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WHO RENTS GREEN? ECOLOGICAL RESPONSIVENESS AND CORPORATE REAL ESTATE

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WHO RENTS GREEN?

ECOLOGICAL RESPONSIVENESS AND CORPORATE REAL ESTATE

Better management of real property is quite important for firms seeking to adopt more ecologically responsive business practices. Indeed, for many business functions (*e.g.*, corporate offices) energy consumption and carbon emissions are determined principally by the choices firms make in their use of real estate. Buildings and their associated construction activity account for almost a third of global greenhouse gas emissions (Royal Institution of Chartered Surveyors, RICS, 2005). The U.S. property sector is responsible for approximately forty percent of U.S. energy consumption (U.S. Department of Energy, 2003), and for seventy percent of U.S. electricity consumption (Energy Information Administration, EIA, 2008). Moreover, it is reported that about one quarter of greenhouse gas abatement potential involves improving efficiency in the real estate sector, at zero or even negative net costs to owners, occupants, and investors (Enkvist, Naucler & Rosander, 2007).

The demand for 'green' real estate – real estate labeled for its exemplary environmental performance – is on the rise throughout the developed world. Examples range from a 'green campus' built by Chevron in Louisiana, to a carbon-neutral research facility developed by Royal Dutch Shell in Amsterdam, to the energy-efficient headquarters of Deutsche Bank in Frankfurt. Moreover, notwithstanding the fact that commercial real estate markets in many countries have endured major contractions due to the economic crisis, the number of green buildings is rapidly increasing (Kok, McGraw & Quigley, 2011).

Recent research has studied the economic implications of green office buildings in the U.S., documenting that green buildings command premium rental rates and sales prices over

conventional office buildings (Eichholtz, Kok & Quigley, 2010a; Fuerst & McAllister, 2011). Effective rents are estimated to be about six percent above the rents of conventional office buildings, and transaction prices are estimated to be sixteen percent higher. The research also shows that part of the rental and value increment can be explained by climatic factors and the thermal attributes of green buildings, so the immediate effects on firm profitability derived from lower utility costs are important. However, in many cases the premium commanded by a green building cannot be explained by energy savings alone. Factors other than short-term operational savings seem to influence corporate choices to operate in 'green' buildings.

These factors suggest that there is an identifiable group of corporate real estate users who are willing to pay a premium for leasing green space. In this paper, we investigate the corporate motivations for the choice of green real estate, using the information provided by 'green' labels to conduct a detailed test of Bansal & Roth's (2000) theoretical framework regarding the ecological responsiveness of firms. This is the first study to link explicitly corporate real estate leasing decisions with theoretical motivations for corporate social responsibility. As noted above, these choices about real property do have important environmental implications.

Aspects of the Bansal & Roth (2000) framework have previously been used to explore the corporate motivations for environmental performance (Bansal & Clelland, 2004; Child & Tsai, 2005). The framework has also been empirically tested by Gonzalez-Benito & Gonzalez-Benito (2005a, b), who evaluated the motivations for the environmental transformations observed among Spanish manufacturing firms, finding that the decision to engage in these transformations arose from ethical as well as competitive considerations.

The extent to which corporations lease 'green' space can be regarded as a measure of their ecological responsiveness; we use this construct to test and extend the Bansal & Roth (2000) framework.

Understanding the motivations of corporations to lease green space is important for three reasons. First, corporations have been increasingly outsourcing the ownership of their properties. Corporate real estate ownership has systematically declined over the last two decades, particularly in the service sector (Brounen & Eichholtz, 2005; Deng & Gyourko, 1999). Thus, for most firms aiming to reduce their ecological footprint, the choices made as real estate tenants rather than as owners are crucial. In that respect, real estate has become an inseparable aspect of firms' overall corporate social responsibility strategies. This paper shows how industry characteristics of firms determine their ecological responsiveness with regard to building choice.

Second, a better understanding of those firms and industries predisposed to opt for 'green' real estate may allow researchers, managers, and policy makers to determine the scope for voluntary measures, relying on building performance disclosure as a market transformation mechanism, rather than regulation and taxation, to promote the consumption of more efficient real estate.

Third, despite the fact that efficient management of real estate can reduce the 'ecological footprint' of firms (Hart, 1995; Rees, 1992), the use of 'green' space by firms and organizations has received scant attention in the fast-growing management literature that relates business organizations and the natural environment. In a recent comprehensive survey of this literature, corporate housing decisions and real estate were not mentioned at all (Etzion, 2007). This paper contributes to the management literature by making a first attempt to fill this gap.

Using the Bansal & Roth (2000) framework, we develop hypotheses about the types of firms and industries more likely to choose green space rather than conventional space. We then investigate these hypotheses, using hand-collected data on the identity and industry characteristics of tenants in 'green' buildings in the U.S. We adopt a working definition of green office buildings, as those certified by either the Energy Star or the Leadership in Energy and Environmental Design (LEED) program.[i] We also construct a control sample of other, conventional office buildings, closely matched on geographical characteristics. This allows us to test the hypotheses by exploiting a unique, rich dataset of office buildings with an Energy Star and/or LEED-rating, matched with a control sample of nearby office buildings without these ratings.

A sample of more than 3,100 tenants in 1,180 green office buildings and a control sample of approximately 8,000 tenants in 4,000 conventional office buildings reveals that a substantial number of firms in the oil industry and in the financial services industry are the largest occupiers of green office buildings. The empirical analysis shows that mining and construction companies, as well as the government and government-related organizations, are systematically more likely to lease green office space rather than conventional space, as compared to corporate tenants in other industries. Furthermore, employee skill intensity and compensation are positively related to the propensity to lease green office space. These findings confirm the hypotheses about the determinants of corporate ecological responsiveness.

This remainder of this paper is organized as follows. In Section 2, we summarize previous work on the ecological responsiveness of private firms, and we develop hypotheses predicting the likelihood that firms in different industries will choose to 'rent green.' Section 3

provides an overview of the data, the methods, and some descriptive statistics. Section 4 presents results of the statistical analysis. Section 5 provides a discussion and conclusions.

ECOLOGICAL RESPONSIVENESS AND REAL ESTATE

The seminal Bansal & Roth (2000) model of ecological responsiveness identifies four determinants of corporate ecological performance: economic opportunities, stakeholder pressure, legislation, and ethical motives. These constructs are calibrated using a dataset of firms in the U.K. and Japan, gathered through interviews, detailed case studies, and corporate documents, as well as public information. Based on their analysis, the authors frame three dominant motivations in conditioning firms' ecological responsiveness: competitiveness, legitimation, and environmental responsibility.

We discuss each of these motivations below, indicating how they are related to corporate real estate leasing decisions, and developing four hypotheses concerning different industries' intensities in the consumption of 'green' real estate.

Competitiveness

Competitiveness as a motivation for ecological responsiveness is closely related to the financial performance of the firm. An active environmental policy – indeed just complying with environmental regulation – is costly. Konar & Cohen (2001) estimate that U.S. firms invest a combined amount of some 1.5–2 percent of GDP annually on environmental policies, and these expenditures may crowd out other productive investments (Palmer, Oates & Portney, 1995). Nevertheless, there appears to be a positive association between corporate environmental

performance and corporate financial performance (Karpoff, Lott & Rankine, 1999; Klassen & McLaughlin, 1996; Konar & Cohen, 2001).

The positive effect of environmental policies on financial performance may materialize following cost reductions by lowering input and waste disposal costs (Porter & Van der Linde, 1995). Green buildings can play an important role in this regard, as the operating costs of such buildings may be substantially lower. For commercial buildings, energy – an important element of sustainability – represents a significant expense in the operation of buildings, with energy costs at nearly ten percent of total housing costs, on average. These costs can be decreased through energy efficiency measures that are often integral to green building design. Anecdotal evidence shows that LEED-certified buildings, on average, use thirty percent less energy than conventional buildings (Kats, 2003), and it is claimed that the energy savings on buildings with an Energy Star label are almost forty percent (U.S. Environmental Protection Agency, 2008). Thus, leasing space in green buildings may have a direct impact on leasing costs.

These costs are likely to be most significant for firms active in sectors that tend to have office-space-intensive operations, which is more likely for firms in the tertiary industry (*i.e.,* the service sector). This suggests that firms operating in the service sector may also be more likely to rent green space as compared to firms in other sectors.

Another, more indirect, benefit that may follow from the occupancy of a green building is an increase in employee productivity. Several studies have reported a positive correlation between a building's internal environment (*e.g.,* its indoor air quality) and employee health and productivity (See Danna & Griffin, 1999, for a review of the literature on health and well-being in the workplace. See also Hoffman, Wood & Kreiss, 1993). The potential gains of reduced sick leave and increased productivity are substantial, and it has been asserted that these benefits

exceed costs by a wide margin (Apte, Fisk & Daisey, 2000; Fisk & Rosenfeld, 1997). Given that staff costs represent a major share of total expenditures for the average firm, the potential financial benefits from improved productivity are substantial, and perhaps even larger than the direct cost savings derived from lower energy consumption (Edwards, 2006; Nelson, 2007).

A recent paper by Edmans (in press) shows that corporate financial performance is positively related to employee satisfaction, which is affected by pecuniary benefits, but also by the quality of working conditions. Indeed, Oldham & Rotchford (1983) and Bitner (1992) show that physical office design has significant effects on various measures of employee satisfaction, like communication, concentration and networking opportunities. Since green buildings are asserted to offer a superior working environment, they may increase employee satisfaction, and thereby productivity.[ii]

We should note that the association between 'green' buildings and higher employee productivity has not yet been established conclusively. But a widespread perception of increases in productivity or morale by firm managers may in itself be sufficient to affect the choice of office space. Moreover, even if green real estate did not make a firm's existing work force more productive, it could attract a more productive workforce. This may arise from an improved corporate reputation deriving from a commitment to green values. Corporate reputation has been documented to be an important determinant of job choice (Gatewood, Gowan & Lautenschlager, 1993), and therefore in acquiring human capital. Indeed, Bauer & Aiman-Smith (1996) show that firms having a positive attitude towards the natural environment are regarded as more attractive employers than otherwise comparable firms without such an attitude. As human capital is viewed as a key source of value creation in modern firms (Zingales, 2000), the attraction and retention of employees is especially important in economies and industries where skilled employees are

scarce and skills are inelastically supplied. Henriques & Sadorsky (1999) show that the perceived importance of organizational stakeholders (for example, the workforce) plays a large role in determining the managerial attitude towards the environment.

Thus, a positive stance towards the natural environment can increase success in hiring and retaining high-quality human capital. For employees, 'green' real estate can be a visible signal of the adoption of an environmental policy, and can therefore contribute to a firm's success in attracting human capital. The degree to which human capital is important for firms is affected by the industry the firm operates in, and we argue that human capital is likely to be most salient for organizations in the service industry. For example, the enhanced indoor air quality arising from an improved building structure, and from better heating, cooling and ventilation systems, is most beneficial for firms largely dependent on highly trained workers, such as firms in the financial industry or in professional services. This results in the following hypothesis:

Hypothesis 1. Firms dependent on high levels of human capital and those operating in space-intensive industries, such as firms in the service sector, will be more likely to rent office space in green buildings.

Legitimation

Legitimation as a determinant of ecological responsiveness is strongly related to reputation and credibility with the broader set of stakeholders. A 'green' corporate headquarters, and the use of green space in general, may signal to stakeholders and customers that a firm has a long-run commitment to the natural environment. If this translates into an improved reputation,

then the occupancy of green buildings can have positive but indirect economic effects (Fombrun & Shanley, 1990).

