# The Financial Benefits to Occupants of Environmentally-Certified Buildings

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**August 2016**

**Abstract:**

Much research has been completed on income and valuation premiums to owners and operators of sustainable and energy efficient (SEE) real estate. However, little work examines the business benefit to the space users, outside of decreased operating costs for office uses. Such implications for space users are of great importance, as tenants may be unwilling or unable to pay a rental rate premium for environmentally-certified space if there is not an associated user benefit. As location-specific income data is difficult to obtain, this research utilizes a novel proxy, retail bank branch deposits, to provide the first measures of SEE-space business benefit. Through an examination of deposit growth, it is determined that LEED certified branches are associated with an increased probability of above-market-rate deposit growth, while Energy Star-certified branches also indicates the possibility of above average deposit growth, but with less consistent results. These results are tested in an event study which validates the findings, and further indicates that the benefits of LEED extend years past initial certification, evidencing lasting income-related benefits of LEED certification for space users. Finally, bank-specific subsample analyses confirm these results while controlling for idiosyncratic bank characteristics.

Key words: Real Estate, Energy Efficiency, Sustainability, Certification, Bank Branches, Deposits

JEL Codes: G21, O31, O330, Q55, R32, R34

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We thank Jaclene Begley, Stephen Martin, Philipp Kruger, Andreas Mense, and Lucia Gibilaro for their discussions on this work, as well as the participants of the 2015 AREUEA National Meeting, 2016 Eastern Finance Conference, Baruch College Real Estate Seminar Series, 2016 AFFI Conference, Maastricht University Seminar Series, European Real Estate Society 2016 Conference, and 2016 AREUEA International Conference. Qingqing Chang thanks the Office of the Comptroller of the Currency, and acknowledges that this work is the responsibility of the authors and does not reflect the views of the agency. All remaining errors are our own.

The use of sustainable and energy efficient (hereafter SEE) space by a business is associated with three categories of benefits: real estate, consumer, and business. The first two categories are well-researched, with analysis supporting operational savings and added value to sustainable and energy efficient real estate, and consumers acting on environmentally-conscious decisions. Evidence of the real estate-related income benefits (higher rents, occupancy rates, and asset values; decreased operating variance) to property owners and operators abounds (Eichholtz, Kok, and Quigley, 2010, 2013; Wiley, Benefield, and Johnson, 2010; Kok, McGraw, and Quigley 2011; Ciochetti and McGowan 2010; Fuerst and McAllister 2009; Devine and Kok, 2015). Importantly, Bond and Devine's (2016a) study of multifamily rental properties provides the first indication that environmental certification carries an added rental premium over that experienced by green, non-certified buildings, indicating the effectiveness of the costly certification signal.

Similarly, research has identified a relationship between consumer decisions and SEE. A key to environmental certification's impact is capturing the attention of a business' greatest arbitrator of success: its customers. A 2015 Neilson study found that 66 percent of respondents, and 73 percent of millennial respondents, are willing to pay more for products from companies committed to positive social and environmental impact. This finding represented a notable increase from 50 and 55 percent in 2013 and 2014, respectively (The Nielsen Company, 2015). The marketing literature works to identify the SEE consumer through economic, demographic, and personal value measures related to environmental consciousness (Schlegelmilch, Bohlen and Diamantopoulos 1996, Shrum, McCarty and Lowrey 1995, Mazar and Zhong 2010). Chen (2001) and Crane (2001) examine the relationship between demand growth and environmentally friendly products. Researchers find that in addition to considering prices and quality preferences, consumers reflect their personal values and beliefs (Caruana 2007, Irwin and Baron, 2001) through SEE consumption (Anderson and Cunningham 1972, Kinnear, Taylor and Ahmed, 1974).

However, little work exists examining the third category of benefits: implications of demand drivers on a space user's (business') income. There may be operating expense savings experienced by the tenants (if passed along by the landlords). However, while research provides evidence of water-related cost savings (Kats, 2010), results regarding power usage are mixed or inconclusive (Newsham, Mancini, & Birt, 2009; Scofield, 2009 & 2013), with the greatest evidence instead supporting decreased operating variance (Devine & Kok, 2015; Devine, Steiner, & Yonder, 2016). This is likely due to the greater electricity demands of newer, more high-tech buildings. Therefore, operating expense savings alone are unlikely to be sufficient to offset established rental rate premiums.

Additionally, the lack of business benefit analysis is unsurprising, as it is difficult to obtain firms' location-specific financial statements, allowing for comparison of a business' financial success in SEE-certified versus non-certified space. However, while the data available to complete this research is limited, the demand for such insight is extensive. Tenants and landlords alike want to know if environmental certification provides a financial benefit to the business operating in certified space. This poses the research question: what is the impact of SEE certification on a business' location-specific financial success?

Given the data limitations described above, a retail business format for which relevant data is available was sought. Bank branches proved well-fitted to the question, offering two specific benefits. First, while location-specific retail sales of private firms – a proxy for a location's success – are difficult data to collect, a similar proxy for bank branches is available. A branch's deposits (specifically deposit growth) provide a representation of each physical location's success. Recent research indicates a "return to retail" in U.S. banks (Hirtle and Stiroh, 2007), with evidence that the retail aspect of banking has become a leading area of strategic importance for U.S. banks (Clark et al, 2007). Second, bank branches are a

substantial market, with U.S. deposits totaling $11.25 trillion.[1] Therefore, understanding the impacts of SEE certification on bank branches will provide insight not only into how individual retail locations of any type might benefit from certification, but also into the impact SEE is having on the public's management of 14 percent of total U.S. wealth.

This research enhances both the bank branch efficiency and SEE real estate literature by providing the first look at the business benefits of SEE certification to the space user. Empirical analysis demonstrates that LEED certification is strongly and consistently associated with above average deposit growth. This result holds true both for the time of certification and in lead and lagged years. Energy Star results often return the expected sign, but lack consistency. Bank-specific robustness tests confirm these results while controlling for bank idiosyncratic characteristics. To the best of our knowledge, this is the first time that location-specific business generation (sales) has been evaluated to determine if there is a business benefit to the users of environmentally-certified space. The results have significant implications for the construction and leasing of real estate by addressing the long-standing discussion regarding the merits of certification, this time from the user's point of view.

## Certification Programs

There are two major players in U.S. sustainable certification: the Environmental Protection Agency's (EPA) Energy Star; and, the U.S. Green Building Council's (USGBC) Leadership in Energy and

[1] As of Q2 2016, total deposits for all U.S. banks, from the Federal Reserve H8, available online at: (http://www.federalreserve.gov/releases/h8/current/).

Environmental Design (LEED).[2] There are several other rating programs available and no evidence that Energy Star and LEED are better programs, they are just more widely used and accepted in the U.S.

The Energy Star program was created in the early 1990s by the EPA, and since 1999, the label can be found on new homes and commercial buildings. To earn Energy Star certification, a building must be more energy efficient than 75 percent of similar building nationwide. The program uses third-party Professional Engineers and Registered Architects to verify successful inclusion of energy efficient features in order to qualify for (re)certification. However, the rigor of Energy Star programs has been questioned. In 2008, the EPA Office of the Inspector General released its report on the Energy Star program, finding the program's claims regarding greenhouse gas reductions were inaccurate and based on faulty data, the reported energy savings were unreliable, and that many of the touted benefits could not be verified.[3] In 2007 and 2008 the EPA released reports claiming Energy Star labels were misleading,[4] and in March 2010, a report by the Government Accountability Office stated that the Energy Star program had accepted fifteen of 20 bogus products and four fake businesses submitted for approval.[5] Certification must be sought annually, is relatively inexpensive and quick, and focuses on energy efficiency in operations.

The Leadership in Energy and Environmental Design (LEED) was developed by the U.S. Green Building Council (USGBC) in 1998 and provides a framework for identifying and implementing green building design, construction, operations and maintenance solutions. The first step in pursuing LEED certification is loosely equivalent to meeting the Energy Star requirements, providing a concise comparison of the two

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[2] Most data are taken from each program's respective website: www.energystar.gov and www.usgbc.org.

[3] Environmental News Service, "Energy Star Climate Change Claims Misleading, Audit Finds," Washington, D.C., December 2008. http://www.ens-newswire.com/ens/dec2008/2008-12-31-092.asp

[4] Becker, B., "Why Obama's Energy Savings Estimate May Be Skewed," *The New York Times*, February 6th, 2009. http://www.nytimes.com/2009/02/07/washington/07energy.html?_r=0

[5] United States Government Accountability Office, "Energy Star Program: Covert Testing Shows the Energy Star Program Certification Process Is Vulnerable to Fraud and Abuse" (GAO-10-470), Washington, D.C., March 2010. http://www.gao.gov/new.items/d10470.pdf

certification programs. To meet LEED requirements, a building can meet sustainability requirements in the categories of location and transportation, materials and resources, water efficiency, energy and atmosphere, site sustainability, indoor environmental quality, innovation, and regional priority. Complaints of the LEED programs include its high certification costs (both financial and time), the fact that many of its programs are design tools and not a performance measurement tool, and that is it not yet climate-specific (although the newest version hopes to address this weakness). It has historically been believed that LEED certification may result in increased initial costs, but recent findings indicate that when green strategies are incorporated from the beginning of the planning process, added costs may be avoided. Additionally, as green construction methods and materials become the standard rather than the exception, this construction cost premium is shrinking.[6] LEED certification comes in two categories: design-based (including the popular New Construction program), which is earned during development or redevelopment and retained; and operations based (the Existing Buildings: Operations and Management program), which is valid for a five-year period. Existing Buildings certification programs were piloted in 2002, with the first EB:OM program launched in 2008. LEED New Construction is, by definition, commonly found in newly constructed properties, while LEED EB:OM is more commonly sought in existing buildings, whether they have operated for a few years or several decades. All LEED programs are regularly re-evaluated and refined.

