The Fiscal Return of Green Building Incentives to Local Government: Early Evidence

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Recent trends in commercial building have included a movement towards more environmentally friendly design and construction. The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program is a leader in developing "green" building standards. To encourage environmentally friendly building initiatives, several local and state government programs provide financial incentives for new build and renovation projects receiving LEED certification. This study investigates whether such government programs' incentives add value to building projects in terms of increased property values, in addition to any environmental benefits they may produce, thus providing a direct benefit to property owners and a public benefit in the form of increased property tax revenues. Data for Seattle, Washington, is analyzed using a hedonic model of property values for commercial buildings. Results indicate that properties participating in Seattle's LEED incentive program exhibit significantly higher appraised property values than comparable properties not receiving incentives.

In recent years, increasing attention has been paid to environmental issues and the environmental impact of behavior in both the private and public sectors. From product composition and production to firm management practices to compliance with governmentally enforced as well as self-imposed standards, private firms and public agencies alike are becoming increasingly aware of the environmental consequences of their decisions, and of the salience of these actions in both the market and the political arena. Included among recent environmentally-targeted initiatives is the concept of "Green Building," practices associated with the planning and creation of new structures, and the remodeling and reuse of existing

structures, intended to reduce the negative environmental impact of construction, conserve and protect resources, and encourage environmentally targeted, sustainable development.

Although most compliance with Green Building standards to date has occurred as a result of private firms' perceptions of the individual benefits associated with such practices, a small but growing number of state and local governments have also attempted to encourage Green Building by extending public subsidies to firms employing standardized Green Building techniques, such as those established and certified by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system. Unfortunately, direct evaluation of Green Building to this point has been limited. Investigations have tended to focus on either the difficult to quantify benefit side and the valuation of positive public externalities arising from Green Building[1], or on the cost side through estimations of the increased marginal costs of construction using Green Building techniques as compared to costs associated with traditional methods of building design and construction[2].

However, an examination of the extension of public subsidies for Green Building allows a third, more straightforward question to be addressed: do incentives encouraging the use of Green Building techniques in commercial property construction generate a fiscal return to local government? If such Green techniques produce increased property values, and hence increased property tax revenues, equal to or exceeding the value of the incentives themselves, such a commensurate return would provide strong justification for the public extension of subsides by generating a discrete public return in addition to the private return of increased property values. At the same time, it would also avoid the need to answer the admittedly thorny questions of quantifying the present and future environmental benefits that are quite likely associated with Green Building practices, and whether such benefits can, by themselves, provide sufficient returns to justify public fiscal support for Green Building.

It is exactly this question – whether public incentives promoting commercial Green Building practices generate additional property tax revenues sufficient to offset the value of the incentive – that this paper attempts to address and, at least in part, to answer. Using commercial property appraisal data from the city of Seattle, Washington, combined with information from Seattle Power and Light's LEED incentive program, a hedonic model of commercial property values is estimated using a number of property characteristics, including receipt of a public subsidy through Seattle's LEED program, thus providing an estimate of the return to local government from Seattle's Green Building program.

The next section of this paper sets the context of Green Building in general, discussing the U.S. Green Building Council's LEED standards and rating system, as well as Seattle's LEED incentive program. This is followed by a section that discusses previous studies' estimates of the value of environmental amenities and disamenities through hedonic modeling and the increased value derived from the practice of ecolabeling products, both of which lend support to the expectation that Green Building techniques will be reflected in the appraised value of Green-compliant commercial properties. The fourth section formally states the study's hypothesis and introduces the regression model and data set that will be used to test it. Regression results, which find that LEED certified properties are appraised at higher values than comparable commercial sites, are presented and discussed in the next section, followed by an examination of whether this observed increase in value

for "green built" properties is sufficient to generate a return in property tax receipts equal to the value of the incentives offered under Seattle's LEED program. The last section concludes with the policy implications of the findings, as well as suggesting refinements and expansions for future research.

Background

For most public and private promoters of Green Building, including Seattle Power and Light's LEED Incentive Program, whether a commercial property is considered "built green" is based upon the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Rating System, first published in 2000 and most recently updated with the introduction of 2003's Version 2.1. The LEED Project Checklist assigns up to 69 possible points to developments across six categories – Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process. The LEED certification process itself is intergovernmental in nature – while projects must be identified and submitted for LEED certification by public and/or private actors at the local level, the ultimate determination of whether or not a project qualifies as 'Green Built' and receives certification rests at the national level with the U.S. Green Building Council. Projects must be inspected and graded for compliance with the Project Checklist by an individual trained and certified by the U.S. Green Building Council. Any individual, including both public officials and private developers, is eligible for LEED certification provided that they pass the certification test administered by the USGBC. Local actors then submit project summaries and appropriate documentation to the USGBC, which reviews these materials directly. Developments are assigned a rating level based upon the number of points earned by the project. In order of increasing compliance level, these ratings are: "certified" (26-32 points), "silver" (33-38 points), "gold" (39-51 points), and "platinum" (52-69 points).

