland

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Abstract  The demand for green buildings and to what extent firms will pay a premium price compared to conventional buildings is a lively debate. Policy instruments like the Swiss CO₂-enactment and the Swiss Building Program encourage and incentivize investments in energy-efficient properties. Based on a corporate real estate survey, I investigate the premium percentage price firms are willing to pay for green buildings. On average, Swiss corporations are willing to pay a premium price of 3.0% for leasing, 4.75% for purchasing, and 5.0% for retrofitting. Depending on firm characteristics, the premium price ranges from 1.3% to 7.9% compared to conventional properties. Firms from the building and financial service industries, as well as public corporations and authorities signal the highest willingness to pay.

Buildings are responsible for approximately 40% of energy consumption and for 24% of worldwide greenhouse gas emissions (IEA, 2006). However, the real estate literature points to a multitude of motivations to invest in energy-efficient properties. Economic and ecological benefits appear when firms try to reduce their energy, water, and waste consumption. With an investment in green buildings, firms hedge against rising energy prices and operating costs, as they try to reduce their ecological footprint (Eichholtz, Kok, and Quigley, 2010). In particular, commercial buildings can reduce their CO₂ emissions easily and to a large extent while investing in energy-saving measures. Moreover, green buildings set higher standards and create better environmental quality indoors, which might lead to an improved working environment, healthy working conditions, and increased employee productivity (Linn and Quintal, 2011). Another likely reason that corporations might increase their demand and be willing to pay for green buildings is acknowledged in terms of image and reputation. A better reputation allows firms to attract prospective employees and investors, and to charge higher sales prices for their business and products (Eichholtz, Kok, Quigley, 2010, 2013). Firms that invest in green buildings illustrate their ecological and social awareness, which is expected to be appreciated by their stakeholders. Some of these advantages and amenities are financially measurable, while others appear as intangible benefits. Therefore, analyzing the willingness to pay for green buildings is associated with a balancing costs and benefits.

In the aftermath of the 2012 United Nations Framework Convention on Climate Change in Doha (the Doha Amendment) and its resolution of a second Kyoto
Protocol, the Federal Council of Switzerland (Bundesrat) announced a revised CO$_2$-enactment and climate change strategy for 2013 to 2020.\textsuperscript{1} Aiming to reduce greenhouse gas emissions by 20\% in the year 2020 compared to 1990, the real estate sector highlights a substantial part of the federal energy strategy in Switzerland (IEA, 2007; Bundesamt für Umwelt, 2010). It is expected that the real estate sector will contribute the majority (up to 40\%) in reducing greenhouse gas emissions, whereas 10\% is expected to come from traffic and 15\% from the industrial sector (Bundesamt für Energie, 2012). The CO$_2$-enactment provides the yearly amount of approximately 200 million Swiss francs to support investments in energy-efficient residential and commercial real estate. The program has been enacted for the upcoming 10 years and it is estimated that more than 2 million tons of CO$_2$ will be saved within that period of time.\textsuperscript{2} The Swiss CO$_2$-enactment allows for a CO$_2$ tax reduction or for an avoidance, when firms contribute significantly to a reduction of greenhouse gas emissions. Moreover, voluntary corporate initiatives and sustainable business behavior is an integral part of the Swiss carbon abatement strategy. Further investments in green buildings are expected and institutional regulation is only going to intensify.

In this paper, I investigate the premium percentage price that firms are willing to pay for green buildings in Switzerland. For the case of Switzerland there is relatively little evidence for private corporations and public authorities displaying a willingness to pay. Most studies related to the Swiss real estate market analyze the willingness to pay of homeowners or the potential of energy efficiency measures for the residential real estate market (Jakob and Madlener, 2004; Jakob, 2007; Alberini, Banfi, and Ramseier, 2011). This study contributes to the literature and fills the gap for commercial real estate and for firms’ willingness to pay for green buildings. The analysis is based on the stated preferences of Swiss corporations.

The literature on green buildings provides empirical evidence for diverging lease and sale prices. Considering these differences, I distinguish between the decision to lease or buy (purchase) corporate real estate. The additional contribution of this paper is the analysis of the willingness to pay for a retrofit. A retrofit occurs when a firm increases the energy efficiency of a building. Moreover, I investigate the impact of firm characteristics, such as firm size, legal form, and industry on the willingness to pay. Besides industry-specific characteristics, it is interesting to examine whether there are any substantial differences between private corporations and public authorities. However, the case of Switzerland allows for a distinctive analysis of regional disparities. Due to the Swiss cantonal municipalities (Swiss cantons), I also control for regional differences in terms of Swiss Grand-Regions. Taking into account that the willingness to pay signaled by the surveyed firms is strongly related to their business behavior, I also shed light on firms’ attitudes towards sustainability in terms of economic, ecological, and social contributions.

Based on a 2013 survey, this study includes a sample of 145 Swiss corporations. This paper contributes to the literature, even though an analysis of stated preferences can be criticized because the responses are not real market or transaction-based data.\textsuperscript{3} Research findings illustrate premium prices that range from 1.3\% to 7.9\% on average compared to conventional properties. Moreover,
the research indicates that corporations from the building and financial service industries are among the firms that recognize the highest willingness to pay for green buildings. In addition, public authorities signal a substantial willingness to pay. With regard to the diverging investment horizons, I find that Swiss corporations are willing to pay a premium price of 3.0% for a lease, 4.75% for a purchase, and 5.0% for a decision to retrofit, on average.

The remainder of this paper is organized as follows. The next section provides a literature review and clarifies the empirical findings regarding the premium prices of green buildings as compared to conventional properties. I describe the methodology, including the descriptive and empirical analysis, in order to investigate the willingness to pay for commercial real estate in Switzerland. In the subsequent section, I describe the results and implications. Finally, the paper closes with concluding remarks.