**An Illustration: LEED & PNC Bank**

PNC's success with green building is an exemplar of the SEE research that has been completed in three categories of interest: real estate benefits, business benefits, and consumer preferences. For more than five years, PNC Bank has trumpeted decreased construction budgets, substantial resource savings, and

[6] World Green Building Council, "The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants," 2013. http://www.worldgbc.org/files/8313/6324/2676/Business_Case_For_Green_Building_Report_WEB_2013-03-13.pdf

increased employee satisfaction associated with their LEED-certified bank branches. PNC estimates construction of their LEED branches costs approximately $100,000 less and is completed more than a month faster than comparable traditionally-constructed branches.[7] These branches are operated on one-third less energy and water, and they divert 80 percent of their waste from landfills. Additionally, worker satisfaction is nearly 50 percent higher in the LEED branches than their traditionally-constructed counterparts.[8] Successes in these three SEE categories of interest contribute to the bottom line of a location's financial performance, emphasizing both the property owner/operator's and the space user's interest in the impact of SEE certification.

**Dissemination of Certification Information**

When a SEE certification is earned (or being pursued), no matter the type, building owners and operators make a point of highlighting the achievement broadly. This is part of the retailing sales aspect which has regained importance in U.S. retail banking (Clark et al, 2007; Hirtle and Stiroh, 2007). Media campaigns and press releases announce the registration of new construction projects when they begin seeking certification (for to-be-constructed buildings) and the receipt of certifications upon their acquisition. Subsequently, plaques and banners on the property highlight the achievement for public consumption. An internet search of the terms "LEED" and "PNC Bank" returned 101,000 hits and 99 news stories over the past 12 month period.[9] It is through these efforts that customers will be informed about branch environmental certification, allowing them to incorporate this information into their banking decisions.

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[7] USGBC, 2009. "Practical Strategies in Green Building: Retail," available online: http://www.usgbc.org/sites/default/files/Practical%20Strategies%20in%20Green%20Buildings,%20Retail.pdf
[8] USGBC, 2010. "USGBC Case Study: LEED Volume Program, PNC Financial Services Group, Inc.," available online: http://www.usgbc.org/sites/default/files/CaseStudy_Volume_PNC.pdf
[9] Search completed on July 28, 2016.

Data

Using the SNL database, a complete list of U.S. bank branches active at any point since 2001 is constructed.[10] This list is cleaned to include only branches with at least two consecutive years of operating history through year-end 2013. By institution type, only commercial/retail bank branches are retained, dropping branches associated with investment banks, thrifts, and credit unions. Similarly, by physical type, only "brick and mortar" branches are retained, dropping a variety of non-traditional branch types as well as those situated within other retail establishments and those offering a limited range of service. Lastly, all branches situated in the institution's headquarters are dropped, as the customer drivers (as well as the decision to environmentally certify that branch) are likely to be different from the other branches in the sample. The resulting sample includes approximately 80,000 branches from which we identify SEE-certified properties and appropriate comparable branches.[11]

Through the end of November 2012, there were 14,932 buildings certified under the LEED program in the U.S. Of those, 529 specify a financial aspect to their nature, most frequently indicating office space and branches of banks and credit unions. Additionally, 100 of these observations are marked as confidential, necessitating their exclusion. Similarly, 428 bank branches were certified under the Energy Star program at least once during the 2004 through 2012 year period. After cleaning these observations based on the guidelines used to create the full sample of bank branches, 400 SEE-certified retail bank

[10] SNL Financial (https://www.snl.com) is a source for U.S. banking data, news, and analysis. SNL deposit data is based on yearly filings as reported on the annual summary of deposits for FDIC-insured institutions as of June 30 every year. SNL creates a complete deposit history of a branch by collecting and matching the FDIC data annually, adding geographic coordinates for each branch, and completing a variety of custom error checks. Additionally, SNL monitors company filings, merger news, and government sources every day, and completes real-time proforma market share updates to the database.

[11] Branches include both rented and owned space. As this research examines the impact on the "sales" activity of space users, the tenancy format is unimportant. Additionally, bank branches are one of the leading users of retail space, and their location decisions are consistent with that of any major retailer, selecting a location based on retail success factors such as agglomeration of other retail uses, regardless of if the branch is freestanding or attached. Lastly, contrary to previous concerns that online business was putting brick and mortar retail out of business, it has been found that the two formats successfully co-exist, as physical locations focus on the in-person shopping experience and benefits (Trefis Team 2015).

branches are identified: 221 LEED certified branches, 183 Energy Star certified branches, and four branches certified under both programs. Dummy variables capture the different SEE certification statuses of a branch. These are defined in a variety of manners, estimating both the impact of and timeframe over which different certification programs impact deposit growth.

Branches generally maintain their environmental certification once it is acquired. As described in the Certification Programs section, most LEED certifications are earned during a design and construction period and are perpetual. LEED Existing Buildings certifications are valid for a period of five years at a time, but the full program was launched in 2008, providing few scenarios to-date in which certification would have lapsed. Energy Star certification must be earned annually, allowing for more opportunities of certification lapse. Certification status is tracked on an annual basis, allowing for branch-level variation due to certification of an existing (traditional) branch or lapse of certification (and perhaps recertification).

*(Insert Figure 1 here)*

Figure 1 highlights the location of the SEE-certified branches using a heat map. While there is a heavy concentration of SEE bank branches in the coastal areas, the property type has permeated the country. Notably, there is an intense presence of these branches in the Midwest. The 400 SEE-certified branches are situated in 118 metropolitan statistical areas (MSAs), with LEED branches present in 63 MSAs and Energy Star branches present in 81 MSAs. Since the goal is to compare the certified branches in a market to their traditional counterparts, only MSAs with at least 100 total branch-year observations (approximately ten branches over the ten-year period) and two SEE-certified branch observations are considered. This results in 57 MSAs, each with between 22 and 5,345 total branches and between two and 42 SEE-certified branches.

Year-over-year percentage change in total branch deposits is used to measure the impact of SEE certification on the financial success of a branch. In order to mitigate any undue influence of outliers, deposit growth is winsorized at the 1% and 99% tails. Branches which opened or closed during a year are not included due to inability to measure percent change in deposits. These subgroups of branches are quite small, at their peak comprising two and three percent of the total branches in a year, respectively.[12] Figure 2 shows the average year-over-year deposit growth change for each of the 57 MSAs considered in this study. This indicates that each MSA experiences its own idiosyncratic deposit activity, with the one major systemic event being the financial crisis of the late 2000s. Annual nominal deposit change scales from a 4.8 percent loss to a 35 percent gain, with the majority of results reflecting five to fifteen percent growth.[13] Given the uniqueness of MSA markets, all analyses incorporate MSA fixed effects (as well as year and bank fixed effects).

*(Insert Figure 2 here)*

Research has shown that understanding branch operation efficiency requires far more than simple accounting ratio analysis (Sherman and Gold, 1985; Berger and Mester, 1997). Evidence suggests the importance of also examining bank size and other characteristics, market characteristics, and geographic impacts. Therefore, to isolate the impact of SEE certification on deposit growth, a variety of controls are included in the model. These controls are separated into four categories: bank and branch characteristics; macroeconomic variables; green characteristics; and, rate and return variables.

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[12] Other definitions of near-closure were tested (98 percent deposit loss, 95 percent deposit loss, etc.) with little change shown in the resulting analysis. Given this limited representation in the sample (less than one percent of the total sample), the impact of survivorship bias should not be a concern.

[13] While historically bank branches were used for everyday transactions, currently physical bank branches are most commonly used in the establishment and modification of a banking relationship, not its maintenance. Therefore, the role of direct deposit and other repeated transactions (such as bill pay) should not significantly impact deposit growth. The establishment of a direct deposit process will impact deposit growth, but the annual increases to the direct deposits will be offset by inflation and increased cost of living (captured through bill pay).

*Bank and Branch Characteristics* - Since bank and branch characteristics may impact deposit activity, controls are included for the bank's total assets to capture the deposit growth due to differences between the banks' economics of scale, and the bank's total asset growth is included to capture the bank's overall operating success. Controls are also included for the branch's age, and the bank's branch intensity (number of branches), both within the county and within the MSA. These bank features effect how present the bank is in the market, both in terms of how long they have been present and how accessible they are to customers, both of which may impact a branch's success. Analysis is completed at this level, as people operate on a regional scale. Therefore, the regional network of branches may impact deposits. All of this data is obtained from the SNL database.

*Macroeconomic Variables* - Market-related economic and regional aspects may also impact a branch's deposit growth (Cohen and Kaufman, 1965). Controls are included for MSA-level job growth and population growth, both taken from the Bureau of Economic Analysis. Dummy variables are included to capture the effect of small markets (defined as MSAs with populations under 450,000), which may impact the size and strength of the branch network.[14] In addition to controlling for comparative differences in these features from one bank branch to another, these macroeconomic variables will control for changes in deposits caused by increased population and bank switches.