In addition, each project must meet a set of required criteria, including minimization of erosion and sedimentation, involvement of a commissioning authority in the design process, compliance with federal and/or local energy efficiency and performance guidelines, reduction of chlorofluorocarbons (CFCs) in heating, ventilation and air conditioning (HVAC) equipment, provision of facilities for the collection and storage of recyclable materials, meeting federal guidelines for minimum indoor air quality, and limiting tobacco smoke within the building's indoor environment.[3] For the checklist's remaining 60 non-mandatory techniques and procedures that can earn projects points toward LEED certification, 59 are associated with the award of one point, with the remaining category (Credit 1, Optimize Energy Performance, under the Energy & Atmosphere grouping) assigned from one to ten points, depending upon the extent of compliance. Several requirements are, however, grouped into what might be termed "blocs," with additional points awarded for reaching successive or cumulative levels of compliance, materials use, and the like.[4] Points are distributed among the six categories in such a manner that certification cannot be achieved without sufficiently reaching benchmarks from *at least* two categories, and that the points required by the highest level of certification cannot be earned without including practices from *at least* four categories. As such, the checklist may be seen to assign roughly equal

weight, and thus equal importance, to all eligible Green Building objectives, and to encourage a fairly broad implementation of techniques intended to produce a range of environmental benefits.

While many of the targets and benchmarks granting points toward LEED certification are explicit and firm, the system also allows for and encourages considerable flexibility on the part of developers in terms of the techniques they may choose to employ in reaching the program's specified objectives. The intent of each credit is clearly presented in the rating system documentation, with both voluntary and prerequisite target descriptions, including suggestions for technologies and strategies that may serve as a starting point for developers' efforts in meeting certification criteria. Design flexibility, creativity, and an understanding of overall LEED goals are also encouraged. To this end, the Project Checklist offers up to four credits for innovative, project-specific design elements to be defined jointly by the Green Building Council's representatives and project design personnel. An additional credit is also extended to developments where one or more design team members have participated in an official LEED certification workshop. In sum, while clear, comprehensive, and requiring the incorporation of Green Building techniques from a number of areas, the LEED rating system also allows for considerable flexibility and initiative in individual projects and from individual developers.

Based upon these standards, the City of Seattle, in conjunction with Seattle City Light and Seattle Public Utilities, has established incentives for the employment of Green Building techniques in private commercial and multifamily housing development through its Seattle Sustainable Building LEED Incentive Program. In order to be eligible for program assistance, projects must be registered with the U.S. Green Building Council and meet the above-mentioned LEED criteria to the extent necessary to receive a minimum rating of "certified." At the local level, developers are required to sign a written agreement with the City of Seattle stipulating the specific Green Building features that will be incorporated in the property. Project developers must also identify all relevant Building Design Decision Participants, including financing partners, architects and design consultants, tenants, and facilities operators and managers and hold meetings with these parties in both the design and development stages to agree upon which Green Building techniques the project will incorporate and the actual design elements and technologies that will be used to implement these features. Extensive project documentation must also be submitted to the City of Seattle's Green Building Team, including LEED evaluation forms, two-year projections of utility and operations costs, and photographic verification.

Projects meeting these requirements and meriting LEED certification at the "certified" level are eligible to receive a minimum program award of $15,000, or a minimum award of $20,000 for projects achieving a higher "silver" level of compliance. Actual awards typically vary from project to project, with incentive amounts in excess of these thresholds negotiated between the city and individual developers and specified in writing based upon the specific green measures used in the project and the extent of any additional LEED compliance and/or certification. The incentive may be used to offset application, documentation, and other costs arising as a result of the LEED certification process, fees for professional environmental assessments of the projects, the coordination of pre and post-design meetings

between Design Decision Participants, or similar uses agreed upon in writing by developers and program officials, but may not be applied towards any hard costs (construction or materials) involved in the project.

Previous Research

Given that the aim of this paper is to investigate whether LEED certification increases the value of commercial property, and hence the tax revenue to local government, to sufficiently offset the direct costs of the incentives extended to encourage those "Green Building" practices, it may first be important to ask whether it is reasonable to expect that LEED certification, or the use of environmentally-conscious technologies and materials that this standard represents, should increase property value *at all*. Basic economic theory suggests two possible sources for an observed increase in a property's value associated with a successful LEED certification. First, the implementation of procedures and practices necessary to receive LEED certification may improve environmental quality for the occupants of the property, reduce upkeep or other variable costs such as utilities due to the use of more efficient "green" technologies, or deliver other positive private environmental benefits.[5] In this instance, the expectation is that such benefits will be capitalized into the property's appraised and/or sale price to reflect the new localized, positive amenity associated with a "green" structure. Simply put, the property will increase in value as a reflection of actual improvements and environmental benefits resulting from activities undertaken to receive LEED certification. Secondly, and independent of whether a "green" building creates any tangible environmental benefit, the ability to operate in an independently certified "green" structure may allow an occupant firm an additional dimension on which to differentiate its products from those of its competitors. Assuming a consumer preference for products produced by an environmentally-conscious firm, the ability to operate in a LEED certified structure provides additional, independently verified information to actual and potential consumers regarding the occupant firm. Such information would allow the firm to distinguish itself from its competitors by what is, in essence, a "branding" behavior that projects an image of environmental consciousness to the market.