**Related Literature**

The real estate literature provides a multitude of studies that deal with the analysis of premium rental and sales prices. Most studies focus on premium prices in order to investigate the financial benefits of green buildings compared to those of conventional real estate. Considering these diverging rental and sales price premiums, it is obviously a crucial distinction, whether firms want to lease or buy. One could expect that the decision to purchase is associated with a longer investment horizon as buying a property ties up a substantial amount of capital in contrast to leasing. Generally, long-term decision-making, including the decision to buy property, is associated with a higher willingness to pay.

**Diverging Preferences and Inefficient Investments**

Differences in stated preferences about the willingness to pay could result from the diverging interests of landlords and tenants. Investments in real estate sustainability suffer when price-sensitive decision makers do not directly benefit from energy savings and related amenities (Alberini, Banfi, and Ramseier, 2011; Eichholtz, Kok, and Quigley, 2011). This situation occurs when landlords or property owners do not occupy their own buildings (Alberini, Banfi, and Ramseier, 2011). Therefore, one could expect a significant difference between the decision to lease or to buy, especially because of market failures and other barriers (Kok, Miller, and Morris, 2012). Besides differences in the willingness to pay, a premium price, market failures, and barriers are responsible for inefficient spending in real estate, especially in the areas of sustainability and appliances (Jaffe, Newell, and Stavins, 2004). The so-called energy efficiency paradox describes the situation of inefficient investments, or simply the lack of investments, in energy-efficient technologies (Jaffe and Stavins, 1994a; Metcalf and Hassett, 1999; Klemick and Wolverton, 2013). This occurs although an investment appears to be appropriate, for ecological, social, and economic reasons (Jaffe and Stavins, 1994b; Jaffe, Newell, and Stavins, 2004). The real estate literature provides a multitude of explanations as to why decision makers do or do not invest in energy-efficient
properties. As Jaffe, Newell, and Stavins (2004) point out, it is generally a question of balancing costs and benefits. Costs appear to represent primary considerations, whereas benefits, such as energy savings and reduced energy bills, occur over a longer time horizon. Therefore, discounting future cash flows from energy-efficient investments is substantial in this context (Kats, 2003). Moreover, Jaffe, Newell, and Stavins (2004) provide an overview of the market and non-market failures that explain the energy efficiency gap. Among those explanations is the lack of information; information asymmetry between counterparties in concurrence with the principal-agent problem; transaction costs; uncertainty about future energy prices; or uncertainty about forthcoming technology developments (Hassett and Metcalf, 1993; Jaffe and Stavins, 1994b; Jaffe, Newell, and Stavins, 2004). Additionally, a low capitalization rate of energy-efficient investments is often proclaimed to be a significant barrier to investment (Houser, 2009). These barriers to an investment in concurrence with individual preferences indicate their impact on diverging stated preferences regarding the willingness to pay (Eichholtz, Kok, and Quigley, 2010, 2011). For some decision makers, it is appropriate to wait with an investment in energy-efficient technology and to delay the decision to invest. This also holds for individuals and firms.

Another reason for diverging preferences regarding the willingness to pay occurs when corporations outsource their properties, as they increasingly do (Eichholtz, Kok, and Quigley, 2010). Owning properties is becoming less common, especially in the third industry sector. Ownership of commercial real estate has decreased significantly, as pointed out by Brounen and Eichholtz (2005) and Eichholtz, Kok, and Quigley (2010). Although I do not control for varying effects across time, differences in the ownership of real estate assets indicate their impact on the willingness to pay.

**Empirical Evidence on Premium Prices**

In one of their initial studies, Eichholtz, Kok, and Quigley (2010) provide evidence on the economic value of green buildings. Based on real estate market transactions, they analyze more than 10,000 commercial buildings with a control sample of conventional properties. They use a geographical information system to control for diverging location preferences and for the overall quality of the building. The control building in their study had to be within a given radius of the corresponding certified building. Using ENERGY STAR and LEED office buildings from the CoStar database, they analyze rents, effective rents, and selling prices.

For the U.S. real estate market, the labels ENERGY STAR and LEED are well documented and describe certified properties or so-called green buildings. In collaboration with the U.S. Green Building Council and the U.S. Environmental Protection Agency, the CoStar Group developed a comprehensive database with Energy Star ratings and LEED certified buildings, which is a rich source for a multitude of real estate research. Whereas ENERGY STAR primary concentrates on energy efficiency, LEED describes a wider concept of sustainability attributes.

The findings of Eichholtz, Kok, and Quigley (2010) indicate a 3% rental premium per square foot, as well as a 6% premium price for effective rents. Distinguishing
between ENERGY STAR and LEED, they find a 3.3% premium rent for ENERGY STAR and a 5.2% premium for LEED properties. Using effective rents, the premium increases to 10% for ENERGY STAR and 9.4% for LEED. These findings correspond to the decision to lease addressed here. For the decision to buy, they find a selling price premium of 16% for green buildings on average. With regard to the characteristics of the ENERGY STAR and LEED programs, Eichholtz, Kok, and Quigley (2010) acknowledge that for ENERGY STAR labeled properties, the premium price is strongly related to energy-savings characteristics. However, they also conclude that the relative premium for green buildings is higher in low-cost and less expensive metropolitan areas. The percentage increase in rent or sales price is systematically higher in low-cost and more peripheral regions.