Reputation may also be important for investors. Investors are powerful corporate stakeholders (Mitchell, Agle & Wood, 1997), and the investment community has embraced the concept of socially responsible investments (SRI) with enthusiasm. For example, the number of SRI mutual funds has grown rapidly. SRI assets under management increased from $639 billion in 1995 to $2.71 trillion in 2007 (SIF, 2007). Important institutional investors like APG in the Netherlands, Hermes in the U.K., and TIAA-CREF in the U.S., have formulated and implemented SRI strategies, strategies which are consistently communicated to the capital markets and to their clients.[iii]

Barnea, Heinkel, & Kraus (2005) report that investors following an SRI approach can induce polluting firms to reform, and Henriques & Sadorsky (1996) find that the environmental policies of firms are quite responsive to shareholder pressure. Non-governmental organizations (NGOs) also increasingly use an SRI approach – by investing in SRI mutual funds – to influence firms to adopt corporate social responsibility (CSR) and specific environmental policies (Guay, Doh & Sinclair, 2004).

SRI strategies typically imply that investors avoid corporations that cause social injury or environmental damage (Spicer, 1978). This 'negative screening' may lead institutional investors (such as pension funds, university endowments, banks and insurance companies) to be systematically underinvested in so-called 'sin' stocks (Hong & Kacperczyk, 2009). It is likely that corporations with environmentally sensitive operations are exposed more directly to the risk of exclusion. This suggests that the adoption and implementation of an environmentally responsive strategy could reduce the risk of negative SRI screening by institutional investors.

If leasing green office space leads to a superior corporate reputation, this may enable firms to attract investors more easily and at better market rates (Milgrom & Roberts, 1986). Some empirical studies have argued that companies with highly developed environmental engagement are able to obtain better credit ratings, thereby lowering the cost of debt (Bassen, Holz & Schlange, 2006). Also, evidence shows that these firms can have a lower implied cost of equity (Derwall, 2007).

Customers comprise another important set of stakeholders. Indeed, it is asserted that 'customers drive corporations green' (Vandermerwe & Oliff, 1990). Firms operating in competitive markets are exhorted by customers to incorporate environmental responsiveness in manufacturing, research, and marketing. A superior reputation – for example for ethical behavior – may appeal to many segments of customers (Auger, Devinney, Louviere & Burke, 2003). This, in turn, may enable firms to attract and retain customers (Porter & Van der Linde, 1995) and to increase sales or else charge premium prices (Creyer & Ross, 1997; Klein & Leffler, 1981). The importance of reputation among customers depends on the domain in which a firm operates and the degree to which it interacts directly with retail customers. For example, for those firms involved in risky technologies (*e.g.,* nuclear or biotechnology), in national and international public policy debates (*e.g.,* those active in certain oppressive societies), or for those operating in controversial product-markets (*e.g.,* tobacco or weapons), ecological responsiveness may simply be a way to alter a negative image or to offset an otherwise unsavory reputation. In the literature, this has been termed as 'corporate social responsibility for irresponsibility' (Kotchen & Moon, 2007; Strike, Gao & Bansal, 2006).

Bansal & Clelland (2004) show that firms with low environmental legitimacy can reduce the associated negative stock performance effects by expressing an active commitment to the

natural environment. Leasing green real estate may be a low-cost and easy-to-implement factor to express that commitment. Occupying space in a green building may reify the environmental and social awareness of a firm and may signal the superior social responsibility of the tenants who locate there. Thus, ecological responsiveness in corporate leasing decisions could potentially help in offsetting a negative corporate image or in improving the reputation of firms in objectionable industries.

The likelihood of becoming a target of environmental litigation and public scrutiny is strongly dependent on the industry type and the location of operations. For example, firms in environmentally sensitive industries are more exposed to media visibility, which shapes the public's view of firm activities (Fombrun & Shanley, 1990). Henriques & Sadorsky (1999) find that the firms engaging most actively in environmental activities tend to place special importance on environmental industry groups.

Thus, the discipline of financial markets and customers may cause firms to implement active CSR policies. Especially for firms with environmentally sensitive operations, the risk of negative screening by investors is likely to be important, and through attention from the media and NGOs, these firms are also more exposed to public scrutiny from consumers. Firms differ in the environmental sensitivity of their operations especially across industries, while these differences are likely to be less apparent within an industry. This leads to the following hypothesis:

Hypothesis 2. Firms in industries characterized by environmentally sensitive operations will be more likely to lease green office space.

Environmental Responsibility

Although the attention of investors is focused understandably on firm profits, there is a distinct group of organizations for which the non-financial utility from pursuing an active environmental policy exceeds the potential monetary costs of such a policy. The concept of environmental ideology (Kahn, 2007) suggests that non-profit organizations and government agencies may be more active in environmental engagement than purely profit-maximizing firms. Since Energy-Star-labeled office buildings are known to emit far less carbon than conventional buildings (Eichholtz, Kok & Quigley, 2010b), leasing green buildings may be a logical step for these organizations, even if the rents are higher.

Furthermore, first-movers and early-adopters of environmental innovations are often those parties for whom monetary gains are of secondary importance. For example, the U.S. government announced in 2010 a mandate that no federal agency may enter into a leasing contract for a building that has not earned the Energy Star label in the most recent year. Since, by design, just one quarter of the U.S. office stock meets these energy standards, that decision considerably narrows the potential supply of space available to the public sector, and is therefore likely to increase occupancy costs.

This example illustrates that the public sector is relatively eager to demonstrate its environmental engagement through leasing space in green buildings, because this is 'the right thing to do' (Wood, 1991). Indeed, environmental ideology may determine the choice for green office space, in a similar way that it helps determine the choice of consumers in the private market (Kahn, 2007), and of portfolio managers in the investment industry (Hong & Kostovetsky, 2009).

Finally, for a public sector trying to 'nudge' society towards reduced energy consumption and lower carbon emissions, leading by example is an alternative to regulation. Since such a policy does not put a direct – financial – burden on certain groups of consumers or manufacturers, it may be more palatable politically than implementing regulation. These considerations lead to our third hypothesis, again formulated at the industry level:

Hypothesis 3: Organizations in the public sector and other non-profit institutions will be more likely to lease green space.

Mixed Motivations

These three motivations for the adoption of ecologically responsible business policies are likely to carry a different weight in different industries, and the outcomes in terms of ecological responsiveness are therefore expected to be industry-specific. However, some firms' ecological engagement will be unusually high. Bansal & Roth (2000) investigate the conditions under which this is likely to occur, and they argue that 'mixed motivations' can play an important role. So, the intensity with which firms consume 'green' real estate may be enhanced through the reinforcement of different motives. We expect these mutually reinforcing motivations to be reflected especially in the office leasing decisions of the oil and gas industry, where competitiveness (*i.e.*, attracting human capital) and legitimation (*i.e.*, offsetting an otherwise negative environmental reputation) are both at work. This leads to our fourth hypothesis:

Hypothesis 4: The intensity of green space use will be highest in the oil and gas industry.

GREEN REAL ESTATE AND TENANT DATA

To address empirically the four hypotheses, we collect information on tenants in commercial office buildings that have received an Energy Star or LEED certification. These labels represent the most widely used certifications of green buildings in the U.S.

Energy Star was established in 1992 as a voluntary labeling program designed to classify and promote energy-efficient products, and was first applied to computer equipment and home appliances. The Energy Star label for new homes was established in 1993, and Energy Star for commercial buildings was adopted in 1995. The label has been promoted as an efficient way for consumers to identify energy-efficient buildings. The Energy Star label is also marketed as an indication of better environmental protection, but the label focuses solely on energy consumption, and does not measure other 'green' characteristics. Thus, its implicit definition of a building's sustainability is quite narrow. The Energy Star website draws attention to the relationship between energy conservation in buildings and other aspects of good 'corporate governance.' But the EPA also stresses that the label is an indication of lower ownership costs, better energy performance, and higher resale values.

Commercial properties can receive an Energy Star certification if the source energy use of the building, as certified by a professional engineer, achieves certain specified benchmark levels. The benchmark is chosen such that the label is awarded to the top quarter of all comparable buildings, ranked in terms of source energy efficiency.

As of June 2009, 14,622 buildings in the U.S. had been awarded the Energy Star designation, including 5,311 office buildings.

The LEED rating system has been developed to encourage the 'adoption of sustainable green building and development practices.' LEED uses a broad definition of building

sustainability and is based on a point system, encompassing a wide range of criteria. The requirements for certification of LEED buildings are more complex than those for the award of an Energy Star rating, and additional points in the certification process are awarded for such factors as 'site selection,' 'brownfield redevelopment,' and the availability of 'bicycle storage and changing rooms,' as well as energy performance.

An external consultant evaluates the performance of a building in six different categories, and projects must satisfy particular prerequisites to earn points.[iv]

It is claimed that LEED-certified buildings have lower operating costs and increased asset values and provide healthier and safer environments for occupants. It is also noted that the award of a LEED designation 'demonstrate[s] an owner's commitment to environmental stewardship and social responsibility.'

As of June 2011, there were 21,459 buildings certified by the LEED Program of the USGBC, of which 3,959 certified office buildings (representing 755 million square feet).

The addresses and postal codes of the Energy Star and LEED buildings are publicly available. We match these addresses to office buildings listed in the CoStar database. CoStar is the major repository and provider of U.S. commercial real estate financial data. The CoStar Group maintains records on some 2.4 million properties, including current rental and occupancy data and the quality characteristics of buildings. We matched the CoStar database with the Energy Star and LEED address files as of June 2008. We obtained a match for 1,360 green labeled office buildings in the Costar database; 1,045 buildings were matched to those with an Energy Star certification, 286 buildings were matched to a LEED certification, and 29 buildings had a certification from both organizations.

Figure 1 provides a geographic summary of our match between the Energy Star-certified commercial office buildings, the LEED-certified buildings, and the population of commercial buildings identified in CoStar. The figure reports the number of certified commercial office buildings in each state, as well as an estimate of the fraction of office space in each state that has acquired a green rating.[v]

About three percent of the U.S. office building stock is green-labeled. As the map indicates, in some states – notably Texas, Washington, and Minnesota – more than five percent of office buildings are rated. The incidence of green office space is almost nine percent in California – 122 million square feet of office space is labeled. In a large number of states, however, only a very small fraction of office space is certified by Energy Star or LEED. Apart from California, states with extreme temperatures are apparently more likely to have rated office buildings.

– Insert Figure 1 about here –

Control Sample

Even if corporations base their housing decisions on the environmental characteristics of office buildings, these are not likely to be their paramount considerations. Corporations will also evaluate the quality of the building and, most important, the location of the premises. We therefore match each green building to a set of commercial office buildings that are in close proximity. In this way, we identify clusters of nearby buildings. Each cluster contains one green office building and all other office buildings within a quarter mile radius. This match, which

relies upon the latitude and longitude recorded for each green building, yields 1,180 clusters, each containing one green building and an average of three nearby control buildings.

Figure 2 illustrates the research design with examples from three different urban environments. For the green building depicted in Chicago, the map indicates that there are 41 non-green office buildings within the quarter mile radius. For the green building in Houston, there are six nearby non-green buildings, while for the green building in Columbus, there is only one non-green building within a quarter of a mile.