Other work to date has not directly addressed the question of whether either of these two potential avenues of value capitalization would be expected to occur as a result of LEED certification. Yet related work concerning the capitalization of negative environmental externalities into property values and the observed influence on consumer behavior of product differentiation on the basis of the environmentally-sensitive production, or "eco-branding," strongly suggest that either or both of the above-mentioned sources of value creation may be expected to pertain in the case of LEED certification. Ihlanfeldt and Taylor's (2004) findings on the effect of small-scale hazardous waste sites on urban property values in Atlanta suggest that environmental externalities can have a substantial impact. In their hedonic modeling of property values for five separate types of land use, with average losses associated with such sites estimated at $54 to $377 million, depending upon land-use type, with a total loss of $1 billion, or ten percent of the appraised value, for all properties within a 1.5 mile radius. Similarly, Gawande and Jenkins-Smith's (2001) work on the effect of shipping nuclear waste in South Carolina on the value of neighboring residential

properties indicated that while property values remained largely unaffected in rural areas, in more densely populated urban areas and locations where waste transport was a visible issue, home values decreased by roughly three percent. Gawande and Jenkins-Smith's study is also notable in that it finds significant effects in a situation where, as the authors themselves note, impacts upon property values may be driven by the public's risk perception, regardless of the accuracy of these evaluations (Gawande and Jenkins-Smith 2001, 230). A similar result concerning the effect of public risk perceptions associated with hazardous waste was found by McCluskey and Rausser (2003). In this case, not only did the authors detect a lag in the appreciation rates of residential property in proximity to hazardous waste sites, but also a slowed readjustment of appreciation rates to equilibrium even after sites had been cleaned up. While these three previous studies dealt with the effect of environmental *dis*amentities, there does not seem to be any reason why one would not expect positive amenities to be reflected in property values in a similar fashion. Indeed, Won Kim, Phipps and Anselin (2003) estimate that the value of reduced air pollution is reflected in the housing market for Seoul, Korea, with a permanent four percent improvement in air quality precipitating an increase in housing value of approximately one and a half percent. In sum, it appears that not only the real effects of environmental externalities may be capitalized into property values, but that property values may also reflect public and market perceptions of the value of these externalities, regardless of whether said perceptions are accurate. Even when externality effects are marginal, difficult to quantify, and may result in a positive public externality as great, if not greater than the value realized by any individual owner (Won Kim, Phipps and Anselin, 2003), non-trivial changes in property value have been found, suggesting that when extended to higher-valued commercial properties, even imperfect capitalization may be expected to produce a significant effect.

Teisl, Roe and Hicks (2002) provide support for the idea that eco-branding can influence consumer decisions in their investigation of the effect of dolphin-safe labeling on the sale of tuna. The authors find that the presence of dolphin-safe labeling on tuna products results in an increase in market share of for all tuna, both products labeled and not labeled as dolphin-safe, of one percent.[6] While consumers did not respond instantaneously to environmental practice information provided by tuna labeling, when the diffusion of information was supplemented by information from official sources, such as policymakers and regulators, increased response rates were observed. "If a significant portion of the consumer population demands environmentally friendly products, the presence of an eco-labeling program may provide firms an incentive to differentiate and market their products along an environmental characteristic(s)," (Teisl, Roe and Hicks 2002, 355-6) a branding strategy that an independently certified asset like a LEED-approved "green" building would also presumably enable firms to pursue.

When taken together, previous work on both environmental externalities' effect on property values and environmental branding on consumer behavior support the expectation that LEED certification may increase that value of the commercial property examined in this study. Whether the value of the certification derives from true positive environmental externalities of "Green Building" practices employed in the property itself, from certification's ability to allow firms to differentiate themselves and their products from their

competitors through eco-branding, or from a combination of the two, one may reasonably expect the value of certification to be capitalized into the property. Whether this expected capitalization is observed to occur in Seattle, and whether any additional value that is created produces additional property tax revenues sufficient to offset the public incentives offered to encourage this behavior, is an empirical question, and one to which the remainder of this paper is devoted.

Data

The data used in this paper come from two sources. The first set of data is a database containing information, including tax-appraised value, for all commercial properties in King County, Washington. The second set of data provides information on building projects, also in King County, Washington, that have received funding from Seattle City Light's LEED incentive program.