Notably, changes and levels of per capita income, the unemployment rate, wages and salaries, the poverty rate, and GDP were tested and found uninformative (as were interactions of a variety of macroeconomic variables). Additionally, controls for the distribution and change in percent of households by age group were included, which could impact deposits in two ways. First, younger households generally have less in savings while older households (especially those nearing retirement) are more focused on savings and

[14] A dummy variable was tested for large markets as well (defined as markets with populations in excess of 4 million). This variable proved uninformative across the analyses, likely due to high correlation between large markets and other control variables.

deposits. Second, younger households – particularly those in Generation Y – are shown to be more motivated by sustainability (Torres 2010), and may therefore be more interested in banking with a SEE branch. Despite extensive modeling, results related to these controls were found uninformative.

*Green Characteristics* - The impact of consumers demanding SEE products may create a local environmental ideology that would lead firms to invest in SEE real estate to capture a corporate image benefit. If this occurs at an above average level, it could increase an area's likelihood to support the construction and patronage of environmentally-certified bank branches (without impacting deposit growth otherwise). This propensity to be green is captured through two types of variables. First, Walk Score (a number from 1 to 100) measures the density and walkability of a location. This has been found to be highly correlated with green properties, as people seeking sustainable lifestyles often do so through seeking walkability (Devine and Kok, 2015).

The second variable set is a measure of electric and ethanol (E85) fueling stations. These clean fuel stations are counterparts to gas stations and provide different clean fuel options (electric car charging stations, ethanol, etc.). The instrument relationship is that a clean fuel station will only be operated where it is demanded. Since people usually refuel their automobiles near their homes, a clean fuel station is a strong proxy for the local presence of alternative fuel vehicles. Alternative fuel vehicles are an already-accepted proxy for green ideology in the sustainability literature (Kahn & Vaughn, 2009; Bond & Devine, 2016b). The U.S Department of Energy provides a continuously-updated database of every clean fuel station in the U.S. Clean fuel stations permeate the country, generally following the overall population distribution, with

electric stations common on the east and west coasts and ethanol stations common in the Midwest.[15]

*Rate and Return Variables* - Lastly, interest rate and return variables are included, as deposit growth is directly impacted by the market risk, interest rate risk, and the terms of other investment vehicles. Controls for the credit spread (Moody's Baa rates less Moody's Aaa rates), the market yield on one-year and 20-year U.S Treasury securities, and the volatility of the S&P 500 (VIX) are included.[16]

*(Insert Table 1 here)*

A complete list of variable names, definitions, and summary statistics is included in Table 1. Panel B highlights the mean and standard deviations for several variables used in the analysis. The average year-over-year deposit growth for non-certified branches is twelve percent, and the deposit growth associated with any LEED certification (and the LEED New Construction subsample) is 30 percent. However, the average deposit growth for Energy Star certified branches is only four percent, well below the non-certified average and a fraction of that experienced by LEED certified branches. It should be noted that Energy Star branches experience the least variance in deposit growth.

Other notable relationships include larger branch networks associated with non-green branches than with green-certified branches (at both the county and MSA level), indicating that green certification could be being used by new entrant or smaller institutions. This could be as a way to distinguish the subject branch from the larger-network competitors. Additionally, Energy Star branches are associated with the

[15] For more information, see Bond and Devine, 2016b

[16] It is important to consider all of these rate variables, as they reflect different types of risk to which depositors may be responding. Credit spread and VIX may reflect an investor's choice between investment and saving, but for different reasons - increased credit risk does not necessarily lead to market uncertainty, nor is it the only source of market uncertainty. Additionally, long-term bond rates are market-determined, as the market reflects on short-term rates and expected inflation. Therefore, despite the fact that some of the information in these rates is offsetting other rate information, to exclude any of these rate variables would be inappropriate. Interest rate swaps, the 3-month T-bill, the 10-year bonds, and LIBOR were tested and found to not provide additional information.

largest banks (and those with the smallest asset growth, an unsurprising paired result), and are more commonly situated in small markets. Energy Star branches are also positioned in the "greenest" areas, having both the highest Walk Score and the most local electric charging stations. Taken together, LEED branches tend to be situated in markets similar to the non-certified branches, while Energy Star-certified branches appear in uniquely different areas.

A correlation analysis (results suppressed to conserve space) indicated only weak relationships existing between the utilized variables. All the dependent and the treatment variables are less than five percent correlated with all variables. Aside from related variables (such as interest rates), the correlations amongst all control variables are quite small, indicating low probability of multicollinearity issues.

Branch age distribution also differs quite a bit by subsample, as seen in Figure 3. Uncertified branches are generally evenly distributed across the vintage categories, while LEED-certified branches are overwhelmingly newer construction. However, remarkably few Energy Star-certified branches are new construction, with more than 70 percent of observations being of branches over 20 years old.[17]

*(Insert Figure 3 here)*

**Methodology**

The effect of SEE certification on bank branch growth is assessed through analysis of probit models. These models analyze the impact of SEE certification on the likelihood that branch-specific deposit growth will be higher than the MSA average annually. The sample used in the analysis consists of all commercial/retail "brick and mortar" bank branches in the United States that were active anytime between 2002 and 2013. Coarsened Exact Matching is utilized to cluster SEE branches with appropriate

[17] The LEED New Construction program may be associated with a long-existing branch for two reasons: 1) the program is available to substantial renovation projects; and, 2) certification is by building, so an existing branch could have been resituated into a new building following construction.

comparables and, along with fixed effects, separates returns associated with time, bank, and location from returns associated with a specific branch.

Coarsened Exact Matching (CEM) is utilized in order to effectively match the SEE certified branches and their comparables, therefore largely eliminate the endogenous effect in the models. CEM is a monotonic imbalance reducing matching method developed by Iacus, King, and Porro (2011). CEM differs from propensity score matching in that CEM allows for the balance between the control and treatment groups to be selected ex ante rather than determined through trial and error of model estimations. CEM is completed in three steps. First, the data is coarsened by discretizing the variables to build a multi-dimensional histogram. Then, if a cell does not contain at least one control and treatment observation each, all observations in that cell are discarded. For the remaining cells, weights are created. Each treatment observation is assigned a weight of one, and each control observation a weight of $Treatment_i/Control_i$ (a weighted weight).

CEM has several advantages over other matching procedures. The process guarantees common empirical support without requiring specific data restrictions, and adjustment of one variable's imbalance does not affect the maximum imbalance on other variables. Additionally, the results are robust to measurement error and the process is highly transparent. CEM has outperformed other matching methods in Monte Carlo tests (Iacus, King and Porro, 2012).[18] Matching is based on MSA, year, bank total assets, and bank total asset growth, and is completed for each definition of certification examined.[19] All models (excepting base cases) are run on matched samples.

[18] Following the Diamond and Sekhon (2005) method, Iacus, King, and Porro (2012) completes 5,000 Monte Carlo replications. CEM, propensity score matching, nearest neighbor Mahalanobis matching, and genetic matching results are compared in terms of bias, standard deviation, and root mean square error. CEM dominates all three evaluation categories.

[19] CEM matching was executed utilizing a variety of criteria sets and interpretations, and the differences of the results were minimal.

Probit equations are evaluated relating the probability of year-over-year deposit growth to green certification (the variable of interest) and a variety of control variables. The probit model is of the form:

$$y_{it}^{*} = \beta_1 + \beta_2 X_{it} + \beta_3 g_{it} + \varepsilon_{it,}\ y_{it} = \begin{cases} 1 \ \ if\ y_{it}^{*} > \tau \\ 0 \ \ if\ y_{it}^{*} \leq \tau \end{cases},\ t = 2002, \ldots, 2012 \qquad \text{(Equation 1)}$$

In Equation 1, $y_{it}^{*}$ is the propensity for a branch to have an annual deposit growth larger than the sample's MSA mean, and $\tau$ is the average annual deposit growth for all sample branches in each MSA, evaluated annually.[20] $X_{it}$ is a vector of the bank and branch-specific characteristics, macroeconomic variables, green characteristics, rate and return variables, and other relevant variables, including controls for branch age and census division. The variable of interest, $g_{it}$, is a dummy variable with a value of 1 if property *i* is certified under a SEE program, and zero otherwise. Similar versions of the equation are estimated using different versions of the treatment variable as well. All β, are estimated coefficients and $\varepsilon_{it}$ is an error term.

SEE-certified branches tend to appear in some MSAs more than others, and tend to be built in more recent years. Additionally, some banks may differentiate themselves in unique way. To address such factors, MSA, year, and firm (bank) fixed effects are employed, and three-dimensional clustered standard errors (in the style of Petersen, 2009) are calculated to allow for heteroscedasticity and within-group correlation.

[20] Analysis was also completed using different "cutoffs" on deposit growth (for example: the probability that deposit growth exceeded nine percent, fifteen percent, etc.). Certification-related results were highly consistent across different model definitions.