– Insert Figure 2 about here –

Descriptive Statistics

Table 1 provides more detailed information on the sample of green buildings, and on the control sample of conventional office buildings. (Variable definitions are in Appendix Table A1). The table shows that the green buildings differ substantially on some key quality issues. For example, the green buildings are substantially larger, on average, than the nearby control buildings. They are also slightly taller, by about two stories. The age difference between green buildings and conventional buildings is large: green buildings average about 24 years in age, while buildings in the control sample are about 49 years old, on average. Because they are older, the control buildings are much more likely to have been renovated than are the green buildings.

The overall quality of the green buildings is substantially higher. 79 percent are rated as 'class A,' while only 35 percent of the control buildings have that rating. Only about one percent of the green buildings are rated as class C, while over sixteen percent of the control buildings

have this rating. A larger fraction of green buildings have on-site amenities such as retail shops, mail rooms, and exercise facilities.

The green buildings have slightly higher occupancy rates, and the cross-sectional variability in occupancy is lower for green buildings than for the control buildings. Green buildings are also more likely to have a net-rent contract, in which the tenants pay directly for utilities.

These quality differences illustrate the importance of controlling for building quality when analyzing corporate housing decisions. Location decisions are likely to be made on the basis of many of the quality characteristics presented above, and the greenness of the building is just one of these. For example, building age is also an important determinant of corporate housing decisions, and given the strong relation between age and greenness, not controlling for age could lead to inaccurate inferences.

– Insert Table 1 about here –

ANALYSIS AND EMPIRICAL RESULTS

In assessing the relation between corporate leasing decisions and the three pillars of the Bansal & Roth (2000) framework (*i.e.*, competitiveness, legitimation, and environmental responsibility), the empirical researcher can follow two paths: a firm-level analysis within an industry, or an industry-level analysis across different industries.

The first approach has been used, for example, by Marshall, Cordano, & Silverman (2005) for the U.S. wine industry, and by Gonzalez-Benito & Gonzalez-Benito (2005a, b) for Spanish manufacturing firms. A within-industry analysis provides insight about individual firm

motivation for ecological responsiveness, or even in the motivations of the managers within these firms. Of course, such an analysis is only possible if the researcher has access to firm-level micro data.

The second, cross-industry approach allows for analysis of industry differences, which have been documented to play a crucial role in ecological responsiveness. Bansal & Roth (2000) show that field cohesion – "the intensity and density of formal and informal network ties in an organizational field" – is an important determinant of a firm's environmental performance. Field cohesion is likely to be strong within industries and less strong across industries. (See also Ramus & Montiel, 2005.) It would therefore be difficult to find meaningful results in a broad firm-level analysis of ecological responsiveness; the firm-level effects would be dominated by the industry influences.

In our analysis, we follow the industry-level approach. This choice arises partially from our interest in industry-level differences in the motivations of firms to opt for commercial space in green buildings. In addition, we have access to a large number of observations across different industries, but we lack firm or establishment-level data. Instead, we observe publicly-listed, privately-traded and non-profit firms, as well as space occupied by the government, or government-related entities. Of course, systematic corporate information (*e.g.,* financial metrics) is available only for the former, which inhibits a comprehensive firm-level analysis.

We investigate how the motivations to rent green office space differ across industries. Some industries will have a higher likelihood of leasing green office space as compared to other industries: the *competitiveness hypothesis* is related to operational costs and human capital considerations, and therefore likely to play an important role in the service sector. The *legitimation hypothesis* is linked to corporate reputation, and therefore likely to be more salient

in environmentally sensitive industries, like mining and oil. The motive of *environmental responsibility* is probably most prevalent for governmental and non-profit organizations. The intensity of green space consumption is probably higher in case of *mixed motivations*, which may be the case for the oil and gas industry; both *competitiveness* and *legitimation* are likely to play an important role for firms in these industries.

Green Space Consumption by Firms and Industries

The first part of our analysis focuses on the individual firms that are the dominant consumers of green space in the U.S. office market. For each green building in the sample, we recorded the names of the five largest tenants, their Standard Industry Classification (SIC) codes, and the floor space they occupied. We were also able to determine the total volume of green office space occupied by each individual firm. Similarly, we collected data on the total square footage of green office space that was occupied in each specific four-digit SIC code.[vi] This matching and data extraction yields a sample of 1,180 green office buildings, occupied by a total of 3,179 different tenants. We also collected information on all buildings in the control sample: the five major tenants, their SIC classifications and the square footage occupied for each control building. In total, the control sample includes 4,390 office buildings, with approximately 8,000 unique tenants.

Table 2 provides an overview of the green space occupied by the twenty largest tenants in the U.S. Column (1) shows the total square footage of green space occupied by each tenant. Commercial banks, such as Wells Fargo Bank, Bank of America, and ABN-AMRO are all among the largest consumers of green space. These are all firms with high human capital intensity, which lends support to Hypothesis 1. However, this high ranking for the banking sector

is partially explained by its extensive use of office space in general; the banking industry is notoriously space intensive.

Furthermore, in support of Hypothesis 3, the federal government and government-related organizations, such as the Department of Health and Human Sciences and the Environmental Protection Agency are prominent tenants of green office space. Last, the oil industry seems to be well represented in green office buildings, with tenants such as Shell and Chevron leasing a substantial percentage of the green building office stock. This is in line with the *legitimation hypothesis* (Hypothesis 2), where we posit that firms with environmentally sensitive operations are more inclined to lease space in green buildings.

To account for differences in office space utilization among industries, column (4) shows the total volume of office space occupied by the largest green tenants, and column (5) presents the green office stock rented by each tenant, relative to the total office stock it occupies (as reported in CoStar). Several trends are apparent. First, the California Environmental Protection Agency (Cal/EPA) is not only among the top-twenty occupants of green office space, but *all* of its office stock has a green label. Indeed, the agency boasts that its headquarters building in Sacramento is equipped with state-of-the-art techniques to improve indoor air quality and to reduce energy use and that it is among the world's most energy- and resource-efficient buildings. They note that the building 'gives a physical presence to the reality of an agency whose single task is to guard the great environment.' This is a clear example of how non-profit or governmental organizations derive non-financial utility from leasing green, supporting Hypothesis 2. As mentioned on the Cal/EPA website, 'this approach not only makes environmental sense, but it also makes the building a better place to visit and in which to work.'

Some of the commercial banks are not only prominent tenants of green space in absolute terms, but also relative to their total office stock. For example, ABN-AMRO and Wells Fargo lease substantial proportions of their total office needs – 58 percent and 37 percent, respectively – in green buildings. For the former, the headquarters in Chicago provides the main explanation; the 1.3 million square foot office building, which makes up most of the office stock leased by ABN-AMRO in the U.S. in 2007, was awarded a 'LEED for New Construction' label at the Gold level in 2007. Wells Fargo occupies several buildings with a green label. In fact, sustainability is a major strategic issue, and the bank has a well-articulated sustainability policy. In interviews conducted by telephone with the authors, a representative explained that '...it is important to show our environmental focus, for example, by leasing green office space.' As argued by Ramus & Montiel (2005), it is the implementation of CSR policies rather than the policy commitment that is necessary to reap direct business benefits.

For other corporations, such as Adobe Systems, Compuware Corp., or The Vanguard Group, leasing green space may not be a deliberate choice, but it may merely come with a preference for high quality office space, in combination with a growing need for space due to rapid expansion. Alternatively, the location of firm activities in green buildings may attract and retain highly qualified employees.

Finally, it is worth noting that the twenty tenants documented in Table 2 occupied, on aggregate, almost one sixth of the total inventory of green office space in the U.S. in 2007.

– Insert Table 2 about here –

Although the analysis of the leading corporate consumers of green office space provides interesting perspectives on these firms' motivations, this comparison also has a drawback. Since it focuses on the largest firms, it under-reports firms in less concentrated industries. We therefore study the aggregate amount of green office space occupied by the largest four-digit SIC codes, in absolute terms as well as relative to the total office stock occupied by the SIC code. These numbers are presented in Table 3. Column (1) shows the twenty industry categories with the highest aggregate of total green office space. Legal services – which includes attorneys and their support staffs – is by far the largest occupant of green office space. Although only one individual tenant from the legal services industry – Skadden, Arps – is among the twenty major occupiers of green space, the sector as a whole has a clear preference for sustainable office buildings. This reflects the fact that firms in the legal services industry are relatively small, so their choices are not clearly visible at the level of the individual firm when ranked by absolute total green space consumption. The preference of the legal services industry for more sustainable office space is in line with the *competitiveness hypothesis* (Hypothesis 1), wherein we posit that tenants in the tertiary sector are more likely to lease space in green buildings, as the direct benefits of leasing green space affect these tenants most.

Other industry categories that are among the largest tenants of green space are public administration, national commercial banks, crude petroleum and gas, and investment advisors. This is generally in line with the evidence in Table 2.

In Column (5), where we document the incidence of green space as a percentage of total office space occupied by the sector (as reported in CoStar), we observe that more than sixty percent of the total office stock occupied by the crude petroleum and gas industry is leased in office buildings with a green label. This fraction is far higher than it is for other industries and is

consistent with the *mixed motivations hypothesis* (Hypothesis 4). For example, as noted above, Chevron Corp. has recently occupied a newly developed building in Louisiana, which has been awarded a LEED Gold certification. Leasing green space 'supports the company's long-standing commitment to the Gulf Coast and the state of Louisiana. The building is located in a park-like setting, and the three hundred thousand square foot office building provides a safe, healthy and productive workplace for up to 750 people.'[vii] Although this expression of social and environmental awareness is unrelated to the core business of Chevron, it may help to improve its reputation among stakeholders.

– Insert Table 3 about here –

Tenant Concentration in Green versus Non-Green Buildings: Tobit Analysis

To investigate the four hypotheses more systematically, we calculate the fraction of leased office space per building for each tenant in the sampled buildings. Then, we aggregate these fractions based on one-digit SIC codes for each green building and each control building.[viii] We consider the following one-digit SIC codes: 0) agriculture, forestry and fishing, 1) mining and construction, 2 & 3) manufacturing, 4) transportation, communications, electric, gas, and sanitary services, 5) wholesale and retail trade, 6) finance, insurance and real estate, 7 & 8) services, and 9) public administration.

For each building, this yields the distribution of office space by major industrial category, matched with the characteristics of that building – such as building age, size, and quality – and the presence of an Energy Star and/or LEED certification.

To investigate the extent to which firms in specific industries are likely to lease green office space, we analyze the propensity to lease green space for a specific industry. We estimate the following equation for each one-digit SIC code:

$$(1) \qquad O_{in} = \alpha + \beta_i X_i + \sum_{n=1}^{N} \gamma_n c_n + \delta g_i + \varepsilon_{in},$$

where the dependent variable is the total square footage O_{in} occupied by tenants in building i in cluster n as a fraction of total occupied office space in the building. X_i is a vector of hedonic characteristics of building i – building age, building size and building quality – and c_n is a dummy variable with a value of 1 if a building is located in cluster n and zero otherwise. These location coefficients allow for differences in tenant concentration at each location, and they account for unobserved characteristics associated with each specific location. g_i is a dummy variable with a value of 1 if building i is rated by Energy Star or LEED and zero otherwise. α, β_i, γ_n, and δ are estimated coefficients and ε_{in} is an error term.