The commercial building database is maintained by the King County, Washington, Tax Assessor's Office. These data are updated several times a year and are available for the public to download from the Tax Assessor's website. Property characteristics including address, predominant use, building quality, gross square footage, and other physical characteristics are included. In addition, information on tax-appraised value is included. The land and improvements are appraised separately. Appraised values are included even for properties that are fully or partially tax exempt. Separate taxable values are included to reflect such tax-exempt properties. Therefore, appraised values reflect the Tax Assessor's full valuation of even public buildings that do not pay taxes. The appraised property values were obtained from the King County Tax Assessor in June 2007.

Seattle City Light tracks information on projects that receive funding from their LEED incentive program. These projects are identified by address, project name, and type of project. This information can be matched to the Tax Assessor's database using the address. Also included in this data is the level of LEED certification and the dollar amount of the incentive funding received by or approved for the project. Table 1 provides descriptive statistics for the sample of data used in this paper. The descriptive statistics are divided into two categories, those for convention buildings and those for Green Buildings. Although a total of 23 properties have been approved as of 2007 for incentives under Seattle City Light's LEED incentive program, due to a lack of available data for more recently approved recipients, this study is restricted to consideration of nine such properties for which sufficient data exists. The sample of non-recipient buildings also does not include all buildings in King County; it is a subset of 1004 conventional buildings which are deemed most comparable to the Green Buildings receiving funding from the Seattle City Light incentive program. A key element of any careful policy analysis, and especially those dealing with the evaluation of economic outcomes, is the establishment of the counterfactual situation that would be expected in that absence of any policy intervention. As such, it is appropriate in this instance to compare the growth in appraised value for properties receiving LEED incentives to the growth in value of other Seattle area properties with similar "characteristics that make them likely candidates to be designated" for similar policy treatments (Greenbaum and Engberg, 2004). Specifically, this comparison group of 1004 buildings uses only commercial build-

ings in zip codes which also contain Green Buildings and which additionally display predominant use codes corresponding to the predominant use codes of the nine Green Buildings in the data set, thus ensuring that the growth in value of LEED recipients is compared only to those properties in similar areas and with similar functions.

Through this process of elimination, the total number of over 40,000 commercial buildings in King County is reduced to the sample of 1013 buildings used in this analysis. The mean size of Green Buildings (91,700 square feet) exceeds that of conventional buildings (19,100 square feet). The mean quality of Green Buildings (average score of 5.11) also exceeds that of conventional buildings (average score of 3.97). Both the size and quality of Green Buildings are not as diverse as conventional buildings. The mean appraised value of Green Buildings ($15.2 million) is nearly 12 times that of conventional buildings ($1.29 million).

Methods

We construct a hedonic pricing model for commercial properties to quantify the value that is added when a property is certified as a "Green Building." The model regresses the natural log of a property's appraised value against individual property characteristics such as size (square footage) and quality, a ZIP code fixed effect term intended to proxy for unobservable neighborhood characteristics which may be capitalized into the property's value, and a dummy indicating the property's successful participation in Seattle's LEED certification program. The selection of a hedonic approach, as well as the choice of the other parameters included in the model over alternative variables and specifications, will be discussed at length in the remainder of this section.

The concept of hedonic pricing models was first introduced by Court (1939) in the 1930s for the automobile industry. Hedonic modeling is used to develop pricing schedules for differentiated goods. Differentiated goods are, as the name implies, all different. For instance no two properties sold in the real estate market are exactly like. Even if they are built identically, they each occupy a unique location. Therefore, this violates the assumption that a well functioning market trades identical goods. But this problem can be worked around by recognizing that the price paid is a composite of the prices of the various attributes of the good. It was in the 1970s that Rosen (1974) perfected hedonic modeling techniques for housing markets. The basic structure of a hedonic model is to take the market price for a good (in this case the selling price of a property) as the dependent variable and take all of the characteristics that come together to make the good as the independent variables. The coefficients for the various characteristics are the implicit prices of the variable in question. For real estate markets, the independent variables can be grouped into two categories: the structural characteristics and the neighborhood characteristics. The structural characteristics are a physical description of the property itself, the lot size, the size of the building, the quality of the building, etc. The neighborhood characteristics are the bundle of goods that are purchased along with the physical characteristics. These variables include socio-economic characteristics of people living near the property, public services provided by the jurisdiction where the property is located, and the effect of other objects in the environment. The effects of all of these externalities are capitalized into the price of the property. This makes hedonic modeling a tool for finding prices when there is no well

Table 1. Descriptive Statistics for Convention Buildings and Green Buildings

Descriptive Statistics								
	Conventional Buildings				Green Buildings			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Appraised Improvement Value[a]	129	443	0.1	8,090	1,520	1,840	30	5,260
Building Gross Square Footage[b]	1.91	4.74	0.05	72.41	9.17	10.37	0.38	29.91
Building Quality[c]	3.97	0.81	2	7	5.11	1.69	4	8
N	1004				9			