Results

Equation 1 is estimated to determine the impact SEE certification has on the probability that a bank branch will increase its deposits at a rate greater than the annual MSA average. A variety of variables are used to control for the geographic, institutional, economic, and financial market characteristics which may also impact deposit growth rates, and CEM matching is utilized to ensure the comparison of similar branches.[21] The strength of the following findings is notable, given the rigor of this model, which is subject to matching as well as MSA, year, and firm fixed effects. Table 2 provides the results in which the dummy treatment variable captures the deposit growth effect of the LEED and Energy Star certification programs. Throughout these models, the branch age controls and rate and return variables prove consistently informative, as do many other control variables.[22] Results indicate the consistent importance of bank size (measured in total assets) and branch network strength in shaping deposit growth. Of note is the unimportance of the institution's total asset growth in relation to the branch's deposit growth – a finding which persists throughout all analyses. While this asset and liability relationship is not being evaluated on the same level (institutional asset growth against branch deposit growth), the disconnect still raises interesting questions for future research, particularly given the consistent economic and statistical significance of institutional-level total assets in relation to branch deposit changes.

*(Insert Table 2 here)*

In Column 1, the two certification programs are examined concurrently. The loading on the LEED treatment variable is 0.255 and has a p-value of 0.000, indicating that if a bank branch is LEED certified,

[21] When an equation is modeled to evaluate a specific certification program, all branch observations certified under a different program are suppressed from the sample. Therefore, comparisons are strictly between the program of interest and non-certified branches. When multiple certification programs are examined in the sample model estimation, the full sample is used.

[22] All equations in Tables 2 - 5 were tested for the impact of interaction variables involving the variables of interest and total asset growth, Walk Score, and the two clean fuel station variables. These variables added no explanatory power to the results.

there is a twelve percent increase in the probability that its year-over-year deposit growth rate will be greater than the annual MSA market average. The loading on the Energy Star treatment variable reflects similar statistical strength, but less than half the economic strength of LEED certification, with a marginal impact of five percent. Of note here is the dramatic difference in the economic impact between the programs, with LEED results proving much stronger. This indicates that, while both SEE certification programs may be associated with a higher probability of above average deposit growth, LEED certification provides more than twice the relative increased likelihood. Therefore, if a space user is considering the probability that SEE certified space will increase their income, they would be advised to seek LEED certified space over Energy Star.

Columns 2 through 4 represent the same equation, this time evaluating the impact of each certification program individually. Column 2 indicates that, when examined alone, the Energy Star certification result loses its statistical significance. However, the significance persists for the LEED-only model evaluation (Column 3), with the LEED treatment variable returning findings similar to those highlighted in Column 1 (strong statistical significance, eleven percent marginal increase). Finally, a subsample analysis of the Column 3 estimation is completed for LEED New Construction-certified branches alone.[23] Here too the statistical significance persists, although the economic strength is slightly less, indicating an eight percent increase in the probability that a bank branch with LEED New Construction certification will experience deposit growth in excess of the MSA's annual mean.

While Table 2 compares environmentally-certified branches to comparable non-certified branches, in reality some banks are highly unlikely to pursue green certification. Such investments fall outside the scope of their strategy or interest. Therefore, if green certification matters to a customer, that customer will not consider such a bank in their depository relationship decision process. To account for this, the

[23] A specification for LEED EB:OM is not estimated due to sample size limitations.

analyses completed in Table 2 are recalculated, this time limiting the sample to only banks which have, at some point during the sample period, operated at least one environmentally-certified branch. This sample restriction serves as a proxy for identifying "green banks." Analysis of this subsample also allows the opportunity to compare the branches without the use of matching (thereby increasing our sample size, despite the subsample analysis), while still retaining the strong rigor of MSA, year, and firm fixed effects. Results are presented in Table 3.

*(Insert Table 3 here)*

The estimations in Table 3 mirror those in Table 2. In these unmatched samples, the control variable results are extremely consistent across the estimations, with strong economic importance tied to population growth (or, more specifically, population loss). It is important to evaluate these loadings within the context of models incorporating MSA and year (as well as firm) fixed effects. As with the estimations from Table 2, bank size and network strength, as well as market size, remain important drivers of deposit growth, along with branch age and interest rate controls.

Column 1 concurrently evaluates the impact of both Energy Star and LEED certification, again finding economically and statistically strong results. In this unmatched analysis, the two programs indicate smaller marginal impacts of four and five percent, respectively. Individual certification program analysis (Columns 2 through 4) all retain the expected sign and magnitude of marginal impact, but contrary to the Table 2 results, this time it is the LEED results which lose some statistical strength (yet still remaining significant at the ten percent level of analysis). LEED New Construction results prove statistically insignificant. Therefore, when comparing only banks which have, at some point, made a commitment to green branching, the depository growth benefit of certification persists, yet is smaller than when compared to all bank branches. This is logical: all of the banks in this subsample benefit from the

corporate image impact of green branching, so the added benefit of a green branch is decreased. However, the location-specific added benefit of greening a specific branch still persists.

**Event Analysis**

In many cases, certification occurs when a branch is initially opened. However, this is not always the case, and our sample does not include the first year of a new branch by definition (as deposit growth would not be measurable).[24] Frequent alternate scenarios include SEE certification of the operation of an existing branch (Energy Star and LEED Existing Buildings Operation and Management), and the certification of a new building to house an existing branch (LEED New Construction). While the results from Tables 2 and 3 indicate that SEE certification does impact deposit growth, the next logical question is: how long does that impact last?

To examine this question, an event study is completed, in the format of Equation 1. Table 4 presents the probit results for equations modeling the impact of the news of environmental certification (one year prior to certification), the certification event, and two years of lagged certification impact.[25] These event variables are framed to measure the probability that a branch's deposit growth will outstrip the sample average growth rate for each MSA-year. Full sample results incorporating CEM matching are presented in Columns 1 and 2, and green bank sample results without matching are presented in Columns 3 and 4; all models incorporate year, MSA, and firm fixed effects and clustered standard errors. Columns 1 and 3 analyze the impact of LEED, and Columns 2 and 4 capture the impact of Energy Star certification.

[24] The question of the relationship between certification and a new branch effect was examined. At its peak, LEED New Construction only comprised two percent of the total new branches in a year, indicating a very low correlation between the two measures. Additionally, a control for total new branches was tested in the Table 2 and 3 regressions and never proved statistically significant.

[25] An announcement effect one year prior to the opening of an environmentally-certified branch is not unlikely, particularly in the cases of new construction and LEED certification. Real estate construction is a drawn-out process, and a bank will market the future branch location throughout the construction process, particularly at the site of the new location. Such marketing campaigns would include references to any environmental certification being sought in conjunction with that site.

Energy Star certification is completed quickly, and the resulting certification status is often not known prior to pursuing certification, so there is no lead variable. Additionally, Energy Star certification must be reestablished annually, so only one year of lagged effect is measured.

*(Insert Table 4 here)*

Both Columns 1 and 3 in Table 4 indicate an announcement effect for LEED certification, as well as statistically and economically significant impacts in the event and lagged years. Column 1 marginal effects scale from a thirteen to fifteen percent increase in the probability of above-market deposit growth for LEED-certified bank branches in evaluated years. Both the statistical and economic strength is less in the green banks, unmatched sample (Column 3), but still indicate marginal effects of five to seven percent in each year of the event study. This indicates that LEED certification is a powerful tool in increasing branch deposit growth. Not only does the LEED certification event increase deposits above the market rate, but the higher rate of deposits continues well after newness of the certification has passed. Therefore, customers are interested in permanently aligning their business with a branch that supports SEE principles, indicating long-term income benefits for SEE certified space users. Since the financial benefit associated with LEED certification is ongoing, rather than a short-term benefit, paying higher rents or purchase prices for SEE certified space is justifiable to space users.

The Energy Star event analyses (Columns 2 and 4) are less convincing. Results are largely statistically insignificant, with the only statistically significant finding associated with the one year lag for the green banks sample. This result indicates a seven percent marginal impact of Energy Star certification. While this relationship is neither as strong nor as consistent as that seen for LEED, there is evidence of a lagged benefit to Energy Star certification.

**Robustness Test: Bank-Specific Analysis**

Despite the controls included in the analysis, it is possible that bank-specific differences are driving the deposit growth. Brand loyalty, product offerings (both financial and technical), and incentive programs may encourage a consumer to select a specific bank. To test for this, subsample analyses are completed on three banks. Each of these three banks has a number of environmentally-certified branches in addition to traditionally-constructed branches, and has been operating these green branches for a number of years. By examining only deposit change activity within these individual bank subsamples, the analysis controls for the idiosyncratic aspects of a bank, even more strongly than through bank fixed effects. Customers of these branches receive the same pricing, products, and promotions, whether they elect to deposit their funds with an environmentally-certified or traditional branch.

Table 5 provides highlights of this analysis. Panel A details the branching breakdown for each of the three banks studied. All three have been operating environmentally-certified branches for at least three years. While the percent of certified branches in each sample scales from four to fourteen percent, the number of green branches is notable, scaling from 39 to 110.[26] Bank B only possesses Energy Star-certified branches, and Bank A possesses a very small number of LEED-certified branches in addition to a collection of Energy Star-certified branches. Bank C possesses a predominance of LEED-certified branches, but also a number of Energy Star-certified branches. Based on this, an Energy Star-focused analysis is completed on all three banks (Panel B), with further LEED-focused analysis completed for Bank C (Panel C).