Because the dependent variable has a large number of zeros (*i.e.,* an industrial category rents no space in a particular building), we estimate Equation (1) as a Tobit model. In any case, the estimated coefficients indicate the propensities of different industries to locate in various kinds of buildings. Table 4 presents estimates of Equation (1), with each column corresponding to a specific industry group. The column headers in the table refer to the one-digit SIC codes of the industries considered. Since we do not have enough observations for SIC code 0 (agriculture, forestry, and fishing) and SIC code 1 (mining and construction) we are forced to exclude these industries from the Tobit analysis.

The dependent variable represents the fraction of office space occupied by tenants in the corresponding industry group. Column (2 & 3) reports the results for the manufacturing industry, which includes firms ranging from apparel producers to car manufacturers. Office utilization is

expected to be rather limited for these sectors. Indeed, the main explanatory variables are inconclusive, and the indicator variable for a green building has no significant effect. The same holds for the transportation and communications industry, as documented in column (4). Column (5) shows that office space leased by retail and wholesale trade is mainly in small buildings of relatively lower quality. As green certification is more prevalent in new and large buildings, the negative coefficient for the indicator variable for green buildings is in line with expectations.[ix]

Columns (6) and (7 & 8) report results for the finance, insurance and real estate industry, and the services industry, respectively. Especially for these industries, which include legal services and commercial banking, one would expect that leasing space in green office buildings is rational, as perceptions about indoor air quality and human resource consideration (Hypothesis 1) are of major importance. However, in contrast to expectations, the results indicate a negative coefficient on the green variable for both estimations. Although descriptive evidence indicated that some firms in the finance and services industry are among the larger tenants of green space, a more pervasive trend towards leasing green cannot be documented for these industries, when controlling more directly for building and location quality. This finding is in line with that of Henriques & Sadorsky (1996), who find that firms in the services sector are less likely to have environmental plans. The difference between the results in Table 2 and Table 4 suggests that it is rather the larger and more visible firms that move first in the implementation of social and environmental measures, followed subsequently by the critical mass in the same industry.

Finally, in line with Hypothesis 3, tenants in public administration seem to have a systematic preference for green office space, indicated by the positive and significant coefficient for the 'Green Rating' variable as documented in Column (9). These results show the increased

occupancy of green space by government-related tenants relative to otherwise comparable regular office space, while controlling for quality and location characteristics.

– Insert Table 4 about here –

Leasing Green Office Space Rather Than Conventional Space

One could argue that a more direct test of tenant preferences would be to investigate the likelihood that certain industries systematically lease green space rather than conventional office space. In Table 5, we therefore compare the fraction of office space occupied by a specific industry in a green building with the fraction occupied by the same industry in each control building in the same cluster. Using this more refined methodology allows for the inclusion of the agriculture, fishing and forestry industry, and the mining and construction industry. We also include summary measures of variations in the average characteristics of each one-digit industry code by metropolitan area. We estimate the following equation for each one-digit SIC code:

$$(2) \qquad (O_{gn} - O_{cn}) = \alpha + \beta_n (X_{gn} - X_{cn}) + \sum_{n=1}^{N} \gamma_n c_n + \varepsilon_n ,$$

where the dependent variable is the difference between the fraction of square footage occupied by tenants in green building g in cluster n and the fraction of square footage occupied by tenants in control building c – where c is located in the same cluster. Again, we control for building and location characteristics that are likely to influence corporate housing choices. (X_{gn} – X_{cn}) is a vector of the hedonic characteristics of the green building – building age, building size and building quality – in cluster n, minus the corresponding quality characteristics in the control building. c_n is a dummy variable with a value of one if building n is located in cluster n and zero

otherwise. Again, these location coefficients account for unobserved characteristics related to each specific location. α, β_n, and γ_n are estimated coefficients and ε_n is an error term.

Results are presented in Table 5 for ordinary least squares regression models corrected for heteroskedasticity (White, 1980). Each column header corresponds to a specific one-digit SIC industry. Given the relatively high adjusted R^2s, the model seems to explain corporate housing decisions quite well.

Columns (6) and (7 & 8) show that firms in the finance, insurance, and real estate sector and the services sector are more inclined to lease green office – due in some part to the fact that green buildings are of higher quality than conventional office space, as indicated by the significantly positive coefficient on 'Building Quality.' The opposite holds for firms in the retail and manufacturing industries, where the choice for green real estate is not primarily determined by the underlying differences in building quality.

Holding other factors in the regression constant, the intercept indicates whether the fraction of office space occupied by tenants in a specific industry is larger (or smaller) in green office buildings as compared to conventional office buildings. For most industries, the constant is significantly negative, which indicates that tenants are more likely to lease space in conventional office buildings rather than in environmentally-labeled buildings. This is consistent with the small fraction of the total office stock that has been certified by the USGBC and/or the Energy Star program.

Exceptions to the pattern of significantly negative coefficients are the mining and construction industry - Column (1) - and public administration sector - Column (9). The former has a significantly positive constant, which indicates that tenants in this industry group, on average, lease more office space in green buildings than in non-green office buildings,

controlling for differences in building quality. This finding is in line with the *legitimation hypothesis*. The fact that the intensity of green space use for this industry is highest is also in line with the *mixed motivations hypothesis*. As documented in Table 3, companies in the mining and construction industry have a large fraction of office inventory in green buildings, which is confirmed by the results in Column (1) of Table 5. Indeed, the tendency of 'irresponsible' organizations to offset an otherwise negative corporate image by responsible 'social' or 'environmental' behavior is widely acknowledged in the literature (Kotchen & Moon, 2007; Ramus & Montiel, 2005; Strike et al., 2006).

Note that there is an insignificant difference in space occupied in green buildings as compared to regular buildings for the public administration sector. This means that, relative to conventional office buildings in the same geographical area, the government and government-related tenants do not occupy significantly more space in green office buildings. But, given the fact that we find significantly negative coefficients for six other industries, the public sector is found to be relatively more likely to rent green office space as compared to most other sectors. Of course, this is in line with the *environmental responsibility hypothesis*.

– Insert Table 5 about here –

As a last test, we adapt regression Equation (2), including further controls for differences in the average characteristics of industries across metropolitan areas. We include a vector Y_n of variables that measure average employee output, payroll per employee, the number of employees per establishment, and the number of establishments. These data are computed for each one-digit

SIC code by Metropolitan Statistical Area.[x] This leads to the following equation for each one-digit SIC code:

$$(2a) \qquad (O_{gn} - O_{cn}) = \alpha + \beta_n (X_{gn} - X_{cn}) + \sum_{n=1}^{N} \gamma_n c_n + \delta_n Y_n + \varepsilon_n$$

Table 6 reports the results. Data limitations inhibit this analysis for three sectors: SIC code 0 (agriculture, forestry, and fishing), SIC code 1 (mining and construction), and SIC code 9 (public administration).

The variables measuring differences in the average characteristics of industries across metropolitan areas – the concentration of establishments and labor productivity – are generally statistically significant. This suggests that there are variations in the propensity to 'lease green' by industry across metropolitan areas – arising from variations in industry characteristics across metropolitan areas. This is in line with results documented by Cottrill (1990), Henriques & Sadorsky (1996), and Ramus & Montiel (2005), showing that the extent to which firms engage in CSR and actually implement a stated CSR policy is, to a large extent, determined by industry characteristics.

We measure the clustering of certain industries by including a variable reporting the number of establishments for the specific industry in each metropolitan area. The coefficient on this variable is negative for the finance, insurance, real estate sector and for the services industry. This implies that in areas with a higher office space density, the likelihood of leasing green office space rather than conventional office space is smaller. These locations are likely to be in, or very close to, the Central Business District (CBD), which usually has the highest location value. This result confirms previous research, *e.g.,* Eichholtz, Kok & Quigley (2010a) which reports that the increased rents and market values documented for green buildings are smaller at the most desirable locations.

The variable representing the average size of establishments, measured by the number of employees, is significantly positive for four out of five industries. This suggests that in larger companies, there is a preference for green office space.

For the variable measuring the payroll per employee – a proxy for the quality of human capital – the coefficient is almost consistently positive. (Recall that this variable varies for each industry group by metropolitan area.) The results suggest that tenants who are more dependent on high levels of human capital are more likely to rent office space in green buildings, supporting Hypothesis 1. Moreover, the significantly positive coefficient on the variable measuring sales per employee, a common proxy for labor productivity (see for example Koch & McGrath, 1996), indicates that in areas with higher employee productivity – or higher value-added per employee – tenants across all industries are more likely to lease green rather than conventional office space. More productive companies employing valuable human capital are more likely to rent space in these same buildings. Again, this is in line with the *competitiveness hypothesis*. Furthermore, the intercept is significantly negative for the finance, insurance, and real estate industry, as well as the services industry, but it is substantially closer to zero than the intercepts for other industries reported in Table 6. These differences suggest that firms in the financial sector and in the services industry are more likely to rent green space as compared to firms operating in the manufacturing, transportation and communication, and trade industries, which lends further support to the *competitiveness hypothesis.*

– Insert Table 6 about here –

CONCLUSIONS AND DISCUSSION

Awareness is growing that the built environment is an important source of greenhouse gas emissions and a major consumer of energy and raw materials. Industry conferences dedicated to energy-efficient buildings, like EcoBuild in the U.K. and Greenbuild in the U.S. draw record numbers of participants. The number of green commercial properties is rapidly increasing, despite the fact that the U.S. commercial property market has been severely affected by the economic crisis. On average, firms seem to be willing to pay a rental premium for 'green' office buildings, suggesting that this development is at least partly demand-driven. Firms conscious of environmental issues seem to consider real estate choices in their ecological responsiveness.

Both markets and governments have created a variety of environmental rating systems for commercial properties, which can assist corporations in evaluating this important component of their environmental policies. The U.S. labels, LEED and Energy Star, which are centerpieces of this paper, are examples of a broader global trend: BREEAM is the leading green real estate label in the U.K.; Australia uses the Green Star labeling scheme; and Singapore has adopted the GreenMark scheme. These environmental labels provide corporate tenants with a yardstick to measure the 'greenness' of properties, and they create a platform for property funds with a clearly defined green profile. For example, CalPERS has initiated one of the first green property funds: the Hines CalPERS Green Development Fund. This fund was formed in August 2006 to develop sustainable office buildings that are certified through the LEED program.

We use the information provided by these labels to conduct extensive tests of Bansal & Roth's (2000) theoretical framework regarding the ecological responsiveness of firms, and we investigate how these instruments of market transparency can help nudge corporations towards enhanced ecological performance.

Bansal & Roth (2000) identify three main motivations for firms to engage in ecological activities: competitiveness, legitimation, and environmental responsibility. These motivations are likely to have different weights for different industries. We exploit them here to develop hypotheses regarding the willingness of firms from different industries to consume green space rather than conventional space.

Our descriptive results show that firms in the legal sector and financial services industry lease a substantial share of green office space. This is consistent with the *competitiveness hypothesis*, since firms in these office space-intensive sectors are likely to profit most from the operational as well as productivity benefits of green buildings. These findings are reinforced by a more robust regression analysis, which shows that the concentration and size of establishments, as well as the extent to which human capital is available across metropolitan areas, has a distinct influence on the fraction of environmentally-labeled space that is leased. Again, this is in line with the competitiveness motivation for the choice for green office space and the perception that labeled office space may create a high-quality labor environment.

