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Avoidance Behavior Due to More Stringent Environmental Standards: Evidence From The LEED Certifcation

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Abstract

LEED certification is the most widely used green building rating system in the world. The certification is a symbol of sustainability achievement, and on November 1st, 2016, the rating system transitioned into a more stringent one. Using data on the LEED applicants, this paper studies the applicants' behavior response to the transition. The analysis yields three main results. First, the total number of applicants to LEED increased significantly in October 2016 and decreased drastically once more rigorous standards are in place. Second, the proportion of applicants receiving the basic certification is significantly higher for applicants that bunched in October 2016. Lastly, individually owned projects account for the majority of applications that bunched in October 2016. These findings demonstrate that many LEED applicants, specifically individual applicants, actively avoided the more stringent environmental standards and tried to be certified before the transition with little effort.

Keywords: Environmental Standards; LEED Certification; Avoidance Behavior

JEL Classification Numbers: Q40, D22, Q54

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I Introduction

The fundamental objective of the government is to provide for the common good and to improve general welfare through the direct provision of public goods and services such as public transportation and unemployment benefits. Government issues and enforces standards ranging from environmental quality to consumer protection, business and banking practices, nondiscrimination in employment, internet privacy, labels and "disclosure," safe food, drugs, products, and workplaces. A well-crafted regulation can have tremendous benefits such as faster economic growth (Djankov, McLiesh and Ramalho, 2006), reductions in poverty (Freeman, 1996), a decrease in infant mortality (Greenstone and Hanna, 2014), and the control of pollution and emissions (Popp, 2006).

The public interest theory of regulation emphasizes that regulation is supposed to improve public welfare, however, the very act of implementing a new regulation or a new standard often induces behavioral effect where the regulated individuals and firms will actively try to exploit loopholes for their own benefits (Posner, 1974). Hence, it is crucial to understand how an individual would react to the implementation of new standards or regulations to maximize its benefits.

One area in which the government is particularly active is regulation and legislation that improves standards on environmental quality. Especially in the US, the government has been pursuing increased environmental regulation since the 1970s through regulations such as the Clean Air Act and the Clean Water Act. Many Non-Profit Organizations and Non-Government Organizations such as the World Wide Fund for Nature, Greenpeace, and the United States Green Building Council (USGBC) are also pushing for better environmental standards to fight climate change. As climate change and sustainability become a more prominent issue raised at the national and international stage, governments and organizations are taking a more active role in creating stricter environmental standards.

This paper investigates the effect of a more stringent environmental standard by examin-

ing the change in the number of applicants to the Leadership in Energy and Environmental Design (LEED) certification. The USGBC transitioned from the LEED 3.0 Rating System (LEED v3 system) to the more technically stringent LEED 4.0 Rating System (LEED v4 system) in November 2016, which created an opportunity for building project owners to manipulate their registration time to avoid stricter environmental standards. LEED certification is an important topic to study because green buildings and sustainable building design play significant roles in the discussion of environmental sustainability. According to the 2019 Global Status Report for Buildings and Construction[1], the building and construction sector accounted for 36% of final energy use and 39% of energy and process-related carbon dioxide emission in 2018. Transition to sustainable building design is crucial to decrease energy consumption and emissions. Since LEED is the most widely used green building rating system, understanding its applicants' behavior can inform the implementation of future environmental standards and their potential impact.

This is the first paper to analyze the number of LEED applicants to research the behavior effect induced by stricter environmental standards. In this paper, I use a manipulation test based on density discontinuity developed by Matias D. Cattaneo, Michael Jansson, and Xinwei Ma (Cattaneo, Jansson and Ma, 2018) to argue that knowing the upcoming change to the rating system, applicants manipulated their time to register for LEED certification. I also use two empirical specifications to investigate the change in the number of applicants to LEED and the change in the distribution of certification level received by the applicants.

This paper provides a two-step analysis that presents five facts about LEED certification: (1) There is bunching right before the transition date; a significant number of applicants registered in September 2016 and October 2016, the last two months to register under the LEED v3 system. (2) The number of applicants to LEED decreased significantly after USGBC transitioned to the more rigorous LEED v4 system. (3) A significantly higher proportion of projects that registered in October 2016 receive the lowest LEED certification,

[1]https://www.worldgbc.org/news-media/2019-global-status-report-buildings-and-construction

"LEED Certified." By splitting the number of applicants into three groups: individual applicants, private sector applicants, and public sector applicants, I found that (4) Projects owned by individuals account for most of the bunched applicants. (5) A significantly higher proportion of projects owned by individuals that registered in October 2016 receive the lowest LEED certification, "LEED Certified." This paper's result demonstrates that building owners, specifically individual building owners, actively avoid the more stringent LEED v4 system by bunching right before the transition date and those building owners who bunched were trying to obtain a LEED certification with minimal effort towards sustainable building design.