*(Insert Table 5 here)*

[26] These represent only the branches that remain in the sample after data cleaning. See the Data section for further information.

Panel B provides weak results regarding Energy Star certification, both in terms of significance and expected sign. Only Bank A experienced a statistically significant increase in the probability of above-average deposit growth associated with the year following Energy Star certification (Panel B, Column 1), with the balance of the results insignificant. Panel C indicates the Bank C experiences stronger results with its LEED-certified branches than its Energy Star-certified ones. Column 1 shows LEED certification is associated with a four percent increase in the probability that the branch's year-over-year deposit growth rate will be greater than Bank C's annual MSA-specific market average. Event study analysis of the LEED program indicates statistically stronger results in the year of certification and the first year following, with positive marginal impacts of seven and six percent, respectively.

Therefore, when presented with the exact same suite of products, pricing, and promotions at a specific bank, evidence indicates customers are electing to deposit their money with the environmentally-certified branch. There are limitations to the interpretation of these results due to sample size and statistical strength. However these results support the underlying story: when faced with the exact same bank, one traditionally-constructed and one environmentally-certified, a customer elects to place their money with the latter.

**Discussion**

One of the most popular debates in SEE real estate is over added value. While environmental benefit is certainly its own important goal, investing in "green" must result in a company being in the black to encourage a commitment to SEE. In order to fully understand the impact of environmental certification on real estate, the financial benefit to the space user must also be considered. Without benefit to the leasee's business, tenants may be unwilling or unable to continue paying the higher rents commanded by SEE properties.

This analysis reveals what matters in shaping deposit growth, and what does not. Throughout the analyses, bank network and size (measured in total assets) and branch age all prove consistently important. Along with these, the only other variables which return consistently significant results, after controlling for bank, MSA, and year fixed effects, are environmental certification variables. While the results related to Energy Star certification are not nearly as strong (both economically and statistically) as those of LEED certification, environmental certification is consistently associated with a deposit growth premium over traditional branches, and is never associated with a statistically strong below-average deposit growth rate.

On the contrary, total asset growth proves insignificant in its relationship to deposit growth. As total asset growth can be interpreted as a bank's business development, there appears to be little relationship between a branch's business strategies to grow its loan base, and its ability to grow the deposits required to support such loans. Instead, a bank would be better served by focusing its efforts on seeking and maintaining SEE certification in order to attract customer funds and grow the deposits necessary to support an increase in total assets.

Also proving unimportant is a market's propensity to be green. Variables capturing an increased probability that a SEE branch would be more demanded by the local consumers prove consistently insignificant. This shows that the strong impact SEE certification has on deposit growth can be anticipated in both "green-minded" and traditional areas, indicating pursuit of SEE certification may be a good idea in any market.

Conclusion

Property owners and users seek evidence that pursuing SEE principles and certification will result in a net-positive outcome. In order to understand the impact of SEE certification on real estate, analysis must happen at a sub-rental rate level – looking to the space user's financial benefit from the SEE space. Without added financial benefit for the tenant's business, it may be unrealistic to anticipate their willingness and ability to pay higher rent.

PNC was an early adopter of the LEED program with more than 100 LEED-certified branches in their portfolio, and has clearly stated the financial and quality of life benefits they experience with their SEE-certified bank branches. Several other major retail banks have also adopted green construction and operation practices regarding their building stock. Today there are hundreds of SEE-certified retail bank branches in the U.S. Combined with the availability of branch-level deposits data (providing a glimpse at a retailer's location-specific success), this makes the examination of bank branches a unique opportunity to measure the impact of SEE certification on a space user's financial success with consumers.

The findings of the four completed bank branch analyses (Tables 2-5) are highly consistent. Results indicate that LEED certification is associated with a twelve percent increased probability that a branch will outperform the market in terms of deposit growth (Table 2, Columns 1, 3, and 4), and that these results persist when solely compared to branches of banks that have committed to environmentally-sensitive branches (Table 3, Columns 1, 3, and 4). Additionally, within the context of the SEE certification event, LEED proves a strong signal to consumers, creating statistically significant increases in the probability of above-market deposit growth rates both at the time of the certification event and in the preceding and following years (Table 4, Columns 1 and 3). This indicates an announcement effect of seeking certification as well as an increased probability of long-term above-average deposit growth,

making LEED certification an investment with expected positive payback not just at the time of certification, but also in the future operations of the branch.

Energy Star certification results offered some economic and statistical strength, not but at the levels experienced by LEED certified branches. Finally, a bank-specific subsample analysis allowed for control of idiosyncratic bank characteristics such as pricing, products, and promotions, and results support earlier findings (Table 5, Panels B & C): customers are electing to place their money with environmentally-certified branches, particularly in the case of LEED certification.

Greater deposits are not a strict match to traditional retail sales or a business' income. However, it is an aspect on which consumers select a retail outlet, of which they have many options. This is particularly true in the U.S., where consumers have numerous choices of where to bank. Environmental certification of branches is one way for a bank to differentiate itself from its competitors based on a characteristic which matters to the public. When more consumers select a SEE-certified bank branch for their deposits, the bank can translate those increased funds into more loans, which provide their income source.

Based on the summary statistics (Table 2, Panel B), LEED-certified branches are appearing in markets comparable to those of traditionally-constructed branches, and then increasing their deposits far in excess of those comparable branches. Energy Star branches are appearing in smaller markets which have a higher propensity to be green, yet these branches are performing at the market average. Altogether this analysis indicates that green certification is a worthy pursuit, as it will not hurt a business' income, and that LEED certification may provide increased income for the SEE certified space user, making the leasing and purchase of environmentally-certified real estate a valid and appealing option.

**References**


Anderson, W. & Cunningham, W. (1972). The socially conscious consumer. *The Journal of Marketing*. 36 (3): 23-31.

Berger, A. and Mester, L., 1997. Inside the black box: What explains differences in the efficiencies of financial institutions? *Journal of Banking and Finance*, 21(7): 895-947.

Bond, S. and Devine, A., 2016a. Certification Matters: Is Green Talk is Cheap Talk? *Journal of Real Estate Finance and Economics*, 52(2): 117-140.

Bond, S. and Devine, A., 2016b. Incentivizing Green Single-Family Construction: Identifying Effective Government Policies and Their Features. *Journal of Real Estate Finance and Economics*, 52(4): 383-407.

Caruana, R., 2007. A sociological perspective of consumption morality. *Journal of Consumer Behavior*, 6: 287-304.

Chen, C., 2001. Design for the environment: A quality-based model for green product development. *Management Science*, 47: 250-263.

Ciochetti B. and McGowan, M., 2010. Energy Efficiency Improvements: Do they Pay? *Journal of Sustainable Real Estate*, 2 (1):305-333.

Clark, T., Dick, A., Hirtle, B., Stiroh, K., and Williams, R., 2007. The Role of Retail Banking in the U.S. Banking Industry: Risk, Return, and Industry Structure. *FRBNY Economic Policy Review*, 13(3): 39-56.

Cohen, B and Kaufman, G, 1965. Factors determining bank deposit growth by state: an empirical analysis. *The Journal of Finance*, 20(1):59-70.

Crane, A., 2001. Unpacking the ethical product. *Journal of Business Ethics*, 30: 361-373.

Devine, A. and Kok, N., 2015. Green Certification and Building Performance: Implications for Tangibles and Intangibles. *Journal of Portfolio Management*, 41(6): 151-163.

Devine, A., Steiner, E., and Yonder, E., 2016. Decomposing the Value Effects of Sustainable Investment. Working Paper.

Diamond, A. and Sekhon, S., 2005. Genetic Matching for Estimating Causal Effects: A General Multivariate Matching Method for Achieving Balance in Observational Studies *The Review of Economics and Statistics*, 95(3): 932-945.

Ecofys, 2003. Cost Effective Climate Protection in the EI Building Stock. Report for EURIMA. Ecofys: The Netherlands.

Eichholtz, P., Kok, N., and Quigley, J., 2010. Doing Well by Doing Good: Green Office Buildings. *American Economic Review*, 100:2494-2511.

Eichholtz, P., Kok, N., and Quigley, J., 2013. The Economics of Green Building. *The Review of Economics and Statistics*, 95(1): 50-63.

Fuerst, F. and McAllister, P., 2009. An Investigation of the Effect of Eco-Labeling on Office Occupancy Rates, *Journal of Sustainable Real Estate*, 1 (1):49-64.

Hirtle, B. and Stiroh, K., 2007. The return to retail and the performance of US banks. *Journal of Banking & Finance*, 31(4): 1101-1133.

Iacus, S., King, G., and Porro, G., 2011. Multivariate Matching Methods That are Monotonic Imbalance Bounding. *Journal of the American Statistical Association*, 493:345-361.

Iacus, S., King, G., and Porro, G., 2012. Causal Inference Without Balance Checking: Coarsened Exact Matching. *Political Analysis*, 20(1): 1-24.

Irwin, J. and Baron, H., 2001. Response mode effects and moral values. *Organizational Behavior and Human Decision Processes*, 84: 177-197.

Kats, Greg. 2010. *Greening Our Built World: Costs, Benefits, and Strategies.* Washington, DC: Island Press.

Kahn, M. and Vaughn, R., 2009. Green Market Geography: The Spatial Clustering of Hybrid Vehicles and LEED Registered Buildings. *B.E. Journal of Economic Analysis & Policy: Contribution to Economic Analysis & Policy*, 9(2): 1-22.