Our findings further show that the mining and construction industry and, more specifically, the oil industry are major users of green office space, which follows from the *legitimation hypothesis*. Firms in environmentally sensitive industries may actively incorporate sustainability in strategic decisions, such as headquarters selection, to offset negative reputation effects. However, for these decisions, competitiveness rationales related to employee productivity and attractiveness are likely to be mixed with the legitimacy motivation, which could increase the intensity of green space consumption. The results of the regression analysis show that green space consumption is highest for the mining and construction industry, suggesting that *mixed motivations* may indeed lead to stronger ecological responsiveness.

The empirical results also show that government and government-related organizations, for which non-financial utility may be more important, have a relatively strong likelihood to rent green office space. This is likely to arise from the *environmental responsibility* motivation. The most prominent example is California's Environmental Protection Agency, with all of its activities located in highly sophisticated environmental-friendly office buildings.

For managers, the findings in this study clearly show that corporate leasing decisions can facilitate the implementation of an ecologically responsible strategy. The magnitude of corporate real estate leases and assets and is such that the costs associated with renting and owning these properties have become second only to payroll costs in many organizations (Veale, 1989). Despite that, corporate real estate has generally not been regarded as important to corporate management (Brounen & Eichholtz, 2005; Zeckhauser & Silverman, 1983). However, our results show that real estate provides a tangible element of the ecological responsiveness of a firm, and may therefore become more central in managerial decision-making. Anecdotally, these findings are supported by recent, well-publicized decisions of large U.S. corporations to opt for 'green' buildings.

Second, 'green' labels seem to assist managers in their corporate real estate decision-making, which suggests that such labels may also be important for other corporate procurement decisions. For some corporate resources (*e.g.*, FSC-certified paper) these labels already exist, but for many others good, labels are lacking.[xi] For instance, important industrial commodities like ore, oil, and industrial chemicals are not subject to environmental labeling, but it is clear that these resources can be produced in ways that affect the environment to a different extent. The apparent usefulness of the existing labels in differentiating across products may induce the

introduction of environmental labels in other sectors, which may benefit from enhanced transparency as a mechanism to transform their market.

A third implication for corporate managers is related to capital market activities. Firms with a poor record on sustainability risk the likelihood of being excluded from the portfolios of institutional investors, which may increase their cost of equity capital (Hong & Kacperczyk, 2009). Recent research shows that firms' corporate social responsibility choices affect their cost of debt as well (Bauer & Hahn, 2011). Our results show that real estate is an aspect of firms' stance on corporate social responsibility, and corporate real estate decisions may therefore have an impact on firms' cost of capital.

For developers and institutional real estate investors, the findings in this study have important implications. The higher initial outlay that may be needed for a newly constructed sustainable office building, or for the refurbishment of an existing office building, can be recouped through energy savings and lower risk premiums, or through higher net rents. This study shows what types of firms, in which industries, are most likely to incur increased occupancy costs.

For policy makers and regulators, this research shows that certain industries already adopt green real estate practices, without regulatory coercion. This suggests that the 'green' labels created by government and industry bodies can serve as an inexpensive tool of market transparency, allowing firms to make informed decisions regarding the real estate dimension of their ecological strategy. These labels enhance the potential for policies about real property to play a stronger role in global carbon abatement.

Last, the results of this research suggest that the theoretical framework of Bansal & Roth (2000) provides a useful tool for a better understanding of the ecological responsiveness of firms.

However, this research is a first attempt to use corporate real estate decisions as a yardstick for firms' ecological responsiveness, and this has some important limitations.

First, we are only able to test part of the Bansal & Roth (2000) theory, which is a framework of contextual dimensions, motivations, and ecological outcomes. Data limitations allow us to investigate the implications of firm motivations regarding green property use at the industry level only. Ramus & Montiel (2005) show that industry plays an important role in the degree to which firms implement a stated corporate social responsibility policy, and the use of green real estate can be an important factor in that implementation. But, further research will have to be based on more granular firm-level data, which would create a more solid basis for the analysis of the relation between context and motivation.

Second, firm-level data would also allow for a much richer investigation into the relation between firm motivations and ecological strategy. Starik & Rands (1995) argue that in order to analyze the ecological sustainability of an organization, different levels of analysis are needed. This is only feasible with detailed firm-level data. For example, the relation of a firm with its employees, and the degree to which a firm is under public scrutiny, or under the scrutiny of the capital markets, are likely to play a role in that firm's ecological stance.

Third, this research is based on U.S. data only, and it remains to be seen whether the conclusions can be extrapolated to other countries. A recent global survey of the environmental management and investment practices of professional real estate investors (Bauer, Eichholtz, Kok & Quigley, 2011) found that these practices tend to differ strongly across countries. These differences may be related to international differences in the corporate demand for green space, suggesting that adding an international dimension to the study of green corporate real estate

decisions could substantially enrich the analysis. For that, an international data collection effort would be required.

The literature regarding organizations and the natural environment has been silent on the decisions by corporations to relate their decisions about real property into their overall environmental strategy. Yet the impact of real estate on the environment makes corporate housing decisions directly relevant for these strategies. Our results indicate that different types of corporations regard the real estate they consume in ways that differ across industries. Corporate choice for green real estate is predictable by theory, which implies that managers make rational and informed decisions regarding their choices of corporate real estate. The findings suggest that decisions about real property are, at least implicitly, regarded by managers as an inextricable part of their corporate social responsibility efforts. The findings in this paper also suggest that corporate real estate is fertile ground for further academic exploration into the way organizations integrate their policies on ecological responsiveness into their decision making.

REFERENCES

Apte, M. G., Fisk, W., J., & Daisey, J. M. 2000. Associations Between Indoor CO2 Concentration and Sick Building Syndrome Symptoms in US Office Buildings: An Analysis of the 1994-1996 BASE Study Data. *Indoor Air, 10*: 256-227.

Auger, P., Devinney, T., Louviere, J., & Burke, P. 2003. What Will Consumers Pay for Social Product Features? *Journal of Business Ethics, 42(3)*: 281-304.

Bansal, P., & Clelland, I. 2004. Talking Trash: Legitimacy, Impression Management, and Unsystematic Risk in the Context of the Natural Environment. *The Academy of Management Journal, 47(1)*: 93-103.

Bansal, P., & Roth, K. 2000. Why Companies Go Green: A Model of Ecological Responsiveness. *The Academy of Management Journal, 43(4)*: 717-737.

Barnea, A., Heinkel, R., & Kraus, A. 2005. Green Investors and Corporate Investment. *Structural Change and Economic Dynamics, 16*: 332-346.

Bassen, A., Holz, H.-M., & Schlange, J. 2006. The Influence of Corporate Responsibility on the Cost of Capital. *University of Hamburg*. Hamburg.

Bauer, R., Eichholtz, P. M., Kok, N., & Quigley, J. M. 2011. How Green is Your Property Portfolio? The Global Real Estate Sustainability Benchmark. *Rotman International Journal for Pension Management, 4(1)*: 34-43.

Bauer, R., & Hahn, D. 2011. Corporate Environmental Management and Credit Risk. *ECCE Working Paper*. Maastricht: Maastricht University.

Bauer, T. N., & Aiman-Smith, L. 1996. Green Career Choices: The Influences of Ecological Stance on Recruiting. *Journal of Business and Psychology, 10(3)*: 445-458.

Bitner, M. J. 1992. Serviscapes: The Impact of Physical Surroundings on Customers and Employees. *The Journal of Marketing, 56(2)*: 57-71.

Brounen, D., & Eichholtz, P. M. A. 2005. Corporate Real Estate Ownership Implications: International Performance Evidence. *Journal of Real Estate Finance and Economics, 30(4)*: 429-445.

Child, J., & Tsai, T. 2005. The Dynamic Between Firms' Environmental Strategies and Institutional Constraints in Emerging Economies: Evidence from China and Taiwan. *Journal of Management, 42(1)*: 95-125.

Cottrill, M. T. 1990. Corporate Social Responsibility and the Marketplace. *Journal of Business Ethics, 9(9)*: 723-729.

Creyer, C. H., & Ross, W. T. 1997. The Influence of Firm Behavior on Purchase Intention: Do Consumers Really Care About Business Ethics? *Journal of Consumer Marketing, 14(6)*: 421-432.

Danna, K., & Griffin, R. W. 1999. Health and Well-Being in the Workplace: A Review and Synthesis of the Literature. *Journal of Management, 25(3)*: 357-384.

Deng, Y. H., & Gyourko, J. 1999. Real Estate Ownership by Non-Real Estate Firms: The Impact on Firm Returns. *Working Paper*. Zell/Lurie Real Estate Center at Wharton.

Derwall, J. 2007. *The Virtues and Consequences of CSR*, RSM Erasmus University, Rotterdam.

Derwall, J., Guenster, N., Bauer, R., & Koedijk, K. 2005. The Eco-Efficiency Premium Puzzle. *Financial Analysts Journal, 61(2)*: 51-63.

Edmans, A. 2011. Does the Stock Market Fully Value Intangibles? Employee Satisfaction and Equity Prices. *Journal of Financial Economics*, forthcoming.

Edwards, B. 2006. Benefits of Green Offices in UK: Analysis from Examples Built in the 1990s. *Sustainable Development, 14(3)*: 190-204.

Eichholtz, P. M. A., Kok, N., & Quigley, J. M. 2010a. Doing Well by Doing Good: Green Office Buildings. *American Economic Review, 100(5)*: 2494–2511.

Eichholtz, P. M. A., Kok, N., & Quigley, J. M. 2010b. The Economics of Green Building. *Working Paper*. Berkeley: Berkeley Program on Housing and Urban Policy.

Enkvist, P.-A., Naucler, T., & Rosander, J. 2007. A Cost Curve for Greenhouse Gas Reduction. *The McKinsey Quarterley, 1*: 35-45.

Etzion, D. 2007. Research on Organizations and the Natural Environment, 1992-Present: A Review. *Journal of Management, 33(4)*: 637-664.

Fisk, W., J., & Rosenfeld, A. H. 1997. Estimates of Improved Productivity and Health from Better Indoor Environments. *Indoor Air, 7*: 158-172.

Fombrun, C., & Shanley, M. 1990. What's in a Name? Reputation Building and Corporate Strategy. *The Academy of Management Journal, 33(2)*: 233-258.

Fuerst, F., & McAllister, P. 2011. Green Noise or Green Value? Measuring the Effects of Environmental Certification on Office Values. *Real Estate Economics, 39(1)*: 45-69.

Gatewood, R. D., Gowan, M. A., & Lautenschlager, G. J. 1993. Corporate Image, Recruitment Image, and Initial Job Choice Decisions. *The Academy of Management Journal, 36(2)*: 414-427.

González-Benito, J., & González-Benito, Ó. 2005a. An Analysis of the Relationship between Environmental Motivations and ISO14001 Certification. *British Journal of Management, 16(133-148)*.

González-Benito, J., & González-Benito, Ó. 2005b. A study of the motivations for the environmental transformation of companies. *Industrial Marketing Management, 34(5)*: 462-475.

Guay, T., Doh, J. T., & Sinclair, G. 2004. Non-governmental Organizations, Shareholder Activism, and Socially Responsible Investments: Ethical, Strategic, and Governance Implications. *Journal of Business Ethics, 52(1)*: 125-139.

Guenster, N., Derwall, J., Bauer, R., & Koedijk, K. 2011. The Economic Value of Corporate Eco-Efficiency. *European Financial Management,* forthcoming.