Fuerst and McAllister (2011) investigate the price effects of green buildings compared to conventional buildings, using hedonic regression analysis. Also for the U.S. commercial real estate market, they use CoStar data to measure the effect of labeled properties, both for rents and sales prices. They analyze price differentials between commercial LEED and ENERGY STAR labeled properties and conventional properties. They control for differences in property characteristics, such as age, quality in terms of building classes, building height, submarkets, and other amenities. To distinguish between rent and sales prices, they develop two hedonic regression models: a rent and a transaction price model. The transaction price model is used to estimate the premium price per square foot taken from real estate sales transactions. In contrast to their rent model, the sales price model additionally includes a time trend variable that controls for price inflation and other unobserved trends over time (Fuerst and McAllister, 2011). Moreover, the sales price model provides a control variable for market conditions at the time of sale. The sample includes approximately 200 LEED and 800 ENERGY STAR labeled properties, whereas 15,000 buildings were randomly selected from a control sample. They find a rental premium of 4%–5% on average for green buildings; the sales price premium is substantially higher and achieves up to 25%–26% on average.

Similar findings are provided by Miller, Spivey, and Florance (2008), who also use CoStar data. They control for property size, location, and age of the building. They use hedonic regression models to account for sales and rental prices. Although their findings support a positive impact of labeled properties on rents and sales prices, they are not significant at the conventional 10% level. This holds for both ENERGY STAR and LEED buildings. Nevertheless, they find a premium sales price of approximately 6% for ENERGY STAR buildings and about 10%–11% for LEED properties (Miller, Spivey, and Florance, 2008).

The findings of Wiley, Benefield, and Johnson (2010), analyzing ENERGY STAR and LEED properties in the U.S., support the aforementioned results. They find rental premium prices of approximately 7%–9% for ENERGY STAR buildings and 15%–18% for LEED buildings. With regard to a sales price premium, they find a $130 per square foot premium for LEED buildings and a $30 premium per square foot for ENERGY STAR properties. Fuerst and McAllister (2011) acknowledge that these findings might include another premium in addition to the
energy efficiency label. The premium price both for rent and sales might contain a premium for a preferred site and location. Although Wiley, Benefield, and Johnson (2010) use a dataset with properties from the same metropolitan area, they do not control for possible location differences. Beyond the lease or buy decision, the additional contribution of this paper to the real estate literature is illustrated in the case of real estate renovation and related stated preferences. National and international renovation rates are still too low to achieve global policy goals like the Kyoto Protocol (Jakob, 2007). As (Eichholtz, Kok, and Quigley, 2010) state, in the past decades the annual construction rate of new office buildings account for approximately 2% of the existing building stock. Without a significant rate of energy-efficient renovation, achieving global energy efficiency goals in the built environment would be unfeasible. For the case of Switzerland, Jakob (2007) estimates that energy-efficient renovations only account for 0.4%–0.8% of the total building stock per year. Moreover, the author investigates the drivers and barriers for an investment in energy efficiency or, more precisely, for the improvement of the buildings outer surface. For residential properties, he finds that renovations are much more driven by technical parameters and general housing activities, rather than by socio-economic factors such as income, age, and education. However, the renovation case is particularly interesting because building renovation is one of the key elements in achieving energy efficiency in the built environment (Kok, Miller, and Morris, 2012). Jakob (2007) emphasizes that the existing building stock has an even greater potential to reduce greenhouse gas emissions than do newly built properties.

Kok, Miller, and Morris (2012) analyze the economics of green retrofits. This is one of the first empirical investigations of premium prices for certified properties in terms of renovation cases. Using the CoStar data for the U.S. real estate market, they analyze premium rents and effective rents of LEED certified buildings after a retrofit. They compare rents and occupancy rates of certified and non-certified buildings in a controlled sample. Moreover, they investigate the achieved energy efficiency improvements after a retrofit, along with the related investment costs. The analyzed certification period is between 2005 and 2010. Using a survey among real estate managers, they account for the attitude towards the costs and benefits of green retrofits. The sample includes 374 properties in the U.S. office market. They find that the average premium rent for retrofitted commercial LEED properties is about 7.1% compared to non-certified properties. This finding is equivalent to a premium rent of $2 per square foot. Effective rents are approximately 9% higher, which corresponds to a $3 per square foot premium. The total dollar amount invested in retrofits, in their sample, is roughly $400 per median and $2 million per mean, respectively. The results differ significantly depending on the local real estate market. For example, the differences in premium prices are higher in New York City and Boston than in other markets, such as San Francisco. The results indicate that a retrofit makes sense in terms of the financial payback. On average, the benefits of energy-efficient renovations outweigh the costs of renovation. Deeper renovations improve the quality and competitiveness of the buildings and lower the opportunity costs. Data on real estate rental and sales price premiums are scarce. Most of the studies that provide empirical evidence on premium prices for green buildings are limited to the U.S.
real estate market.\textsuperscript{5} As with this paper, the following studies investigate the Swiss real estate market. So far, empirical studies for Switzerland are only available for the residential real estate market.

Instead of focusing on distinctive premium rent and sales prices, Alberini, Banfi, and Ramseier (2011) provide insight into homeowners’ preferences for energy efficiency renovations. They use a 2010 survey based on a conjoint choice experiment on Swiss homeowners in five cantons. Their 473 participants could choose between different energy-efficient renovation projects to account for upfront costs, monetary benefits from saving energy, time of amortization, and the improved thermal comfort. Interestingly, they find that the likelihood of investing in energy-efficient renovation projects increases with the amount of subsidy offered by the Swiss federal government. Although the available amount of subsidy accounts for only a minor part of the investment costs, this implicitly impacts the willingness to pay. Moreover, their study shows that decision makers care about the upfront costs of energy-efficient investments. Another finding from stated preferences indicates that the public’s attitude towards climate change plays a crucial role for the motivation to invest in renovations. Households that believe in the impact and importance of climate change are more likely to renovate and achieve the status of having a green building (Alberini, Banfi, and Ramseier, 2011). Also, expectations about future energy prices appear to be important in homeowners’ decisions. As Alberini, Banfi, and Ramseier (2011) point out, people who expect increasing energy prices for the next 20 years are more likely to invest in renovations. However, analyzing stated preferences of survey participants, uncertainty is a factor under consideration. Participants who are uncertain about future energy prices do not invest or invest with a substantially lower probability in renovation. Appraising costs and benefits, Alberini, Banfi, and Ramseier (2011) calculate a discount rate of 1.5 to 2.9, which indicates a balanced costs and benefits relation.\textsuperscript{6} Benefits such as future energy savings are not discounted very strongly by Swiss homeowners. These results show that related benefits are acknowledged and that there is a distinctive willingness to pay for green buildings.