Kinnear, T., Taylor, J. and Ahmed, S., 1974. Ecologically concerned consumers: Who are they? *The Journal of Marketing*, 38 (2): 20-24.

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

Mazar, N. and Zhong, C., 2010. Do Green Products Make Up Better People? *Psychological Science*, 21 (4): 494-498.

Newsham, Guy, Sandra Mancini, and Benjamin Birt. 2009. "Do LEED-certified buildings save energy? Yes, but..." *Energy and Buildings* 41(8): 897-905.

Nielsen Company, The, 2015. "The Sustainability Imperative: New Insights on Consumer Expectations." October 2015. Retrieved from: http://www.nielsen.com/content/dam/corporate/us/en/reports-downloads/2015-reports/global-sustainability-report-oct-2015.pdf.

Petersen, M., 2009. Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. *Review of Financial Studies*, 2009(22):435-480.

Schlegelmilch, B., Bohlen, G. and Diamantopoulos, A., 1996. The link between green purchasing decisions and measures of environmental consciousness. *European Journal of Marketing*, 30 (5): 35-55.

Scofield, John. 2009. "Do LEED-certified buildings save energy? Not really..." *Energy and Buildings* 41(12): 1386-1390.

Scofield, John. 2013. "Efficacy of LEED-certification in reducing energy consumption and greenhouse gas emission for large New York City office buildings." *Energy and Buildings* 67: 517-524.

Sherman, H. and Gold, F., 1985. Bank branch operating efficiency: Evaluation with Data Envelopment Analysis. *Journal of Banking and Finance*, 9(2): 297-315.

Shrum, L., McCarty, J. and Lowrey, T., 1995. Buyer characteristics of the green consumer and their implications for advertising. *Journal of Advertising*, 24 (2): 71-82.

Torres, B., 2010. Why Gen Y delays homebuying, *San Francisco Business Times*. Retrieved from: http://www.bizjournals.com/sanfrancisco/blog/2010/06/why_gen_y_delays_homebuying.html?page=all.

Trefis Team. (2015, October 15). Three Ways Brick-and-Mortar Stores Are Closing In On Online Retailers. *Forbes*, Retrieved from: http://www.forbes.com/sites/greatspeculations/2015/10/15/three-ways-brick-and-mortar-stores-are-closing-in-on-online-retailers/

Wiley, J., Benefield, J., and Johnson, K., 2010. Green Design and the Market for Commercial Office Space. *Journal of Real Estate Finance and Economics*, 41 (2): 228-243.

## Table 1: Variable Names, Definitions, and Summary Statistics

Panel A: Variable Names and Definitions

Following is a list of all variables used in the analysis and a brief definition. All growth variables are year-over-year (YOY). For further information on variables, see the Data section.

| Name | Definition |
|---|---|
| **Dependent Variable** | |
| *Deposit Growth* | Year-over-year change in total branch deposits: (branch deposits$_t$ – branch deposits$_{t-1}$)/branch deposits$_{t-1}$ |
| **Certification Variables** | |
| *LEED* | Dummy: 1 when a branch is LEED certified (any program), 0 otherwise |
| *LEED NC* | Dummy: 1 when a branch is LEED New Construction certified, 0 otherwise |
| *Energy Star* | Dummy: 1 when a branch is Energy Star certified, 0 otherwise |
| *GREEN Lead* | Set of Dummy variables: 1 when a branch is certified under a specified program in the following year, 0 otherwise |
| *GREEN Event* | Set of Dummy variables: 1 when a branch is certified under a specified program in that year, 0 otherwise |
| *GREEN Lag* | Set of Dummy variables: 1 when a branch is certified under a specified program in the previous year(s), 0 otherwise (used for both 1st and 2nd year lags) |
| **Bank/Branch Characteristics** | |
| *Ln(Total Assets)* | Natural Log of Bank's total assets, scaled by 100 |
| *Total Asset Growth* | Year-over-year change in total bank assets: (bank's total assets$_t$ – bank's total assets$_{t-1}$)/bank's total assets$_{ti1}$, scaled by 100 |
| *Branches in MSA* | Total number of a bank's branches in the subject's MSA, standardized |
| *Branches in County* | Total number of a bank's branches in the subject's county, standardized |
| *Age* | Set of Dummy variables: 1 when a branch's age is (<5; 6-10; 11-15; 16-20; 21-30; 31-40; 41-50; 51-75; 76-100; >100), 0 otherwise |
| **Green Characteristics** | |
| *Ln(ELE)* | Natural Log of Total Public Electric filling stations, by county |
| *Ln(E85)* | Natural Log of Total Public Ethanol 85 filling stations, by county |
| *Walk Score* | Walkability rating from 1 to 100 (most walkable), as of November 2015, standardized |
| **Macroeconomic Variables** | |
| *Job Growth* | Wage & salary employment growth by MSA |
| *Population Growth* | Population growth by MSA |
| *Small Market* | Dummy: 1 when MSA population < 450,000, 0 otherwise |
| **Rate & Return Variables** | |
| *Credit Spread* | Moody's Baa rates – Moody's Aaa rates |
| *Treasury Bond Yield – 1 Year* | Market yield on U.S. Treasury securities at 1-year constant maturity |
| *Treasury Bond Yield – 20 Years* | Market yield on U.S. Treasury securities at 20-year constant maturity |
| *VIX* | Volatility of the S&P 500 |

## Table 1: Variable Names, Definitions, and Summary Statistics (continued)

Panel B: Summary Statistics

Following are the mean and standard deviation (in parentheses) for select variables used in the analysis. *Non-Green* and *Green* combined create the full (matched) sample. *Green* is further subdivided into *Energy Star* and *LEED*, and information for the *LEED New Construction* subsample is also provided. Statistics are based on untransformed data except where noted below.

| | Non-Green | Green | Energy Star | LEED | LEED NC |
|---|---|---|---|---|---|
| Observations | 72,246 | 880 | 414 | 466 | 355 |
| **Dependent Variable** | | | | | |
| *Deposit Growth* | 0.12 (5.23) | 0.18 (0.50) | 0.04 (0.16) | 0.30 (0.64) | 0.30 (0.61) |
| **Bank/Branch Characteristics** | | | | | |
| *Total Assets (in billions)* | 36.3 (53.9) | 45.2 (50.4) | 57.4 (56.0) | 34.2 (41.8) | 29.1 (35.5) |
| *Total Asset Growth* | 0.15 (1.00) | 0.11 (0.21) | 0.06 (0.10) | 0.16 (0.27) | 0.18 (0.29) |
| *Branches in County* | 34 (39) | 30 (31) | 30 (32) | 29 (31) | 27 (29) |
| *Branches in MSA* | 160 (236) | 115 (122) | 92 (139) | 135 (99) | 137 (96) |
| **Green Characteristics** | | | | | |
| *Total E85 Stations* | 3.7 (5.7) | 2.6 (4.3) | 2.3 (3.4) | 2.8 (5.0) | 2.0 (4.0) |
| *Total Electric Stations* | 15.4 (34.0) | 19.3 (40.1) | 29.5 (50.6) | 10.2 (24.3) | 4.8 (14.0) |
| *Walk Score* | 64.8 (21.5) | 64.8 (23.9) | 73.9 (20.2) | 56.7 (24.1) | 47.4 (17.8) |
| **Macroeconomic Variables** | | | | | |
| *Job Growth* | 0.00 (0.02) | 0.00 (0.02) | 0.00 (0.03) | 0.00 (0.02) | 0.00 (0.02) |
| *Population Growth* | 0.01 (0.01) | 0.01 (0.01) | 0.01 (0.01) | 0.01 (0.01) | 0.01 (0.01) |
| *Small Market (D)* | 0.02 (0.13) | 0.06 (0.24) | 0.11 (0.31) | 0.02 (0.14) | 0.03 (0.17) |