[a] Measured in $10,000
[b] Measured in 10,000 square feet
[c] Measured on a scale of 1-8

functioning market. It allows us to find the implicit willingness to pay for a variety of policies such as pollution control, criminal justice, and Green Building incentives that are not traded in markets. While there are certain limitations to a hedonic modeling approach, such as issues with generalizability and endogeneity as well as the choice of the proper functional form (see Sirmans, Macpherson, Zietz, 2005, for a discussion on the limitations of hedonic modeling), it remains an effective tool for pricing nonmarket goods. The equation below shows the general form of the model,

$$V_i = \beta_0 + \beta_1 \times P_i + \beta_2 \times L_i + \beta_3 \times G_i + \varepsilon_i$$

where V_i is the natural log of the appraised value of the property, P_i is a vector of physical characteristics, L_i is a vector of locational characteristics, G_i is an indicator variable representing the receipt of a Green Building incentive and ε_i is an error term. The constant term is represented by β_0, β_1 and β_2 are vectors of coefficients on the physical and locational vectors. The coefficient on Green Building incentives is represented by β_3.

The dependent variable in this study is the natural log of the tax-appraised value of the improvements (the buildings) on the property. The total appraised value is not used as information on the size of the lot is not included in the dataset. It is widely recognized that market prices differ from tax appraised values for real property. This can be due to lack of sophistication in the methods used by government agencies to assess property values. The difference can also be attributed to the ability of market prices to change instantaneously, capturing current conditions of the property and consumer tastes at any given time. Tax appraised values can significantly lag the market prices, as properties are typically reassessed only every few years. Problems can also exist in using market prices. A market price can only be determined if a property is actually sold. The volume of sales in large commercial

properties, like those receiving Green Building incentives, can be quite small. With a lack of volume, it is difficult to estimate a model of prices. Because the aim of this paper is to determine if the public costs of the LEED incentive program are recouped in the form of increased property tax revenues, the tax appraised value is appropriate assessment of value to use in this case. The assessed values used for the analysis were accessed at a single point in time. Although some buildings have been reassessed more recently than others, the assessment values present an accurate representation of the tax base for that point in time.

The explanatory variables include a vector of physical characteristics for each property, a vector of locational characteristics, and the variable of interest, an indicator variable denoting properties receiving LEED incentive program funding. The physical characteristics of the buildings used in this study are the size of the building measured by the gross square feet of space, the quality of the building, and the predominant use of the building. Building Quality is determined by the Tax Assessor's Office and is rated on a scale of 1 through 8, with 8 denoting buildings of the highest quality. The sample did not include any properties receiving a building quality value of 1, the scale's lowest ranking of quality. The building quality was included as a continuous variable in the analysis. The predominant use of the buildings in the sample were apartment buildings of different categories, buildings for handling animals, warehouse space, office space, community centers, laboratories, and mixed use spaces. Each type of predominant use was included as a dummy variable in the analysis. By including building quality and predominant use, we are able to better assure that the overall type of building is controlled for in the analysis. Although the age of the structure was available in the data set, it was not included in the analysis. Age of a structure is often included as a variable in a hedonic model as a proxy for the obsolescence of a building. As a building ages, it depreciates. It may be in need of significant updates in terms of both building systems and interior finishes. It becomes more costly to maintain and to operate, especially as compared to buildings using newer technology. As all of the concepts mentioned above (and others) contribute to the quality of a building, the 1 through 8 quality rating was incorporated into the analysis in place of age of the structure. A zip code[7] fixed effects model is used in the analysis to control for unobserved, location specific area or neighborhood characteristics capitalized into the assessed value of buildings which may vary from place to place but which remain constant over time.

Results

An ordinary least squares estimation of the model is used. A robust standard errors correction (a White's standard error correction) is used to address issues of potential heteroskedasticity in the dataset. Results from the analysis are shown in Table 2. The coefficients for the size of the building and the quality of the building are both positive, as would be expected, and significant at the 1% level. For each 10,000 square feet of building size, the appraised value of the building increases by 9.5%. For each building quality point, the appraised value of the building increases by 66.5%. Following the strategy of ecolabeling in other products, it was expected that the coefficient on Green Building incentives would be positive. Indeed, it is. The coefficient for Green Building incentives is positive and significant at the 5% level. Green Building designation results in a 195.8% increase in appraised value for

Table 2. Estimations of ln(Appraised Improvement Value)

ln(Appraised Improvement Value)		
Variables[d]	Coefficients[e]	t
Building Gross Square Footage[f]	0.095***	4.44
Building Quality[g]	0.665***	8.45
Greenbuilding[h]	1.958**	2.39
N	1013	
Adjusted R^2	0.4446	

[d] Predominant use of the building and zip code of building location were also included in the estimation but results are not reported.
[e] ** - significant at the 5% level, *** - significant at the 1% level.
[f] Measured in 10,000 square feet
[g] Measured on a scale of 1-8
[h] Equal to 1 if received an incentive for meeting LEED standards, equal to zero otherwise.

the building. The overall fit of the model, the adjusted R^2, explains 44.46% of the variation in the appraised values of commercial buildings in the sample.