Banfi, Farsi, Filippini, and Jakob (2008), in another well-documented study for Switzerland, investigate the willingness to pay for energy-saving measures in residential properties. This study provides evidence on the marginal willingness to pay derived from discrete choice models. Following an approach similar to the present paper, these authors use stated preferences to account for the willingness to pay under different assumptions and energy-saving characteristics.\textsuperscript{7} The participants in their final sample included 163 tenants and 142 homeowners from five Swiss cantons. Participants were asked to choose between maintaining their status quo and realizing different energy efficiency attributes. Implementing a choice experiment and using fixed effects logit models, the authors find that homeowners acknowledge pecuniary benefits resulting from energy savings. Moreover, they find a positive willingness to pay for environmental benefits, as well as for thermal, air, and noise comfort attributes. The authors also ascertain a marginal willingness to pay of about 1%–13% for both rented and purchased properties, depending on renovation attributes. For new buildings, the willingness to pay for enhanced façade insulation is approximately 3%. For a housing
ventilation system, the premium price ranges from 8% to 13%. Interestingly, they find that the willingness to pay for energy-efficient attributes is significantly higher than for related capital costs. Interpreting this finding and considering cost and benefits in relation to an investment decision, which manifest in the willingness to pay, the demand for energy efficiency investments appears to be higher than market supply. Or, the resulting marginal willingness to pay values is overestimated in this study, as Banfi, Farsi, Filippini, and Jakob (2008) suggest.

These above studies illustrate that corporate real estate decision makers value green buildings and they reveal a certain demand in the real estate market. The majority of the studies investigate a distinctive premium price for green buildings compared to conventional properties. These results hold for both commercial and residential properties.

In this paper, I investigate the willingness to pay for energy-efficient investments in the built environment. Moreover, I concentrate on quantifying the results of stated preferences regarding premium percentage prices and contribute to the debate of low adaption rates of energy efficiency investments. The paper documents to what extend premium prices occur for commercial real estate properties in Switzerland.

Data and Methodology

To investigate the willingness to pay for green buildings, I use data from a corporate real estate and sustainability survey in Switzerland. The survey was initiated by the Center of Corporate Responsibility and Sustainability at the University of Zurich in collaboration with CB Richard Ellis and DemoScope. The goal of the original survey was to determine whether or not energy-efficient properties exhibited a price premium. The 2013 survey was revised to quantify the willingness to pay for energy-efficient properties. Moreover, survey participants were asked about their attitude towards sustainability and its implementation in their business behavior. The participants were asked to assess the importance of economic, ecologic, and social sustainability from their perspective. Besides the sustainability issues, the survey was designed to detect regional disparities among Swiss corporations and their willingness to pay a premium for energy-efficient properties. In Switzerland, cultural differences are often cited as relevant; therefore, also the willingness to pay might lead to diverging results over different regions that are merged to Swiss Grand-Regions. The study ensured that firms from all over the country, or more precisely from all 26 cantons, were able to participate in the survey. With a distribution over all Swiss cantons, this study provides an additional contribution to related literature.

To analyze firms’ preferences and their willingness to pay both revealed and stated preferences is a common technical approach. Revealed preferences refer to a real observation of individual preferences and to a real market behavior. Therefore, revealed preferences are defined as a real-world evidence for individual choices. The analysis of premium prices of green buildings, actual choices, and real market behavior is often taken from real estate transaction data or from selling price
Willingness to Pay for Green Buildings

Due to the lack of data availability, stated preferences are used to account for hypothetical situations and questions on the willingness to pay. A prerequisite for using stated preferences is that the survey is purpose-designed. I use a stated preferences technique to investigate the willingness to pay for green buildings. With regard to the general methodology, I follow Kotchen, Boyle, and Leiserowitz (2013). They analyze the willingness to pay and policy instrument choices for climate change in the U.S. Based on a scale of given prices, households were asked about their willingness to pay for policy instruments aiming to reduce greenhouse gas emissions. Kotchen, Boyle, and Leiserowitz (2013) find that the willingness to pay depends on certain socio-demographic characteristics, especially on educational background, age, and income. Similarly, they controlled for household attitudes to climate change; specifically whether they believe if global warming is actually happening or not. I investigate firm characteristics and control for firms’ attitude on sustainability issues and whether or not they acknowledge the importance of sustainability.

Overall, roughly 1,000 Swiss corporations across all industry sectors were contacted by DemoScope. More than 100 survey participants started but did not fully complete the survey and were not selected for the analysis; 145 firms completed the survey. Although some of these 145 participants did not answer single questions, the data could be used for the analysis. The data collection was conducted in two stages. First, telephone interviews ensured a random sample of Swiss firms. This was necessary to recruit suitable contact persons in each firm with a distinctive knowledge and experience in real estate issues. Especially for larger corporations it was highly relevant to contact real estate professionals with sound information about the firms’ real estate portfolios. Also, contact persons should be able to comment on the business behavior and the general strategy of the firm. Additionally, a multitude of firm characteristics were recorded at this stage. Second, the participating firms could answer an online survey.