**Table 2: Probit Results, Pr[Deposit Growth > Annual MSA Average]**

The following table details the coefficient results for probit regressions. In each of these equations the dependent variable is a dummy variable equal to 1 if the year-over-year (YOY) change in deposits at the branch level increased in excess of that year's MSA mean deposit growth, and equal to zero otherwise. Each of the treatment dummy (D) variables equals 1 if the branch is certified under the specified program during a given year, and 0 otherwise. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level of analysis.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Energy Star (D)* | 0.255*** | 0.196 | | |
| | (0.099) | (0.127) | | |
| *LEED (D)* | 0.575*** | | 0.557*** | |
| | (0.093) | | (0.104) | |
| *LEED NC (D)* | | | | 0.388*** |
| | | | | (0.137) |
| *Ln(Total Assets)* | 0.016*** | 0.023*** | 0.009*** | 0.025*** |
| | (0.003) | (0.004) | (0.003) | (0.006) |
| *Total Asset Growth* | -0.001 | 0.020* | 0.001 | -0.015 |
| | (0.006) | (0.011) | (0.006) | (0.017) |
| *Branches in MSA* | 0.065*** | 0.109*** | 0.135*** | 0.168*** |
| | (0.007) | (0.011) | (0.014) | (0.020) |
| *Branches in County* | -0.005 | -0.011 | -0.025 | -0.101*** |
| | (0.012) | (0.015) | (0.017) | (0.028) |
| *Job Growth* | 3.271 | 54.608 | -89.657*** | -277.600 |
| | (13.655) | (68.617) | (8.170) | (360.400) |
| *Population Growth* | -116.100* | 1017.500* | 76.948*** | 289.600 |
| | (61.921) | (558.800) | (10.129) | (412.100) |
| *Small Market (D)* | 3.142*** | -18.683* | 0.311*** | 68.930 |
| | (0.762) | (10.543) | (0.087) | (64.869) |
| *Ln(ELE)* | 0.019** | 0.016 | 0.023** | 0.038** |
| | (0.009) | (0.012) | (0.010) | (0.015) |
| *Ln(E85)* | -0.014 | -0.042*** | -0.013 | 0.002 |
| | (0.009) | (0.013) | (0.010) | (0.017) |
| *Walk Score* | -0.005 | -0.002 | 0.001 | 0.008 |
| | (0.006) | (0.008) | (0.006) | (0.010) |
| *Intercept* | 2.758* | 2.283 | -5.268*** | 13.699 |
| | (1.413) | (3.490) | (1.576) | (19.134) |
| **Census Division Controls** | Yes | Yes | Yes | Yes |
| **Interest Rate Controls** | Yes | Yes | Yes | Yes |
| **Branch Age Controls** | Yes | Yes | Yes | Yes |
| **Year, MSA, & Firm Fixed Effects** | Yes | Yes | Yes | Yes |
| **CEM Weights** | Yes | Yes | Yes | Yes |
| **Observations** | 72,166 | 38,581 | 56,037 | 23,606 |
| **Rescaled R^2** | 0.14 | 0.12 | 0.14 | 0.18 |

**Table 3: Probit Results, Pr[Deposit Growth > Annual MSA Average], Green Banks Only**

The following table details the coefficient results for probit regressions. In each of these equations the dependent variable is a dummy variable equal to 1 if the year-over-year (YOY) change in deposits at the branch level increased in excess of that year's MSA mean deposit growth, and equal to zero otherwise. This subsample represents only banks which operated at least one green branch at some point during the sample period. Each of the treatment dummy (D) variables equals 1 if the branch is certified under the specified program during a given year, and 0 otherwise. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level of analysis.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Energy Star (D)* | 0.185** | 0.269*** | | |
| | (0.095) | (0.103) | | |
| *LEED (D)* | 0.282*** | | 0.183* | |
| | (0.090) | | (0.094) | |
| *LEED NC (D)* | | | | 0.120 |
| | | | | (0.100) |
| *Ln(Total Assets)* | 0.029*** | 0.028*** | 0.029*** | 0.029*** |
| | (0.005) | (0.005) | (0.005) | (0.005) |
| *Total Asset Growth* | -0.033 | -0.029 | -0.031 | -0.029 |
| | (0.028) | (0.028) | (0.028) | (0.028) |
| *Branches in MSA* | 0.050*** | 0.050*** | 0.050*** | 0.050*** |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| *Branches in County* | -0.014** | -0.014** | -0.014* | -0.014** |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| *Job Growth* | -3.225 | -3.517 | -3.226 | -3.477 |
| | (2.525) | (2.528) | (2.529) | (2.529) |
| *Population Growth* | -15.479*** | -15.295*** | -15.625*** | -15.395*** |
| | (2.593) | (2.596) | (2.597) | (2.597) |
| *Small Market (D)* | 0.365*** | 0.365*** | 0.365*** | 0.366*** |
| | (0.071) | (0.071) | (0.071) | (0.071) |
| *Ln(ELE)* | 0.003 | 0.004 | 0.002 | 0.003 |
| | (0.008) | (0.008) | (0.008) | (0.008) |
| *Ln(E85)* | -0.015 | -0.016 | -0.016 | -0.016 |
| | (0.010) | (0.010) | (0.010) | (0.010) |
| *Walk Score* | -0.006 | -0.006 | -0.005 | -0.006 |
| | (0.006) | (0.006) | (0.006) | (0.006) |
| *Intercept* | 1.682*** | 1.739*** | 1.698*** | 1.729*** |
| | (0.302) | (0.303) | (0.303) | (0.303) |
| **Census Division Controls** | Yes | Yes | Yes | Yes |
| **Interest Rate Controls** | Yes | Yes | Yes | Yes |
| **Branch Age Controls** | Yes | Yes | Yes | Yes |
| **Year, MSA, & Firm Fixed Effects** | Yes | Yes | Yes | Yes |
| **CEM Weights** | No | No | No | No |
| **Observations** | 89,009 | 88,560 | 88,589 | 88,489 |
| **Rescaled R^2** | 0.19 | 0.19 | 0.19 | 0.19 |

**Table 4: Probit Event Results, Pr[Deposit Growth > Annual MSA Average]**

The following table details the coefficient results for probit regressions in an event study framework. In each of these equations the dependent variable is a dummy variable equal to 1 if the year-over-year (YOY) change in deposits at the branch level increased in excess of that year's MSA mean deposit growth, and equal to zero otherwise. In Columns 1 and 2, the full sample is used, while in Columns 3 and 4, the sample represents only banks which operated at least one green branch at some point during the sample period. Each of the treatment dummy (D) variables equals 1 if the branch is certified under the specified program during a given year, and 0 otherwise. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level of analysis.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Full Sample | | Green Banks Sample | |
| ***Definition of GREEN*** | **LEED** | **Energy Star** | **LEED** | **Energy Star** |
| *GREEN Lead – 1 Year Prior(D)* | 0.689*** | | 0.329* | |
| | (0.211) | | (0.176) | |
| *GREEN Event (D)* | 0.745*** | 0.026 | 0.382** | -0.027 |
| | (0.148) | (0.138) | (0.151) | (0.130) |
| *GREEN Lag – 1st Year After (D)* | 0.697*** | 0.264 | 0.270* | 0.376** |
| | (0.143) | (0.166) | (0.143) | (0.157) |
| *GREEN Lag – 2nd Year After (D)* | 0.659*** | | 0.322* | |
| | (0.164) | | (0.164) | |
| *Ln(Total Assets)* | 0.009*** | 0.023*** | 0.029*** | 0.028*** |
| | (0.003) | (0.004) | (0.005) | (0.005) |
| *Total Asset Growth* | 0.001 | 0.020* | -0.031 | -0.029 |
| | (0.006) | (0.011) | (0.028) | (0.028) |
| *Branches in MSA* | 0.135*** | 0.109*** | 0.050*** | 0.050*** |
| | (0.014) | (0.011) | (0.007) | (0.007) |
| *Branches in County* | -0.025 | -0.011 | -0.013* | -0.015** |
| | (0.017) | (0.015) | (0.007) | (0.007) |
| *Job Growth* | -89.711*** | 54.561 | -3.203 | -3.527 |
| | (8.171) | (68.642) | (2.529) | (2.528) |
| *Population Growth* | 76.967*** | 1014.900* | -15.657*** | -15.299*** |
| | (10.128) | (559.000) | (2.597) | (2.596) |
| *Small Market (D)* | 0.312*** | -18.633* | 0.364*** | 0.366*** |
| | (0.087) | (10.547) | (0.071) | (0.071) |
| *Ln(ELE)* | 0.022** | 0.016 | 0.002 | 0.004 |
| | (0.010) | (0.012) | (0.008) | (0.008) |
| *Ln(E85)* | -0.013 | -0.042*** | -0.016 | -0.016 |
| | (0.010) | (0.013) | (0.010) | (0.010) |
| *Walk Score* | 0.000 | -0.002 | -0.006 | -0.006 |
| | (0.006) | (0.008) | (0.006) | (0.006) |
| *Intercept* | -5.280*** | 2.264 | 1.695*** | 1.741*** |
| | (1.575) | (3.491) | (0.303) | (0.303) |
| **Census Division Controls** | Yes | Yes | Yes | Yes |
| **Interest Rate Controls** | Yes | Yes | Yes | Yes |
| **Branch Age Controls** | Yes | Yes | Yes | Yes |
| **Year, MSA, & Firm Fixed Effects** | Yes | Yes | Yes | Yes |
| **CEM Weights** | Yes | Yes | No | No |
| **Observations** | 56,037 | 38,581 | 88,589 | 88,560 |
| **Rescaled R^2** | .14 | .12 | .19 | .19 |

## Table 5: Bank-Specific Analysis

The following table highlights key results of the robustness tests on individual bank analysis. Panel A identifies the three banks studied, and the breakdown of their environmentally-certified branching as a portion of their total branching (excluding those branches removed from the sample based on data cleaning – see the Data section for details). Panel B highlights the Energy Star coefficient results for probit regressions in both a full (bank-specific) sample analysis and an event study framework. Panel C highlights the same type of results for Bank C for LEED and LEED & Energy Star analysis. In each equation, the dependent variable is a dummy variable equal to 1 if the year-over-year (YOY) change in deposits at the branch level increased in excess of that year's MSA mean deposit growth for that bank, and equal to zero otherwise. Each of the treatment dummy (D) variables equals 1 if the branch is certified under the specified program during a given year, and 0 otherwise. All equations are unmatched, include year and MSA fixed effects, incorporate all control variables utilized in the other analyses, and utilize clustered standard errors. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level of analysis.