As argued earlier, it would be expected that the appraised value of Green Buildings, both due to decreased operating costs and the popularity of the green movement and ecolabeling, would be higher than the appraised value of conventional buildings. The higher appraised value of Green Buildings translates into a larger property tax base, which in turn, translates into increased revenues for local taxing authorities. The question remains, is this increase in revenues enough to offset the costs of incentive programs that encourage Green Building projects? If so, such programs could point to no cost, or possibly even revenue generating, programs that encourage ecofriendly policy without financial cost to taxpayers.

Calculation of Improvement Values for Sufficient Program Return

This study's hedonic model of appraised property values, presented in the previous section, was able to reject a null hypothesis of implementation of Green Building practices generating no increase in property values, finding instead that properties receiving incentives under Seattle's LEED Incentive Program had a mean appraised value roughly 196 percent higher than comparable commercial properties located in similar areas. While this finding is certainly important in and of itself, it is also important to ask whether this incremental value associated with program participation, and ultimately with LEED certification, produces a public return sufficient to exceed the direct cost of the incentive for the City of Seattle. In order for Seattle's incentive program to be cost effective, the present value of the stream of additional tax revenue resulting from property improvements must, over the life of the property, equal or exceed the present value of the subsidy offered to induce those improvements.

The value of this return can be calculated through a standard present value calculation of

$PV = (TG/r) /[1-1/ (1+r)n]$

using values reflecting 2004 data, where the property tax for the City of Seattle[8] (T) was 0.336% (0.00336), or $3.36 for every $100,000 of appraised property value; r, taken here to be the Bank Prime Loan Rate of the Federal Reserve as of April, 2005, was 5.75% (0.0575); n, the effective life of the improved property,[9] is taken at 30 years; and the present value of the incentive against which the tax revenue generated by the mean project return is assessed is assumed to be the minimum $20,000 amount associated with LEED compliance at the "silver" level.[10] The results of this calculation are presented as Case 1 in Table 3. Thus, Case 1, under the City of Seattle's current municipal tax rate of 0.336%, an interest or discount rate equal to a bank prime loan rate of 5.75%, and assuming a thirty year life for the structural improvements over which tax revenues are expected to be collected, a commercial property certified as "green built" and receiving incentives under Seattle's LEED Incentive Program would be expected, due to its higher appraised value, to generate a stream of additional property tax revenues with a present value of $1,415,500, a return which is significant in both a statistical and practical sense, and which is sufficient to allow the City of Seattle to recoup the full amount of its Green Building program incentive.

In order to test the sensitivity of the value of this estimated tax stream to a variety of assumptions, select variations in the annual property tax rate (T), the discount rate (r), and the duration of the revenue stream, n, were made. While it is possible to examine the full 27 permutations of these three variables, to simplify presentation of these results, Case 1 was compared to two alternatives: a pessimistic return scenario (Case 2) where the Seattle property tax rate was assumed to be 50% of the current rate,[11] the discount rate was assumed to be 9.50%,[12] and the effective life of the property was taken to be 10 years; and an optimistic return scenario (Case 3) where the Seattle city tax rate was taken at 150% of the 2004 value, the discount rate was assumed to be 4.00%, and the project was expected to produce a tax return in perpetuity.[13]

In all three scenarios[14] examined above, a 196% increase in the mean appraised value of a property participating in the LEED Incentive Program would generate a stream of future property tax revenues equaling or exceeding the $20,000 value of the incentive offered by the City of Seattle. Furthermore, when the actual appraised values of participating properties are considered, rather than the mean property value alone, even under the most pessimistic scenario (Case 2), only eleven percent of those Seattle properties actually receiving LEED incentives do not generate a tax revenue stream capable of paying back the city's $20,000 investment. As well, under scenarios reflecting the 2005 City of Seattle property tax rate, discount rate, and a 30 year project lifespan, as well as the scenario depicting the highest tax return (Case 3), all projects currently receiving incentives would realize an increase in appraised value capable of offsetting the value of the initial incentive.

Conclusions

From the results presented above, it appears that Seattle's LEED program does indeed encourage the use of Green Building practices, resulting in statistically significant increases

Table 3. Calculation of Tax Return Generated by LEED Incentive Program Participation Under Various Assumptions

	T (Seattle local tax rate)	**R** (Discount rate)	**n** (No. of years of return)	**Tax Return for 196% Value Increase**[i] (to nearest $100)	**Minimum Project Size for $20,000 Return** ($ million)	**Percent of Sample with Sufficient Return**
Case 1	0.336%	5.75%	30	$1,415,500	0.22	100%
Case 2	0.168%	9.50%	10	$314,300	0.97	89%
Case 3	0.504%	4.00%	∞	$3,753,800	0.08	100%

[i] The column presents the present value for the revenue stream arising from a 196 percent increase in the mean assessed project value of the sample, approximately $15.2 million.

in the appraised values of participating properties relative to similar non-participant sites, and moreover, that the program is capable of paying for itself and generating public financial benefits in the form of additional per-property tax revenue. Even when applied to projects of comparatively modest value and under all but the most unfavorable economic circumstances for the city, the estimated value of this revenue stream is more than sufficient to offset the $20,000 amount of the incentive offered by the City of Seattle.