**Descriptive Statistics**

The descriptive statistics in Exhibit 1 provide an overview of the distribution of firm size, legal forms, and industry sectors of the surveyed firms. The majority of participating firms have up to 10 buildings in their real estate portfolios; 25% have more than 30 buildings. It is imperative to account for different legal types of the firms because of diverging investment requirements. Public corporations such as governmental institutions, non-profit organizations, and other public authorities do not follow a profit-maximizing strategy and are not part of a competitive market environment (Wiencke, 2013). Moreover, public authorities are among the most prominent owner-occupier and renters of energy-efficient properties (Eichholtz, Kok, and Quigley, 2011). Therefore, substantial differences might occur in their acceptance of a premium price for green buildings compared to private sector firms. Approximately 68% of the surveyed firms are large corporations with more than 250 employees. This is equivalent to 94 firms or more than 8% of all large corporations in Switzerland. Approximately 68% of the surveyed firms are large corporations with more than 250 employees. This is equivalent to 94 firms or more than 8% of all large corporations in Switzerland.

**Stated Preferences for Premium Prices.** To state their preferences towards the willingness to pay, participants were asked the following question: “Consider that you have to make a real estate lease, buy, or renovation decision. What are you
### Exhibit 1 | Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>0–10 Buildings</td>
<td>0.500</td>
<td>65</td>
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<tr>
<td>10–20 Buildings</td>
<td>0.200</td>
<td>26</td>
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<tr>
<td>20–30 Buildings</td>
<td>0.054</td>
<td>7</td>
</tr>
<tr>
<td>&gt;30 Buildings</td>
<td>0.264</td>
<td>32</td>
</tr>
<tr>
<td>0–1,000 sqm</td>
<td>0.152</td>
<td>16</td>
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<tr>
<td>1,000–10,000 sqm</td>
<td>0.229</td>
<td>24</td>
</tr>
<tr>
<td>10,000–50,000 sqm</td>
<td>0.324</td>
<td>34</td>
</tr>
<tr>
<td>50,000–100,000 sqm</td>
<td>0.124</td>
<td>13</td>
</tr>
<tr>
<td>&gt;100,000 sqm</td>
<td>0.171</td>
<td>18</td>
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<tr>
<td>Firms under Public Law</td>
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<td>39</td>
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<tr>
<td>Firms under Private Law</td>
<td>0.711</td>
<td>96</td>
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<tr>
<td>International Firms</td>
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<tr>
<td>Employees (≥250)</td>
<td>0.681</td>
<td>94</td>
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<td>Employees (&lt;250)</td>
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<td>Processing Trade Industry</td>
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<tr>
<td>Building Industry</td>
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<td>Public Sector</td>
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</tr>
<tr>
<td>Central Area</td>
<td>0.130</td>
<td>18</td>
</tr>
</tbody>
</table>

Notes: The figures represent mean percentages and the absolute number of observation in each category. The overall number of participating firms is 145 for the year 2013. Deviations appear due to omitted answered questions by the participants. The industry sector classification follows the NOGA classification from the federal statistical office. Due to a lack of observations, the Information and Communication sector as well as Research and Development is not reported. For the Swiss Grand-Regions, Ticino is not reported due to a lack of observations.

willing to pay for energy-efficient or so-called green buildings compared to conventional properties? Please choose your preferred premium price.”

Exhibit 2 provides an overview of stated preferences for each case of a decision to lease, buy, or retrofit a property. On a given scale that ranges from 0% to 15% (or more) firms could select their preferred premium price in intervals of 2.5%. A literature review suggests that a scale between 0% and 15% is suitable and covers most of the findings of international studies that analyze premium prices for green buildings. The highest price category stands for a premium price of 15% or more.
The stated preferences in Exhibit 1 illustrate substantial differences between the different real estate decision cases. The 0% answer clarifies that firms are not willing to pay a premium price for energy-efficient properties. They value green buildings the same as conventional buildings. Interestingly, the bulk of participants indicated that they would not pay more for green buildings when they could lease new space for their corporation. Approximately 40% of the firms would not pay an extra amount of money for their new leased property. Substantially fewer firms are not willing to pay a premium price to buy a new property or to retrofit existing buildings. Additionally, the lower bound of price categories is much wider than the upper bound for the lease case (Exhibit 1). For the buy and retrofit cases, the stated preferences illustrate higher premium prices compared to the decision to lease. Comparing the willingness to pay on average for each decision-making process, participants are willing to accept a premium price of approximately 3% (lease), 4.75% (buy), and 5% (retrofit), as shown in Exhibit 3.

These findings are in line with the results from international studies on real estate premium prices. Most of the studies cited in the literature review use transaction data. Interestingly, the majority of these studies also indicate a higher premium...
sales price compared to a premium lease price. These findings indicate diverging preferences in terms of the investment horizon. Renting a commercial property might be associated with a shorter time horizon than buying a real estate. Owning real estate might indicate a stronger awareness of long-term sustainability issues like energy efficiency. Another reason for higher sales prices is associated with a stronger commitment to the property from a firm’s perspective. Moreover, property owners and tenants might have diverging interests in terms of energy efficiency investments. In order to explain the lower acceptance of lease premium prices, one could argue that a significant sustainability standard is already expected and that prospective tenants are not willing to pay an extra premium price. Due to a very low vacancy rate in the Swiss commercial real estate market, a firm’s primary interest is to obtain suitable property space. Energy efficiency issues might occur secondarily and lead to a limited awareness of energy-efficient properties.