Panel A: Bank Branch Breakdown

| | **Bank A** | **Bank B** | **Bank C** |
|---|---|---|---|
| Years with Certified Branches | 2008-2012 | 2009-2012 | 2005-2012 |
| **Total Branches, 2012** | 789 | 356 | 1,700 |
| LEED Certified | 4 (0.5%) | 0 (0%) | 74 (4.4%) |
| Energy Star Certified | 35 (4.4%) | 51 (14.3%) | 36 (2.1%) |
| Uncertified | 750 (95.0%) | 305(85.7%) | 1,590 (93.5%) |

Panel B: Probit Energy Star Highlighted Results

| | **(1)** | **(2)** | **(3)** |
|---|---|---|---|
| | **Bank A** | **Bank B** | **Bank C** |
| Bank-Specific Model | | | |
| *Energy Star (D)* | 0.378 | 0.315 | -0.494 |
| | (0.317) | (0.233) | (0.543) |
| **Observations** | **6,980** | **13,275** | **14,462** |
| **Adjusted R^2** | **0.19** | **0.27** | **0.16** |
| Event Model | | | |
| *Energy Star Event (D)* | 0.197 | -0.017 | -0.459 |
| | (0.315) | (0.269) | (0.537) |
| *Energy Star Lag – 1st Year After (D)* | 0.640** | 0.370 | -0.150 |
| | (0.294) | (0.330) | (0.755) |
| **Observations** | **6,980** | **3,275** | **14,462** |
| **Adjusted R^2** | **0.19** | **0.27** | **0.16** |

**Table 5: Bank-Specific Analysis (continued)**

Panel C: Bank C, LEED Probit Highlighted Results

| | (1)<br>Bank C |
|---|---|
| Bank-Specific Model | |
| *LEED (D)* | 0.248* |
| | (0.149) |
| **Observations** | **14,705** |
| **Adjusted R^2** | **0.16** |
| | |
| Event Model | |
| *LEED Lead - 1 Year* | 0.218 |
| | (0.240) |
| *LEED Event* | 0.453** |
| | (0.205) |
| *LEED Lag - 1 Year* | 0.373** |
| | (0.189) |
| *LEED Lag - 2 Years* | 0.182 |
| | (0.214) |
| **Observations** | **14,705** |
| **Adjusted R^2** | **0.16** |

**Figure 1: Environmentally-Certified Bank Branch Heat Map**

The following heat map notes the locations of all Energy Star and/or LEED certified full-service retail bank branches in the U.S.

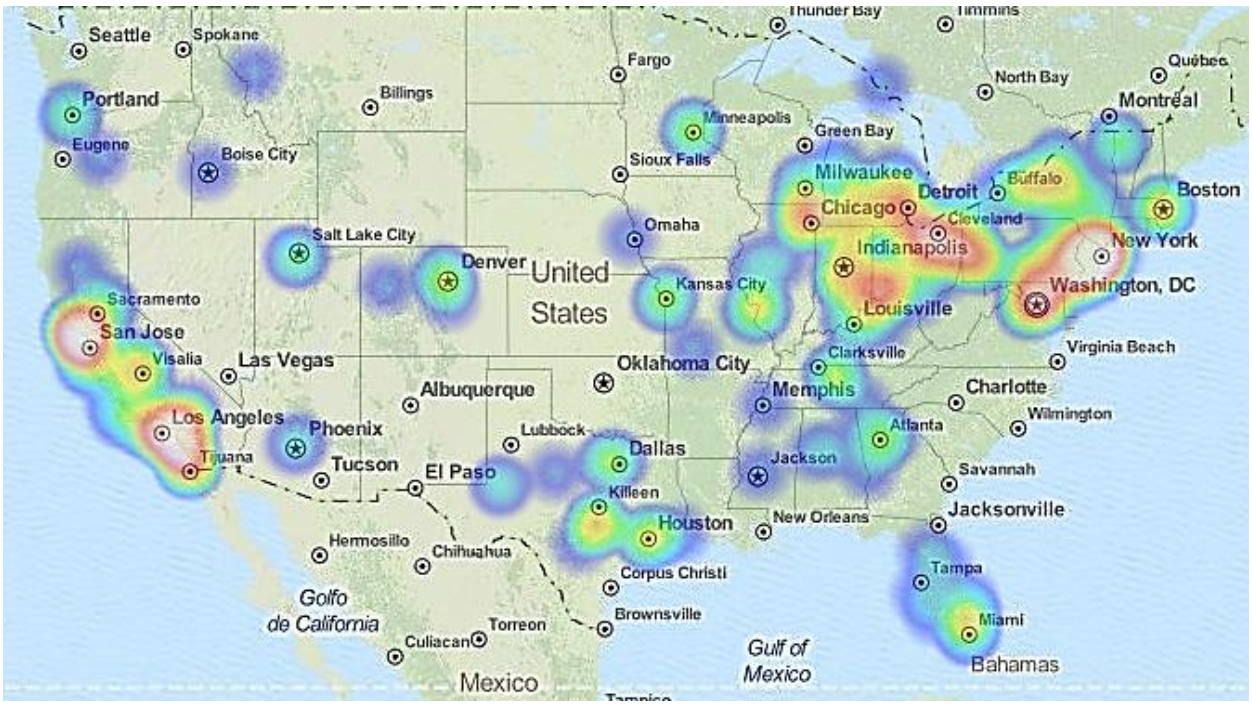
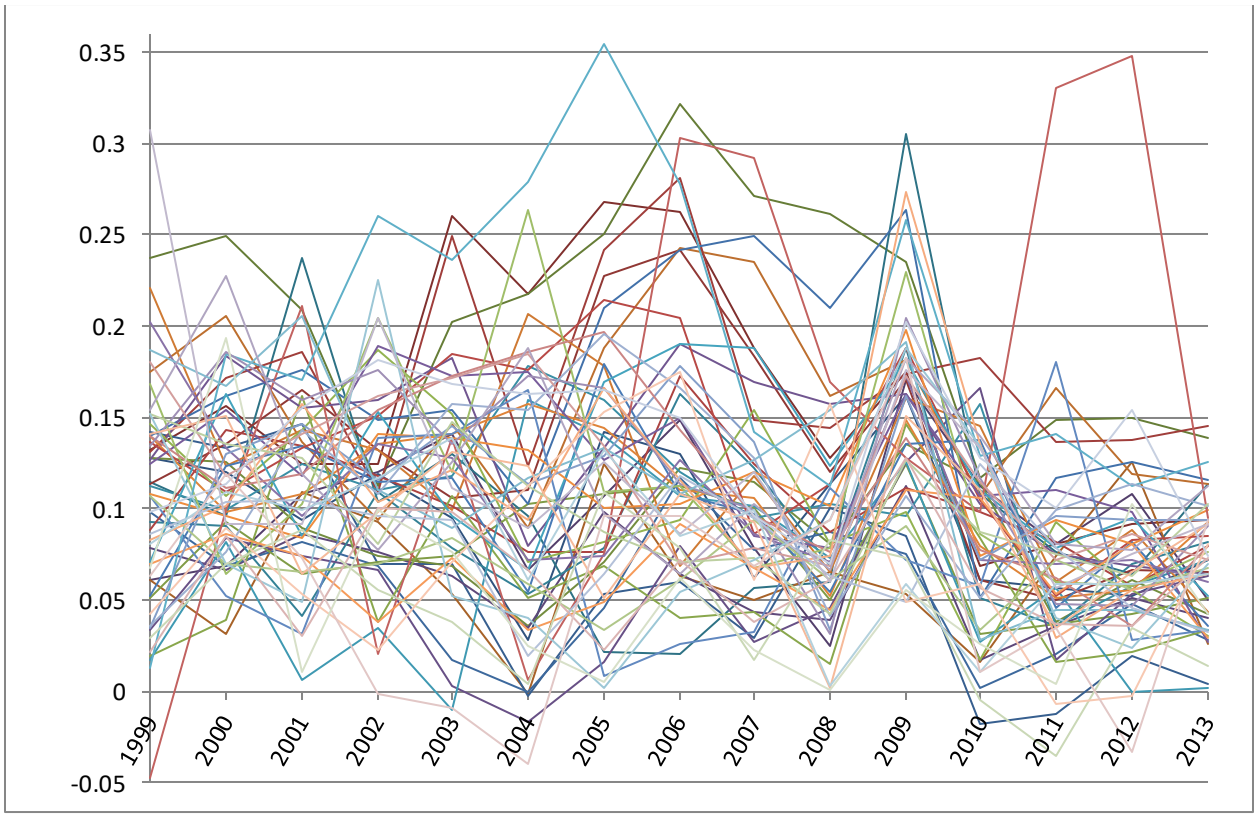


**Figure 2: Average Annual Deposit Growth Change by MSA**

The following graph highlights the average year-over-year branch deposit growth for each of the considered 57 MSAs. Data is reported for 1999 (change from year-end 1998) through 2013, with annual changes ranging from a 4.8 percent loss to a 35 percent gain.



## Figure 3: Distribution of Branch Age by Certification Category

The following graph highlights the distribution of branch observations by age category, by subsample. *Non-Green* and *Green* combined create the full sample. *Green* is further subdivided into *Energy Star* and *LEED*, and information for the *LEED New Construction* subsample is also provided. These age groups are aggregations of the finer age groups used in the regression analysis. For more information, see Table 1, Panel A.