Hart, S. L. 1995. A Natural-Resource-Based View of the Firm. *The Academy of Management Journal, 20(4)*: 986-1014.

Heinkel, R., Kraus, A., & Zechner, J. 2001. The Effect of Green Investments on Corporate Behavior. *Journal of Financial and Quantitative Analysis, 36(4)*: 431-449.

Henriques, I., & Sadorsky, P. 1996. The Determinants of an Environmentally Responsive Firm: An Empirical Approach. *Journal of Environmental Economics and Management, 30(3)*: 381-395.

Henriques, I., & Sadorsky, P. 1999. The Relationship Between Environmental Commitment and Managerial Perceptions of Stakeholder Importance. *The Academy of Management Journal, 42(1)*: 87-99.

Hoffman, R. E., Wood, R. C., & Kreiss, K. 1993. Building-Related Asthma in Denver Office Workers. *American Journal of Public Health, 83(1)*: 89-93.

Hong, H., & Kacperczyk, M. 2009. The Price of Sin: The Effects of Social Norms of Markets. *Journal of Financial Economics, 93(1)*: 15-36.

Hong, H., & Kostovetsky, L. 2009. Red and Blue Investing: Values and Finance. *Simon School Working Paper*. Rochester: Simon Graduate School of Business.

Kahn, M. E. 2007. Do Greens Drive Hummers or Hybrids? Environmental Ideology as a Determinant of Consumer Choice. *Journal of Environmental Economics and Management, 54*: 129-145.

Karpoff, J., Lott, J. R., & Rankine, G. 1999. Environmental Violations, Legal Penalties, and Reputation Costs. *University of Chicago Law School Working Paper*. Chicago.

Kats, G. 2003. Green Buildings Costs and Financial Benefits. Boston: Massachusetts Technology Collaborative.

Klassen, R. D., & McLaughlin, C. P. 1996. The Impact of Environmental Management on Firm Performance. *Management Science, 42(8)*: 1199-1214.

Klein, B., & Leffler, K. B. 1981. The Role of Market Forces in Assuring Contractual Performance. *The Journal of Political Economy, 89(4)*: 615-641.

Klitzman, S., & Stellman, J. M. 1989. The Impact of the Physical Environment on the Psychological Well-being of Office Workers. *Social Science and Medicine, 29(6)*: 733-742.

Koch, M. J., & McGrath, R. G. 1996. Improving Labor Productivity: Human Resource Management Policies Do Matter. *Strategic Management Journal, 17*: 335-354.

Kok, N., McGraw, M., & Quigley, J. M. 2011. The Diffusion of Energy Efficiency in Building. *American Economic Review, 101(3)*: 77–82.

Konar, S., & Cohen, M. A. 2001. Does the Market Value Environmental Performance? *The Review of Economics and Statistics, 83(2)*: 281-289.

Kotchen, M. J., & Moon, J. J. 2007. Corporate Social Responsibility for Irresponsibility. *Working Paper*. Santa Barbara.

Lai, K.-h., Cheng, T. C. E., & Tang, A. K. Y. 2010. Green Retailing: Factors for Success. *California Management Review, 52(2)*: 6-31.

Marshall, S. R., Cordano, M., & Silverman, M. 2005. Exploring Individual and Institutional Drivers of Proactive Environmentalism in the US Wine Industry. *Business Strategy and the Environment, 14*: 92-109.

Milgrom, P., & Roberts, J. 1986. Price and Advertising Signals of Product Quality. *Journal of Political Economy, 94(4)*: 796-821.

Mitchell, R. K., Agle, B. R., & Wood, D. J. 1997. Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *Academy of Management Review, 22(4)*: 853-886.

Nelson, A. J. 2007. The Greening of U.S. Investment Real Estate - Market Fundamentals, Prospects and Opportunities. *RREEF Research*. London.

Oldham, G. R., & Rotchford, N. L. 1983. Relations Between Office Characteristics and Employee Reactions: A Study of the Physical Environment. *Administrative Science Quarterly, 28*: 542-556.

Palmer, K., Oates, W., & Portney, P. 1995. Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm? *Journal of Economic Perspectives, 9(4)*: 119-132.

Porter, M. E., & Van der Linde, C. 1995. Green and Competitive: Ending the Stalemate. *Harvard Business Review, 73(5)*: 120-134.

Ramus, C. A., & Montiel, I. 2005. When Are Corporate Environmental Policies a Form of Greenwashing? *Business and Society, 44(4)*: 377-414.

Rees, W. 1992. Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out. *Environment and Urbanisation, 4(2)*: 121-130.

Renneboog, L., Ter Horst, J., & Zhang, C. 2008. Socially Responsible Investments: Institutional Aspects, Performance, and Investor Behavior. *Journal of Banking & Finance, 32(9)*: 1723-1742

RICS. 2005. Green Value. London and Vancouver: RICS.

Robertson, A. S., Burge, P. S., Hedge, A., Sims, J., Gill, F. S., Finnegan, M., Pickering, C. A., & Dalton, G. 1985. Comparison of Health Problems Related to Work and Environmental Measurements in Two Office Buildings With Different Ventilation Systems. *British Medical Journal, 291(373-376)*.

SIF. 2007. Report on Socially Responsible Investing Trends in the United States. Washington, D.C.: SIF.

Spicer, B. H. 1978. Investors, Corporate Social Performance and Information Disclosure: An Empirical Study. *The Accounting Review, 53(1)*: 94-111.

Starik, M., & Rands, G. P. 1995. Weaving and Integrated Web: Multilevel and Multisystem Perspectives of Ecologically Sustainable Organizations. *Academy of Management Review, 20*: 908-935.

Strike, V. M., Gao, J., & Bansal, P. 2006. Being Good While Being Bad: Social Responsibility and the International Diversification of US Firm. *Journal of International Business Studies, 37*: 850-862.

Teisl, M. F., Roe, B., & Hicks, R. L. 2002. Can Eco-Labels Tune a Market? Evidence from Dolphin-Safe Labeling. *Journal of Environmental Economics and Management, 43(3)*: 339-359.

Vandermerwe, S., & Oliff, M. D. 1990. Customers Drive Corporations Green. *Long Range Planning, 23(6)*: 10-16.

Veale, P. R. 1989. Managing Corporate Real Estate: Current Executive Attitudes and Prospects for an Emergent Management Discipline. *Journal of Real Estate Research, 4(3)*: 1-22.

White, H. 1980. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica, 48(4)*: 817-838.

Wood, D. J. 1991. Corporate Social Performance Revisited. *Academy of Management Review, 16*: 691-718.

Zeckhauser, S., & Silverman, R. 1983. Rediscover Your Company's Real Estate. *Harvard Business Review, 61(1)*: 111-117.

Zingales, L. 2000. In Search of New Foundations. *Journal of Finance, 55(4)*: 1623-1653.

ENDNOTES

[i] Energy Star is the energy-efficiency certification system of the U.S. Environmental Protection Agency and U.S. Department of Energy, and LEED is the system of the U.S. Green Building Council, a non-profit industry group.

[ii] Other researchers have also addressed this topic: Klitzman and Stellman (1989) examine the relationship between the quality of the physical office environment and psychological well-being of office workers and conclude that adverse environmental conditions within the office, especially poor air quality and noise, negatively affect worker satisfaction and mental health. Robertson et al. (1985) show a clear empirical relation between air quality and the physical health of office workers. Those working in naturally ventilated buildings are significantly healthier along a range of characteristics than those working in air-conditioned buildings. Headaches and lethargy were reported twice and three times as frequently in the air-conditioned buildings as compared to naturally-ventilated buildings, and these symptoms are both likely to affect productivity.

[iii] Evidence on the relative performance of SRI investments is rather inconclusive. Heinkel, Kraus, & Zechner (2001), and Hong & Kacperczyk (2009) show that precisely the presence of ethical investors drives the prices of irresponsible companies lower, thereby increasing their expected total returns. Derwall, Guenster, Bauer & Koedijk (2005) and Guenster, Derwall, Bauer & Koedijk (2011) show positive risk-adjusted stock market performance related to corporate 'eco-efficiency'. See Renneboog, Ter Horst, & Zhang (2008) for a recent literature review.

iv The six main characteristics of building sustainability according to LEED are: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation. A LEED certificate is awarded based on the aggregate

score, where the level of the award can range from Certified (pass) to Platinum (excellent). There are separate programs for existing buildings and newly developed buildings.

v Ratios based upon the CoStar data probably overstate the fraction of green office space in the U.S. inventory, since CoStar's coverage of smaller and older office buildings is less complete, and these are less likely to have a green rating.

[vi] The totals of green office space occupied by individual tenants or industry groups are probably underestimated, as CoStar covers approximately 80 percent of the U.S. commercial property market. Moreover, tenant data are not available for all green office buildings.

[vii] Chevron Press Release, May 2008.

[viii] We use one-digit SIC code aggregates rather than two-, three-, or four-digit SIC codes, as these would not yield a reasonable number of observations per industry.

[ix] Note that for retail and wholesale trade, it would be more informative to examine the extent to which the actual retail space has been awarded a green certificate, rather than the office buildings that are measured here. There is an emerging literature addressing 'green' issues in the retail industry (Lai, Cheng & Tang, 2010), but this is clearly an avenue for future research.

[x] The raw were obtained from the Office of Advocacy, US Small Business Administration (based on data provided by the US Census Bureau for 1997).

[xi] As opposed to eco-labels for corporate resources, the literature on eco-labels and consumer goods is well-developed. See for example Teisl, Roe & Hicks (2002).

APPENDIX TABLE A1
VARIABLE DEFINITIONS

Variable	Description
Size (thousands of square foot)	Building size includes the usable area and its associated share of the common areas
Stories (number)	The number of floors in the building above grade
Low (<10) (1 = yes)	Binary variable is 1 if the number of stories is below 10, and 0 otherwise
Medium (10-20) (1 = yes)	Binary variable is 1 if the number of stories is 10 or larger, but smaller than 20, and 0 otherwise
High (>20) (1 = yes)	Binary variable is 1 if the number of stories is 20 or larger, and 0 otherwise
Building Age (number)	The number of years since an existing building was completed.
Less than 10 years (1 = yes)	Binary variable is 1 if the age is younger than 10 years, and 0 otherwise
10 to 20 years (1 = yes)	Binary variable is 1 if the age is 10 years or older, but younger than 20 years, and 0 otherwise
20 to 30 years (1 = yes)	Binary variable is 1 if the age is 20 years or older, but younger than 30 years, and 0 otherwise
30 to 40 years (1 = yes)	Binary variable is 1 if the age is 30 years or older, but younger than 40 years, and 0 otherwise
Over 40 years (1 = yes)	Binary variable is 1 if the age is 40 years or older, and 0 otherwise
Building Class	The office building class designation differentiates buildings of the same building type into different categories of quality.
A (1 = yes)	In general, a class A building is an extremely desirable investment-grade property with the highest quality construction and workmanship, materials and systems, significant architectural features, the highest quality/expensive finish and trim, abundant amenities, first rate maintenance and in an excellent location with exceptional accessibility.
B (1 = yes)	In general, a class B building offers more utilitarian space without special attractions. It will typically have ordinary architectural design and structural features, with average interior finish, systems, and floor plans, adequate systems and overall condition.
C (1 = yes)	In general, a class C building is a no-frills, older building that offers basic space. The property has below-average maintenance and management, a mixed or low tenant prestige, and inferior elevators and mechanical/electrical systems.
Renovated Building (1 = yes)	Binary variable is 1 if a building has been completely restored so that the existing space becomes 'new' space again. The date of the last major renovation is tracked. Minor renovations, such as the improvement of a building's lobby or exterior are not considered full building renovations.