Surprisingly, the premium price for the case of renovation is even higher than the premium prices for leasing or buying a property. Taking into account that conventional renovations do not necessarily need to be energy efficient, participants were able to acknowledge their premium price for achieving a green building. These findings also hold for industry-specific willingness to pay. Exhibit 2 illustrates the stated preferences depending on the top four industries represented by the survey. In concurrence with former results, the non-acceptance of a premium price is again substantially higher for lease decision making compared to the other specifications.

To account for industry-specific differences on the willingness to pay, Exhibit 4 provides an overview. The results show that on average the premium prices ranges from 1.25% up to 7.9%. In line with previous results the highest acceptance can generally be found for the renovation case. Interestingly, the building industry, which also includes civil engineering, represents the highest willingness to pay for green buildings, on average. Moreover, the finance and banking industries and the public sector signal the highest acceptance of premium prices. With regard to the legal form, Exhibit 5 highlights the differences between firms under private and public law. Firms under public law account for substantially higher premium prices than firms under private law. These findings correspond to the often proclaimed pioneer role of public authorities, governmental institutions, and non-profit organizations to acknowledge their awareness of the importance of energy-

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**Exhibit 3 | Summary Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease</td>
<td>2.984</td>
<td>3.384</td>
<td>0</td>
<td>15</td>
<td>124</td>
</tr>
<tr>
<td>Buy</td>
<td>4.750</td>
<td>3.701</td>
<td>0</td>
<td>15</td>
<td>120</td>
</tr>
<tr>
<td>Retrofit</td>
<td>5.020</td>
<td>3.930</td>
<td>0</td>
<td>15</td>
<td>122</td>
</tr>
</tbody>
</table>

*Note: The figures represent mean percentages on a given 0% to 15% scale for (1) lease, (2) buy, and (3) retrofit decision making.*
Exhibit 4 | Industry-specific WTP

<table>
<thead>
<tr>
<th>Industry</th>
<th>Lease</th>
<th>Buy</th>
<th>Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Trade</td>
<td>2.647</td>
<td>4.779</td>
<td>5.214</td>
</tr>
<tr>
<td>Building</td>
<td>4.642</td>
<td>7.500</td>
<td>7.916</td>
</tr>
<tr>
<td>Commerce</td>
<td>1.250</td>
<td>3.214</td>
<td>2.875</td>
</tr>
<tr>
<td>Finance &amp; Banking</td>
<td>3.833</td>
<td>5.000</td>
<td>5.833</td>
</tr>
<tr>
<td>Land &amp; Housing</td>
<td>2.142</td>
<td>4.285</td>
<td>3.928</td>
</tr>
<tr>
<td>Public Sector</td>
<td>4.264</td>
<td>5.882</td>
<td>6.176</td>
</tr>
<tr>
<td>Total</td>
<td>2.975</td>
<td>4.786</td>
<td>5.063</td>
</tr>
</tbody>
</table>

Notes: The figures represent mean percentages of the willingness to pay for green buildings on a given 0% to 15% scale for (1) lease, (2) buy, and (3) retrofit decision making. Due to a lack of observations, the Information and Communication industry, as well as the Research and Development industry are not reported.

Exhibit 5 | WTP and Legal Form

<table>
<thead>
<tr>
<th>Legal Form</th>
<th>Lease</th>
<th>Buy</th>
<th>Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Law</td>
<td>3.882</td>
<td>5.526</td>
<td>6.250</td>
</tr>
<tr>
<td>Private Law</td>
<td>2.591</td>
<td>4.423</td>
<td>4.500</td>
</tr>
<tr>
<td>Total</td>
<td>3.000</td>
<td>4.784</td>
<td>5.063</td>
</tr>
</tbody>
</table>

Note: The figures represent mean percentages on a given 0% to 15% scale for (1) lease, (2) buy, and (3) retrofit decision making.

efficient properties. They signal a distinctive leading role to encourage private investments in green buildings, which is supported by these findings.

Uncertainty about the Willingness to Pay. An analysis of stated preferences indicates that firms can be uncertain about their willingness to pay and about their acceptance of a premium price. Eichholtz, Kok, and Quigley (2010, 2492) state that “both real estate developers and institutional investors are understandably uncertain about how far to go in implementing environmental investments, since the economic rationale for the development of sustainable buildings is based almost entirely on anecdotal evidence.”

Following Kotchen, Boyle, and Leiserowitz (2013), the analysis of a distinctive willingness to pay debate requires an investigation of how firms display uncertainty. It appears to be an expected outcome that uncertainty will harm investment decisions and might decrease the willingness to pay. As discussed above, a multitude of potential investment barriers lead to increased uncertainty by decision makers (Alberini, Banfi, and Ramseier, 2011). Although I do not
analyze the barriers to energy-efficient investments directly, study participants should be able to acknowledge their uncertainty about the topic.

Several reasons emerge for participants preferring to answer “don’t know” instead of signalizing a certain premium price. Indeed, I tried to reduce uncertainty in the sense of not asking the people who are not able to give a proper answer, because of limited knowledge or other reasons. It might provide valuable insights into firm decision making to analyze which factors impact the “don’t know” answer and which firm characteristics increase uncertainty over the willingness to pay. With regard to the different real estate decision making categories (lease, buy, retrofit), it turns out that uncertainty is relatively equally distributed. For the lease case, about 13% of the participants answered “don’t know,” whereas approximately 15% for the buy case and 14% for the retrofit case respectively. To account for an empirical analysis of uncertainty, estimating linear probability models did not lead to valuable results. There are no significant differences with respect to firm characteristics and industry sectors, and therefore these results are not reported here.\textsuperscript{14}