The contributions of this paper are threefold. First, it presents a theoretical rationale supporting expectations that the use of Green Building techniques will result in the creation of value, either in terms of tangible environmental benefits or through the potential for eco-branding, for owners of commercial property, and that this added value will be capitalized into appraised property values. Second, this paper provides a method for empirically testing this hypothesis using a well-established econometric method, hedonic analysis, the results of which indicate that Seattle commercial properties certified as 'green built' through that city's LEED incentive program display statistically higher appraised property values than comparable properties in the same locations. Third, the paper addresses the question of whether the incremental value associated with LEED incentive receipt is sufficient to produce a stream of additional tax revenue over the life of the project capable of offsetting the $20,000 direct cost of the incentive to the City of Seattle, a question which is answered in the affirmative for all but the most economically pessimistic of cases.

Even when considering these contributions, it is also important to keep in mind that the benefits, both public and private, of LEED certification may not be limited to increased property value and the additional tax revenue which may result. The primary objective of Seattle's Green Building Program is not to create the sort of increment in property value, and the subsequent additional property tax revenue, in which this study is interested. Instead, the program is directly concerned with encouraging practices that are expected to produce value through positive environmental impacts, including materials and resource reuse, energy savings, increased productivity, and the like, which may accrue to both building occupants and the community at large. Although this study elected to ignore benefits of this nature due to difficulties in assigning an appropriate value to these returns, instead focusing on the possibility of the program generating additional, more easily estimated returns through increased property values, the possibility of one type of return is not

contingent upon the presence of the other. Seattle's incentive program may generate substantial environmental benefits whose value is capable of completely justifying the extension of incentives, yet which due to their nature lie beyond the more narrow focus of this paper, and which therefore represent additional value beyond tax returns that is not reflected in this study's findings.

Despite the contributions listed above, the conclusions of this study are nevertheless subject to limitations which must be recognized. First, the dependent variable is the appraised value of the properties rather than their sale value which represents the true market value. However, the assumed high degree of correlation between appraised and sale value of properties in general and the fact that this study is concerned with the tax revenue arising from property improvements, a number based upon the appraised rather than the sale value of the property, the use of appraised property value in this study is an appropriate proxy in the absence of sales prices. Caution must also be taken in extending the results of this study to the use of Green Building incentives to other locations in light of the limited scope of Seattle's incentive program. This program has only been applied to a limited number of properties in a narrow range of uses, raising the possibility that the observed increases in appraised value associated with LEED certification may not be entirely generalizable. Given the high salience of environmental concerns and a concomitantly high demand for environmentally conscious products and behaviors which is typically associated with the Pacific northwest in general, and with Seattle in particular, which has recently been ranked as the city taking environmental sustainability most seriously (Portney, 2002), this may mean that the incentive effects observed in this paper are limited to the current context.

As the above discussion indicates, while this paper provides a framework for analysis of the effects of Green Building incentives on commercial property values as well as an estimation of those effects using Seattle's LEED incentive program that suggests such incentives generate incremental property tax revenues exceeding the value of the incentives offered, further investigation is nevertheless needed in this area. Future research should both investigate whether the present findings associated with Seattle's program can be generalized to other locations where public incentives for the use of Green Building are (or might be) offered, and also attempt to answer the more general question of whether programs offering incentives for the use of Green Building techniques are in the interest of the public sector. While the City of Seattle has discontinued its LEED incentive program as of 2007, given that the present study was able to consider less than half of the 24 projects receiving funds under the program due to lack of post-incentive appraisal data for those sites, as such information becomes available in the future it may be worthwhile to reexamine Seattle's incentive program. A follow-up investigation of this nature would allow this study's conclusions to be reevaluated in the context, and confidence, of a larger and more complete sample. Likewise, the estimation techniques presented above may be extended to other locations, such as the state of Oregon, that offer incentives for commercial properties achieving LEED certification. Given that a wide variety of LEED-compliant properties have been constructed in the absence of public incentives of any sort, it may also be worthwhile to examine whether or not these projects' green practices result in property value appreciation, and if the magnitude of such added value is sufficient to justify the creation of public incentive programs in

those locations. It may also be informative for future studies to address the question of whether differential increases in property value are associated with specific component behaviors undertaken to receive LEED certification, that is, whether the value of a green built property depends on exactly which, or how many, Green Building techniques are incorporated. Finally, the use of Green Building techniques is an issue that is growing in both visibility and popularity, with implementation of environmentally conscious construction standards likely to grow in the future. Pioneers such as Seattle's LEED incentive program may be seen as early adopters and policy innovators, and green construction may increasingly be incorporated into public policy, whether through voluntary incentive programs or codified legal requirements, in other locations as well. With the issue of Green Building moving prominently into the public sphere, it thus becomes even more important that the impact of these policies and programs, not only in terms of net environmental impacts but also their effects upon governments and private property owners, continue to be examined.