APPENDIX TABLE A1 (CONTINUED)
VARIABLE DEFINITIONS

Variable	Description
On-Site Amenities (1 = yes)	Binary variable is 1 if the building has one or more special characteristics that can enhance a property's appeal, including the presence of an atrium, banking facilities, concierge, convenience store, day care, dry cleaner, exercise facilities, restaurant, and retail shops.
Asking Rent (dollar per square foot)	Asking rent is the weighted average rent for a building or market. Rents are weighted based on the total square footage available at a rental rate. If the rental rate is zero, it is not counted in the average rent. Average rent is calculated from suite-by-suite detail.
Net Rent Contract (1 = yes)	Binary variable is 1 if the building has a lease structure in which the tenant is responsible for all expenses associated with their proportional share of occupancy of the building. This is the opposite of a Gross Rental Contract, a rental rate that includes normal building standard services that are provided and paid by the landlord.
Occupancy Rate (percent)	Occupancy rate is defined as the square footage of space that is physically occupied by a tenant as a fraction of the total rentable office space. It does not include space that is under a lease obligation, where the tenant does not actually occupy the space.
Employees Per Establishment (number)	The total number of paid employees, which consists of full- and part-time employees, including salaried officers and executives of corporations, who were on the payroll during the pay period including March 12.
Number of Establishments (natural logarithm)	An establishment is a single physical location at which business is conducted and/or services are provided. It is not necessarily identical to a company or enterprise, which may consist of one establishment or more. When two activities or more are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment.
Sales Per Employee (thousands of dollars)	Includes gross receipts from customers or clients for services provided, from the use of facilities, and from merchandise sold during the census year, whether or not payment was received in the year. Calculated as a fraction of the total number of paid employees, which consists of full- and part-time employees, including salaried officers and executives of corporations, who were on the payroll during the pay period including March 12.
Payroll Per Employee (dollars, natural logarithm)	Payroll includes all forms of compensation such as salaries, wages, commissions, dismissal pay, bonuses, vacation allowances, sick-leave pay, and employee contributions to qualified pension plans paid during the year to all employees. Divided by the total number of paid employees, which consists of full- and part-time employees, including salaried officers and executives of corporations, who were on the payroll during the pay period including March 12.

Note:
Sources: CoStar Group and Census.gov

TABLE 1
DESCRIPTIVE STATISTICS
(STANDARD DEVIATIONS IN PARENTHESES)

	Green Buildings	Control Buildings
Sample Size	1,180	4,390
Building Size (thousands sq. ft.)	324.08 (288.92)	218.69 (293.67)
Stories (number)	15.31 (13.26)	13.07 (12.11)
Stories (percent)		
Low (<10)	46.25 (49.90)	53.49 (49.88)
Medium (10-20)	26.66 (44.25)	25.25 (43.45)
High (>20)	27.08 (44.47)	21.27 (40.93)
Age (years)	23.85 (15.57)	49.45 (32.50)
Age (percent)		
Less than 10 years	14.27 (35.00)	4.87 (21.53)
10 to 20 years	24.06 (42.78)	9.40 (29.19)
21 to 30 years	43.37 (49.59)	25.13 (43.38)
31 to 40 years	11.10 (31.43)	13.25 (33.90)
Over 40 years	7.20 (25.88)	47.34 (49.93)
Building Class* (percent)		
A	79.39 (40.48)	34.94 (47.68)
B	19.45 (39.61)	48.78 (49.99)
C	1.15 (10.68)	16.28 (36.92)
On-Site Amenities** (percent)	71.76 (45.05)	49.22 (50.00)

TABLE 1
DESCRIPTIVE STATISTICS
(STANDARD DEVIATIONS IN PARENTHESES)

	Green Buildings	Control Buildings
Renovated Buildings (percent)	21.04 (40.79)	38.51 (48.67)
Asking Rent (dollars/sq. ft.)	29.84 (12.98)	28.14 (15.60)
Net Rent Contract*** (percent)	5.76 (23.32)	3.15 (17.47)
Occupancy Rate (percent)	89.12 (12.76)	81.35 (22.73)

Notes:

The control sample consists of all commercial office buildings within a 0.25 mile radius of each rated building for which comparable data are available.

* Building Classes A, B, and C are nationally standardized quality ratings of commercial property. Class A is best.

** One or more of the following amenities are available on-site: banking, convenience store, dry cleaner, exercise facilities, food court, food service, mail room, restaurant, retail shops, vending areas, fitness center.

*** Net Rent Contracts require tenants to pay separately for utilities.

TABLE 2
INCIDENCE OF GREEN SPACE UTILIZATION BY MAJOR TENANTS
FRACTION OF FIRM'S OFFICE SPACE HOUSED IN GREEN BUILDINGS

				Space Occupied		
		(1)	(2)	(3)	(4)	(5)
Tenant Name	Industry Description	Green Office Space	Fraction of Total Green Space	Cumulative Fraction of Total Green Space	Total Space CoStar	Green Space as Fraction of Total Space Rentals
		X 1000 sq. ft.	*Percent*	*Percent*	*x 1000 sq. ft.*	*Percent*
Wells Fargo Bank	National Commercial Banks	2,741	1.61	1.61	7,343	37.33
U.S. Government	General Government	2,415	1.42	3.03	14,631	16.50
Bank of America	National Commercial Banks	2,124	1.25	4.28	18,695	11.36
ABN AMRO	State Commercial Banks	1,724	1.01	5.29	2,993	57.60
State of California	General Government	1,568	0.92	6.21	5,706	27.49
Deloitte and Touche	Accounting, Auditing, Bookkeeping	1,554	0.91	7.13	5,131	30.28
Best Buy	Radio, Television, Consumer Electronics	1,500	0.88	8.01	2,104	71.31
U.S. Dept. of Health & Human Sc.	General Government	1,442	0.85	8.86	1,662	86.72
Shell	Petroleum and Gas	1,362	0.80	9.66	3,989	34.14
Chevron	Petroleum and Gas	1,229	0.72	10.38	6,181	19.88
Blue Cross and Blue Shield	Hospital and Medical Service Plans	1,211	0.71	11.09	12,251	9.89
Adobe Systems	Prepackaged Software	1,158	0.68	11.77	1,388	83.43
Compuware Corporation	Prepackaged Software	1,094	0.64	12.41	1,300	84.18
American Express	Personal Credit Institutions	1,018	0.60	13.01	6,754	15.07
The Vanguard Group	Investment Advice	990	0.58	13.59	1,569	63.07
Cal/EPA	Land, Mineral, Wildlife, Forest Conservation	950	0.56	14.15	950	100.00
Mitre Corporation	Commercial Physical and Biological Research	944	0.55	14.71	1,293	73.02
JP Morgan Chase	Investment Advice	907	0.53	15.24	10,670	8.50
Skadden Arps	Legal Services	889	0.52	15.76	1,751	50.77
Ernst and Young	Accounting, Auditing, Bookkeeping	864	0.51	16.27	4,149	20.83

TABLE 3
INCIDENCE OF GREEN SPACE UTILIZATION BY INDUSTRY
FRACTION OF OFFICE SPACE HOUSED IN GREEN BUILDINGS BY FOUR-DIGIT SIC

		Space Occupied				
		(1)	(2)	(3)	(4)	(5)
SIC Code	Industry Description	Green Office Space *x 1000 sq. ft.*	Fraction of Total Green Space *Percent*	Cumulative Fraction of Total Green Space *Percent*	Total Office Space CoStar *x 1000 sq. ft.*	Green as Fraction of Total Space Rentals *Percent*
8111	Legal Services	25,593	15.04	15.04	217,097	11.79
6021	National Commercial Banks	9,436	5.55	20.59	86,782	10.87
9199	Executive, Legislative and General Office	9,035	5.31	25.90	67,081	13.47
1311	Crude Petroleum and Gas	7,076	4.16	30.06	11,304	62.60
6282	Investment Advice	6,532	3.84	33.90	100,939	6.47
8721	Accounting, Auditing, and Bookkeeping Services	5,158	3.03	36.93	136,766	3.77
5731	Radio, Television, and Consumer Electronics Stores	1,531	0.90	37.83	3,888	39.37
9311	Public Finance, Taxation, and Monetary Policy	822	0.48	38.31	14,491	5.67
7373	Computer Integrated Systems Design	816	0.48	38.79	19,487	4.19
3812	Search, Detection, Navigation, Guidance	291	0.17	38.96	4,869	5.97
2759	Commercial Printing, NEC	287	0.17	39.13	3,996	7.17
3069	Fabricated Rubber Products, NEC	285	0.17	39.30	769	37.08
4731	Arrangement Transportation of Freight and Cargo	282	0.17	39.46	8,348	3.38
9621	Regulations and Adm. of Transportation Programs	280	0.16	39.63	9,115	3.07
7997	Membership Sports and Recreation Clubs	274	0.16	39.79	1,696	16.15
8641	Civic, Social, and Fraternal Associations	274	0.16	39.95	14,362	1.91
2086	Bottled and Canned Soft Drinks, Carbonated Waters	261	0.15	40.10	5,037	5.19
5411	Grocery Stores	253	0.15	40.25	8,363	3.03
4724	Travel Agencies	252	0.15	40.40	7,539	3.34
6552	Land Subdividers and Developers,	250	0.15	40.55	9,676	2.58

TABLE 4
TOBIT REGRESSION RESULTS
INDUSTRY PREFERENCE AND GREEN BUILDINGS
FRACTION OF OFFICE SPACE OCCUPIED BY ONE-DIGIT SIC CODE IN EACH BUILDING

	(2 & 3)	(4)	(5)	(6)	(7 & 8)	(9)
Green Rating (1 = yes)	0.030	-4.134	-0.075	-0.478	-0.178	0.730
	[0.028]	[0.000]	[0.028]**	[0.026]**	[0.019]**	[0.030]**
Building Class						
Class A (1 = yes)	0.000	0.135	-0.125	0.041	-0.028	0.105
	[0.041]	[0.061]*	[0.034]**	[0.029]	[0.027]	[0.050]*
Class B (1 = yes)	-0.024	0.109	-0.059	0.029	-0.043	0.108
	[0.031]	[0.043]*	[0.023]**	[0.021]	[0.020]*	[0.040]**
Fraction Occupied	-0.012	0.083	0.106	0.055	0.251	0.031
	[0.076]	[0.106]	[0.060]	[0.052]	[0.051]**	[0.088]
Stories						
High (yes = 1)	0.034	-0.085	-0.152	0.013	-0.029	0.069
	[0.042]	[0.059]	[0.037]**	[0.029]	[0.028]	[0.048]
Intermediate (yes = 1)	0.018	-0.006	-0.095	-0.010	-0.042	-0.029
	[0.029]	[0.040]	[0.024]**	[0.021]	[0.019]*	[0.034]
Age						
< 10 years	0.016	0.014	0.065	0.020	0.071	0.049
	[0.049]	[0.083]	[0.045]	[0.038]	[0.035]*	[0.057]
10 – 20 years	0.026	-0.083	-0.051	0.007	0.009	0.071
	[0.046]	[0.079]	[0.043]	[0.034]	[0.031]	[0.052]
20 – 30 years	-0.052	-0.014	-0.012	0.005	0.020	0.092
	[0.036]	[0.049]	[0.030]	[0.025]	[0.024]	[0.041]*
30 – 40 years	-0.051	-0.005	-0.008	0.033	-0.013	0.012
	[0.038]	[0.051]	[0.032]	[0.026]	[0.025]	[0.043]
Renovated (1 = yes)	0.024	-0.060	-0.013	-0.061	0.016	0.049
	[0.025]	[0.033]	[0.020]	[0.017]**	[0.016]	[0.030]
Building Size	0.038	0.161	-0.180	0.077	-0.030	-0.194
(millions of sq.ft.)	[0.052]	[0.073]*	[0.056]**	[0.038]*	[0.038]	[0.067]**
Constant	-0.424	-0.804	-0.525	-0.220	-0.315	-0.896
	[0.099]**	[0.244]**	[0.095]**	[0.083]**	[0.075]**	[0.110]**
Sample Size	10,462	10,462	10,462	10,462	10,462	10,462
Chi^2	1340.17	1123.84	1363.73	1482.93	1070.80	2104.36
Pseudo R^2	0.26	0.29	0.20	0.16	0.08	0.28