**Empirical Analysis**

Censored regression models are used in the empirical analysis. Due to the survey design, which provides a range of possible answer categories, I use Tobit models for the regression analysis (Amemiya, 1973). The dependent variable, which is the stated percentage premium price, is a censored variable. It has a given lower bound including the null price premium for participants who are not willing to pay a premium price. Non-negative values are not possible. The highest value of the dependent variable is “15% or more,” so there is no censoring from above. A fundamental characteristic of the data is that there are observations for the premium price that are zero. Therefore, the linearity assumption and the method of ordinary least squares are not suitable. Following the theoretical Tobit model, I assume a latent dependent variable, which is equal to the observable dependent variable whenever the latent variable is non-negative (Amemiya, 1984).\textsuperscript{15}

\[
y_i = \begin{cases} 
y^*_i & \text{for } y^*_i \geq 0 \\
0 & \text{for } y^*_i < 0
\end{cases}
\]

The latent variable can be written as:

\[y^*_i = x_i + e_i,\]

The following estimation accounts for the empirical analysis:

\[
y_i = \beta_0 + \beta_1 \text{Build} + \beta_2 \text{Employ} + \beta_3 \text{Legal} + \beta_4 \text{Space} \\
+ \beta_5 \text{Industry} + e_j + \text{controls}.
\]
I investigate the impact of distinctive firm characteristics on the willingness to pay. To account for different firm size measures, I use the number of buildings, the number of employees, and space measures (in sqm). Considering different space types, such as office, sales, or storage, space intensity is very diverging over different industry sectors. Firms might have a relatively small amount of employees but still use a large amount of space in square meters. This holds, for example, for storage or sales-intensive industries. Therefore, I control for diverse measures of firm size. The regression model also includes the legal form of the surveyed corporation to acknowledge differences in expected profit maximizing or non-profit business behavior. Additionally, the industry specification is part of the analysis. Moreover, I analyze the impact of firm attitude towards sustainability in general. Fuerst and McAllister (2011) point out that so far there is little empirical evidence that commercial real estate prices are influenced by sustainability characteristics. However, I take this into account and control for sustainability issues. It might have an impact on the announced premium prices, whether firms signal a strong importance of sustainability in their business behavior, or if they negate this question. Participants were asked about their attitude towards sustainability in their business behavior. The notion of sustainability issues has been dismantled into the well-documented terms of economic, ecological, and social sustainability. I use a Likert scale with five possible answers: “Not important at all,” “Less important,” “Undecided,” “Important,” “Very important.” Despite a loss in information, I simplify the five categories to a dummy variable coded 1 when the answer given is at least “Important” and 0 otherwise.

To control for diverging stated preferences depending on regional disparities, I merge the Swiss cantonal municipalities to Swiss Grand-Regions. Firms from very prosperous regions might signal a higher willingness to pay for green buildings. The Swiss Grand-Regions “Lake Geneva,” “Northwest,” and “Zurich” account for the highest GDP rates, whereas the regions “Middleland,” “East,” and “Central” account for substantially lower GDP rates, as well as a lower diffusion of corporations. Therefore, it is important to control for heterogeneous Grand-Regions.

Results and Implications

The results of this paper are twofold. At a first stage, the descriptive statistics provide a decent overview of the stated preferences on premium prices and show the willingness to pay of the respondents. Second, the empirical analysis investigates the impact of industry-specific and firm characteristics on the announced premium prices.

The participants were asked to consider a real estate lease, purchase, or retrofit decision. The analysis implies diverging price announcements for each decision. Moreover, a substantial amount of participants reveal uncertainty about their willingness to pay for green buildings. Particularly, when participants consider a lease, instead of a purchase or retrofit decision, approximately 40% of the
respondents are not willing to pay a premium price for a green building. In contrast to the lease case, the non-acceptance rate of a premium price is about 15%–18% on average and appears to be similar for the decision to purchase or retrofit a property. The findings for leasing new properties imply that a distinctive energy efficiency standard is already expected without paying a premium price. When the supply of suitable commercial space already provides a decent green building standard including property labels and certifications, there is obviously no need to pay an extra amount for it. One the other hand, it might also imply that the respondents value the associated additional costs of a green building higher than the benefits.

The empirical analysis indicates that participants with a larger amount of space acknowledge a higher premium price. For example, participants in the highest category of space usage (100,000+ sqm), indicate a 3.8% higher premium price than those with lower space intensity. These findings are significant at the 5% confidence level. The results remain significant when I control for the sustainability attitude and regional disparities. The results do not illustrate a significant impact of space intensity for the decisions to purchase or retrofit a property. Firms with more than 250 employees accept a higher premium price compared to smaller firms. The results are positive and significant, especially for the decision to buy a property. This finding is identified as important for employee-intensive industries such as the financial service or commerce industry in Switzerland. It indicates that green buildings are a relevant factor for industries that are attempting to attract highly-skilled people.

The results do not indicate that a larger property portfolio leads to a higher willingness to pay for a green building. On the contrary, the survey indicates that the results are negative for firms with more than 10 buildings. So, human capital, captured via the number of employees in a firm, has a stronger and more significant impact on the willingness to pay for green buildings than does the number of buildings in a firm’s property portfolio. Concluding, firms that are using more space reflect a positive and significant impact on the willingness to pay, whereas a larger amount of buildings do not support this finding. This might imply that firms that using more space are likely to be larger companies with CSR requirements and be financially able to pay more.

Participants under private law account for an assumed profit-maximizing business behavior, which is not the case for governmental institutions, public authorities, and non-profit organizations. Here, the insert dummy variable stands for public corporations. For all specifications, the variable LegalForm is positive but not significant in terms of the standard significance levels. This result is in line with the related literature that proclaims the importance of public sector authorities, for their implementation of green policies. This finding also corresponds with the industry specification of the public sector, which is not limited to the legal type of public law. With regard to industry-specific findings, the building industry sector has the strongest positive and significant impact on the willingness to pay. Participants from the building industry that consider leasing a property acknowledge a 4.7%–5.8% higher premium price for green property compared to other industry sectors. Also, an increasing impact on the willingness to pay occurs
for the finance and banking industry, as well as for the public sector. These findings hold, even when we control for different sustainability attributes and regional disparities. This complements Eichholtz, Kok, and Quigley (2010), who point out that firms from the finance, insurance, and real estate industry signal a substantial interest and willingness to pay for green buildings. The industry-specific findings indicate that labor-intensive industries and industries with a distinctive awareness of representative space account for the highest willingness to pay. The impact of image and reputation could be associated for the financial service industry, which has an extensive awareness of customer relationships.