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Notes

[1] See, for example, Kats et. al. (2002), which estimates a social benefit of $50/ft2 from the implementation of Green Building practices at the LEED Certified or Silver levels of compliance at a cost premium of only $4/ft2 over the cost of standard building techniques. However, it is also important to note that 70% percent of this benefit arises from estimated increases in occupant productivity and health. It is also important to note that any benefits arising from increases in the appraised value of the property are not considered in the Kats paper.

[2] In addition to the cost premium estimate for Green Building provided by the Kats study, above, Mathiessen and Morris (2004) find no discernable difference in the construction cost of Green buildings versus non-Green properties across a variety of building and use types.

[3] These required criteria correspond, respectively, to the LEED Project Checklist's Sustainable Sites, Prereq. 1: Erosion & Sedimentation Control, Energy & Atmosphere, Prereq. 1-3: Fundamental Building Systems Commissioning, Minimum Energy Performance, and CFC Reduction in HVAC&R Equipment, Materials & Resources, Prereq. 1: Storage & Collection of Recyclables, and Indoor Environmental Quality, Prereq. 1-2: Minimum IAQ Performance and Environmental Tobacco Smoke (ETS) Control.

[4] These are Water Efficiency Credits 3.2 and 3.2 (Water Use Reduction), Energy & Atmosphere Credits 2.1-2.3 (Renewable Energy), Materials & Resources Credits 1.1-1.3 (Building Reuse), 2.1 and 2.2 (Con-

struction Waste Management), 3.1 and 3.2 (Resource Reuse), 4.1 and 4.2 (Recycled Content), 5.1 and 5.2 (Local/Regional Materials), and Indoor Environmental Quality Credits 8.1 and 8.2 (Daylight & Views).

[5] While it is also reasonable to expect that many environmentally friendly procedures undertaken in pursuit of LEED certification may result in a positive public externality for either the immediate neighbors of the commercial property or the community as a whole, such public benefits in excess of those received by the building's occupants or owners are not expected to be capitalized into the property's appraised or sale value.

[6] Competitive food products in the market were considered to be luncheon and deli meats, other seafood, and red meat (Teisl, Roe and Hicks, 2002).

[7] While the use of fixed effects is intended to account for unobserved neighborhood characteristics which may be capitalized into assessed property values, the choice of ZIP codes to approximate such neighborhoods is not without shortcomings. Being a spatial distinction of a purely administrative and/or political nature, the areas covered by ZIP codes may not necessarily follow logical boundaries, especially non-physical ones, which functionally sort the City of Seattle into neighborhoods. However, by the same token, alternate means of defining neighborhoods such as census tracts, while typically smaller, likewise reflect urban subunits of a political and administrative nature which themselves may be equally unlikely to approximate 'true' neighborhoods in either their size or boundaries. Given the ease with which the available data may be linked to ZIP codes, the need to account in some fashion for the impact of unobserved neighborhood characteristics on property values, and the unclear superiority of other readily-available, alternate means of geographically disaggregating the city at a micro level, the authors feel that the advantages of employing ZIP codes to proxy for neighborhoods on the sub-urban level outweigh the drawbacks and assumptions present in their use.

[8] Note that this amount is only the portion of the total property tax accruing to the City of Seattle itself, and does not include increases in the property tax facing the owner of the property as a result of taxes resulting from other sources. The total 2004 property tax burden facing a resident of the City of Seattle arising from all sources is approximately 1.15% of the appraised value.

[9] This is a modified formula for the present value of an annuity, with the substitution of the expression (T * G) for the periodic payment (Pindyck & Rubinfeld, 2005).

[10] Of the 23 total projects approved for Green Building incentives through the Seattle program, 14 received a $20,000 incentive, although several of these properties actually met a higher (gold or platinum) level of compliance with LEED standards. To date, no project has received an incentive in excess of $20,000 through the program.

[11] By comparison to the 2004 tax rates in other Washington state cities, the low comparison rate of 0.168% is lower than the lowest rate observed for any other city (Bellevue, WA, with a rate of 0.186%), and the high comparison rate of 0.504% is higher than the highest rate observed for any other city (Maple Valley, WA, with a rate of 0.360%). Thus, both the high and low estimates of potential property taxes for the City of Seattle presented here are fairly extreme in comparison with the 2004 city property tax rates observed for other Washington cities.

[12] These low and high values for the Bank Prime Loan Rate represent the low and high values, respectively, for this rate over five-year period extending from September, 1999 to April 2005.

[13] In this instance, the formula for the present value of the tax stream reduces to

$$PV = (TG) / r$$

(Pindyck & Rubinfeld, 2005).

[14] For those interested, the additional 24 permutations falling between the extreme values presented above are available from the authors upon request.

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