Notes:

Columns correspond to one-digit Standard Industrial Classification (SIC) codes:
(2 & 3) Manufacturing
(4) Transportation, communications, electric, gas, and sanitary services
(5) Retail and wholesale trade
(6) Finance, insurance, and real estate
(7 & 8) Services
(9) Public administration
Each regression also includes 1,180 dummy variables, one for each distinct cluster.
Standard errors are in brackets. Significance at the 0.05 and 0.01 level indicated by *, and **, respectively

TABLE 5
REGRESSION RESULTS
INDUSTRY PREFERENCE AND GREEN BUILDINGS
(DIFFERENCES IN FRACTION OCCUPIED BY SIC IN GREEN BUILDINGS AND NON GREEN BUILDINGS WITHIN THE SAME CLUSTER)

	(0)	(1)	(2 & 3)	(4)	(5)	(6)	(7 & 8)	(9)
Δ Building Age	-0.005	0.000	-0.000	0.000	-0.000	-0.001**	0.000*	0.000
	[0.004]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ Building Quality	0.094	0.004	-0.040**	-0.005	-0.113**	0.029*	0.024	0.003
	[0.187]	[0.028]	[0.015]	[0.019]	[0.017]	[0.012]	[0.012]	[0.016]
Δ Building Size	-0.114	0.020	0.023	0.007	-0.206**	0.178**	-0.122**	0.021
(millions of sq. ft.)	[0.356]	[0.081]	[0.030]	[0.067]	[0.059]	[0.030]	[0.032]	[0.053]
Constant	-1.043	0.356**	-0.521**	-0.815**	-1.146**	-0.537**	-0.279**	-0.191
	[0.531]	[0.048]	[0.047]	[0.081]	[0.101]	[0.036]	[0.059]	[0.100]
Sample Size	49	447	1,231	1,021	1,689	3,307	4,109	1,013
R^2	0.965	0.890	0.848	0.826	0.706	0.697	0.597	0.866
Adj R2	0.880	0.789	0.772	0.728	0.589	0.613	0.504	0.813

Notes:

Columns correspond to one-digit Standard Industrial Classification (SIC) codes:

(0) Agriculture, Fishing and Forestry
(1) Mining and Construction
(2 & 3) Manufacturing
(4) Transportation, communications, electric, gas, and sanitary services
(5) Retail and wholesale trade
(6) Finance, insurance, and real estate
(7 & 8) Services
(9) Public administration

Each regression also includes 1,180 dummy variables, one for each distinct cluster.
Standard errors are in brackets. Significance at the 0.05 and 0.01 level indicated by *, and **, respectively.

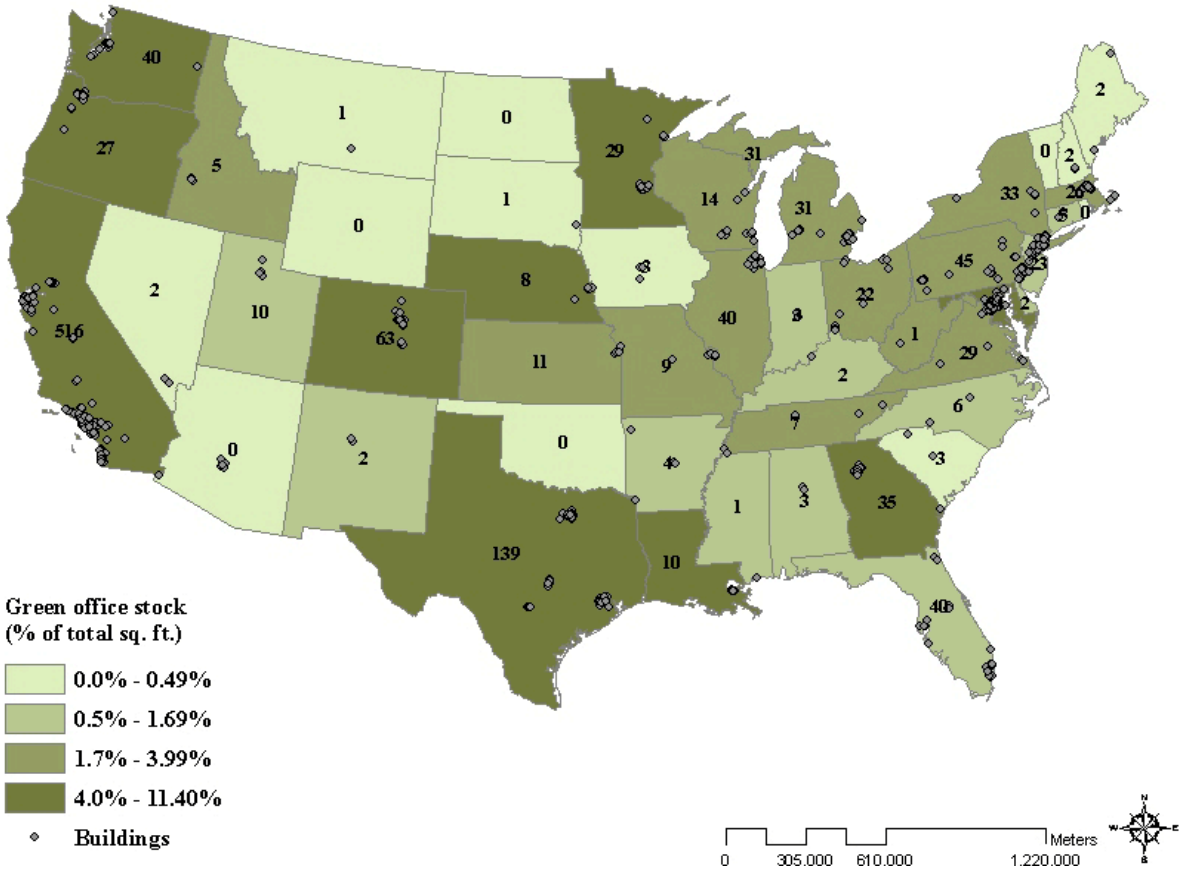
TABLE 6
REGRESSION RESULTS
INDUSTRY PREFERENCE AND GREEN BUILDINGS
(DIFFERENCES IN FRACTION OCCUPIED BY SIC IN GREEN BUILDINGS AND NON GREEN BUILDINGS WITHIN THE SAME CLUSTER)

	(2 & 3)	(4)	(5)	(6)	(7 & 8)
Δ Building Age	-0.000	0.000	-0.000	-0.001**	0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ Building Quality	-0.040**	-0.005	-0.113**	0.029*	0.024
	[0.015]	[0.019]	[0.017]	[0.012]	[0.012]
Δ Building Size	0.023	0.007	-0.206**	0.178**	-0.122**
(millions of sq. ft.)	[0.030]	[0.067]	[0.059]	[0.030]	[0.032]
Employees Per Establishment	0.014**	0.002**	-0.003	0.026**	0.001**
	[0.000]	[0.000]	[0.004]	[0.001]	[0.000]
Number of Establishments	0.152**	0.225**	0.135**	-0.269**	-0.371**
(log)	[0.003]	[0.004]	[0.006]	[0.009]	[0.005]
Sales Per Employee	0.001**	0.001**	0.001**	0.007**	0.080**
(thousands of dollars)	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Payroll Per Employee	0.000**	0.000	0.000**	0.000**	0.000**
(thousands of dollars)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-0.911**	-0.946*	-1.209**	-0.064**	-0.261**
	[0.035]	[0.080]	[0.094]	[0.021]	[0.056]
Sample Size	1,231	1,021	1,689	3,307	4,109
R^2	0.85	0.83	0.71	0.70	0.60
Adj R2	0.77	0.73	0.59	0.61	0.50

Notes:

Columns correspond to one-digit Standard Industrial Classification (SIC) codes:
(2 & 3) Manufacturing
(4) Transportation, communications, electric, gas, and sanitary services
(5) Retail and wholesale trade
(6) Finance, insurance, and real estate
(7 & 8) Services
Each regression also includes 1,180 dummy variables, one for each distinct cluster.
Standard errors are in brackets. Significance at the 0.05 and 0.01 level indicated by *, and **, respectively.

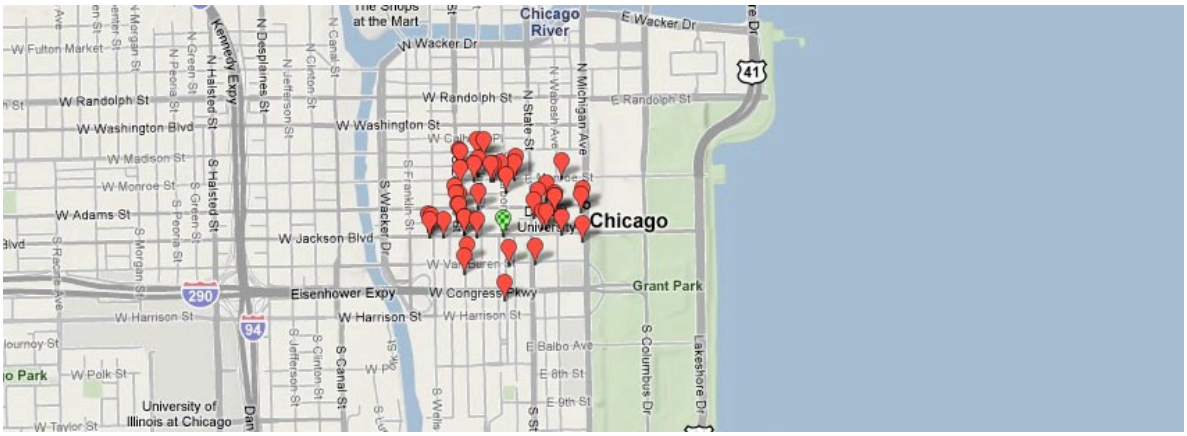
FIGURE 1
DISTRIBUTION OF GREEN OFFICE BUILDINGS BY STATE
(PERCENT OF THE STOCK OF OFFICE SPACE)



Notes: The number of green office buildings in each state is also reported.

FIGURE 2
CLUSTERS OF GREEN AND CONTROL BUILDINGS

A. Chicago, IL



B. Houston, TX

C. Columbus, OH