**Conclusion**

The contribution of this paper to related literature is twofold. First, it is the first investigation of green building premium prices for the commercial real estate market in Switzerland. Second, in addition to an analysis of the willingness to pay for leasing or buying, the survey participants were asked about their willingness to pay for a decision to retrofit a property.

The impact of the built environment on CO₂ emissions is incontrovertible. The Swiss CO₂-enactment aims to encourage and incentivize investments in green buildings. Considering the impact of commercial properties on greenhouse gas emissions, to understand which firm characteristics and industry specifications determine the willingness to pay, is imperative to policy makers and investors. The findings indicate that diverse firm attributes determine the acceptance of a premium price for green buildings. As reinforced by descriptive statistics, substantial differences emerge in the decision-making process, in terms of whether firms intend to buy, lease, or retrofit a property.

The decision to retrofit a property reveals the interest of the firm to improve the status quo of energy efficiency in their property portfolio. The debate about insufficient investments in energy efficiency in the built environment is related to several barriers that prevent investments in green buildings. The theoretical energy efficiency gap, revealed in much of the literature, is caused by a lack of information, by information asymmetry or by principal-agent problems between real estate owner and tenant. Although there are explanations of insufficient investments, the illustrated premium prices for green buildings in this paper account for a distinctive demand and willingness to pay. Moreover, study participants indicate their attitudes towards climate change issues and the abatement of greenhouse gas emissions with their responses on sustainability questions. It turns out that uncertainty about the acknowledged premium price peaks for the decision to lease a property, which corresponds to the lowest premium price on average. The most prominent industry sectors with the highest willingness to pay are the building industry, the financial service industry, and the public sector. For these industries, the benefits of green buildings appear to be higher than additional costs that are associated with green buildings. Although the survey respondents represent all industry sectors in Switzerland, one might expect that firms from the building industry are more aware of the benefits of green buildings. The financial services industry, which is very common for Switzerland,
signals a special interest in representative office space. The often proclaimed benefits of green buildings appear to be appreciated in these industries. On the hand, the findings reveal a relatively low interest in green buildings in the commerce industry. The announced premium prices range from 1.3% to 7.9% compared to conventional properties.

Surveying firms and analyzing their willingness to pay is associated with stated preferences rather than revealed preferences. It is taken into account that stated preferences are not revealed in terms of observable or transaction-based investment decisions. Signaling a certain premium price does not necessarily mean that real estate decision makers would actually pay the announced price.

Therefore, the findings might be overestimated. On the other hand, the results complement the related literature and the empirical findings of transaction-based rental and sales prices. However, the findings contribute to the related literature of green buildings in Switzerland. It provides insight into the green economy and reveals the demand for green buildings.

**Endnotes**

1 The Federal Office for Environment (Bundesamt für Umwelt, 2010) illustrates the Swiss federal strategy to reduce greenhouse gas emissions. In this context, the CO2-enactment was revisited in late 2012. The enactment defines new elements of the Swiss Building Program supported by both, the federal state of Switzerland and cantonal municipalities. The Bundesamt für Umwelt (BAFU) and the Bundesamt für Energie (BFE) provide an overview of the current greenhouse gas strategy in Switzerland, following the Energy Strategy 2050 with a strong emphasis on the built environment.

2 Besides reducing greenhouse gas emissions, the Swiss federal energy policy tries to increase the independence of oil and gas imports, which is also part of the federal strategy for the following decades (Bundesamt für Energie, 2012).

3 The Data and Methodology section provides an introduction of stated and revealed preferences.

4 The data illustrate real market behavior and describe rather revealed preferences than stated preferences.

5 The CoStar database is a leading resource for empirical studies.

6 Diverging discount rates depend on the specification model.

7 Banfi, Farsi, Filippini, and Jakob (2008) acknowledge stated preference methods to compare household decision makers that already experienced energy efficiency investments and those who have not.

8 Gantenbein and Volonté (2012) evaluate the relation between cultural differences and corporate governance for the case of Switzerland. Although the law is equal in both, the German and French speaking part of Switzerland, substantial cultural differences appear in both regions.

9 Swiss Grand-Regions are taken from the official definition of the Federal Statistic Office Switzerland.

10 Verhoef and Franses (2002) provide an overview of revealed and stated preference methods.
Swiss Federal Statistical Office, industry and services, private businesses, and persons employed by size, 2008.

The survey provided a definition of “green buildings.” Moreover, participating contact persons were real estate professionals to ensure a proper interpretation of the question.

The vacancy rate for commercial real estate is about 1%–2%, with regard to the agglomeration (Bundesamt für Statistik, 2012).

Analyzing uncertainty using the “don’t know” answer category does not provide a clear contribution. Taking the “don’t know” variable as a dependent variable and using linear probability models, I do not find significant results for diverging uncertainty.

Amemiya (1984) provides an overview of the standard Tobit model and numerous applications of it, along with a description of the dependent variable and the most important independent variable from diverse economic fields.

Due to the lack of observations, the information and communication industries, as well as the research and development industry are not reported here.

Swiss Grand-Regions follow the definition of the Federal Statistical Office. Due to the lack of observations, Ticino is not reported.

References


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