In studying behavioral responses to avoid increased regulation and standards, this paper contributes to the literature on avoidance behavior such as tax avoidance. When a new tax regulation is imposed or when tax structure changes, instead of paying tax, it is common that people may change their reports to the IRS, change the timing of transactions, and undertake a range of other actions to avoid paying the government (Slemrod and Yitzhaki, 2002). Tax avoidance activities are also central to corporate financial decision-making, and there is substantial literature on the theories of tax avoidance and the firms' behavior to sidestep taxation. Graham (1996),Graham and Rogers (2002), Desai and Dharmapala (2006), and Lim (2011), provide evidence that high tax rate firms use debt more intensively than do low tax rate firms to take advantage of debt tax benefits. Graham (2003) and Hanlon and Heitzman (2010) show that when the corporation's tax rate increases, the corporation manipulates and increases their preference of paying salary compensation instead of option compensation because salary expense is deducted immediately and option expense is delayed. Cowell (1990), Graham and Tucker (2006), and Wilson (2009) also wrote comprehensively on the problem of tax shelters, which are openly carried out by tax-payers taking advantage of special provisions or loopholes in tax laws. When a regulation or a standard is imposed, it prompts a response from the regulated individuals and the implementation of new standards could backfire as the individuals often explore ways to avoid being governed. This study

applies the idea of avoidance to environmental standards using LEED certification to focus on how building owners react to and avoid stricter greenhouse and sustainability standards.

This paper also contributes to the education literature focusing on the sheepskin effect. The sheepskin effect is an extensively studied phenomenon laid out by Hungerford and Solon (1987), Belman and Heywood (1991), and Jaeger and Page (1996) and others. They observe that people with a completed academic degree earn a greater income than people who have an equivalent amount of studying and skills without an academic degree, even if the possession of a degree doesn't actually enhance one's productivity. More recent studies by Fuerst and McAllister (2011), Reichardt et al. (2012), and Eichholtz, Kok and Quigley (2013) and others show that in the US, there is a rental premium and premium in transaction price per square foot for properties with a LEED certification compared to those without a certification in the same market. Hyland, Lyons and Lyons (2013) and Fuerst and McAllister (2011) also provide evidence that higher energy efficiency ratings increase both the sales and rental prices of properties in Ireland and the United Kingdom. This paper brings the sheepskin effect to the market of environmental standards, specifically in the market of green-certified properties. This paper's result indicates that many property owners, specifically individual home-owners, manipulated their registration date to register for the less strict LEED v3 system. As the proportion of buildings receiving the lowest LEED certification, "LEED Certified", is significantly higher for individual property owners who manipulated, we can conclude that individual property owners took advantage of the sheepskin effect and attempted to obtain LEED certification for the ability to increase their property value with little effort.

The rest of the paper is organized as follows. Section II provides background on the LEED Rating System. Section III describes the data and section IV discusses the empirical identification strategy. Estimation results and extensions of the main empirical findings are presented in section V, and section VI concludes.

II Background

A Leadership in Energy and Environmental Design (LEED)

The First LEED Pilot Project Program, referred to as LEED Version 1.0, was launched in the USA in 1998 by the United States Green Building Council (USGBC)[2], an NGO that aims to transform the building and construction sector and ensure buildings are designed, built, and operated with an emphasis on environmental sustainability. The LEED system has undergone some revision, integration, and customization, introducing LEED Version 2.0 in May 2000, LEED v3 system in April 2009, and LEED v4 system in November 2013. LEED v4 is currently in use and the previous versions are retired.

The LEED Green Building Rating Systems are voluntary and are intended to evaluate the environmental performance of the whole building over its life cycle. Different schemes are designed for rating new and existing commercial, institutional, and residential buildings. Each scheme has the same list of eight environmental objectives set out in eight credit categories with multiple required credits, but the number of optional credits under each credit categories, and points allocated to each optional credit change considerably according to the specific area of interest and the building type. Table 1 describes the eight credit categories included in the LEED environmental rating scheme.

The transition from LEED v3 to v4 took place on October 31st, 2016, which was also the last day to register a project under the LEED v3 system. The LEED v4 system introduced new credits and amends existing credits in each credit categories to impose stricter standards in the energy, water, waste, and indoor environmental quality. It also raised the number of required credits from eight to twelve and introduced a whole new credit category: Location and Transportation. The LEED v4 system takes an increased focus on the impact of the building on human health over its life cycle. Life cycle assessment, along with environmental

[2]https://www.usgbc.org

product declarations, and material ingredient reporting are now required under the LEED v4 system as well.

The applicants choose the optional credits they wish to pursue and are evaluated based on the total points achieved for each optional credit. The scoring system has a maximum score of 110 points. Out of the possible total of 110 points, a minimum of 40 points needs to be obtained to receive the basic LEED certification, "LEED Certified". Table 2 describes the different tier of certification corresponds with the points achieved. As of November 2020, 100,020 buildings in the U.S. are registered to the LEED Rating Systems and 61,566 buildings were awarded a LEED certification.

B LEED Certification Process

To receive a LEED certification, a property owner must first register their project into the LEED system. Once the USGBC agrees that the property meets all of the LEED Minimum Program requirements, the owner can then apply to be evaluated for certification. It is important to note that the owner can register but not apply for evaluation, but one cannot apply for evaluation unless the property is registered before the registration deadline.

For example, the registration deadline for LEED v3 is October 31st, 2016. Meaning a project must be registered into the LEED system before October 31st, 2016 to be evaluated under LEED v3. On the other hand, a project that was registered in November 1st, 2016 will be evaluated under the more stringent LEED v4.

The deadline for applying for an evaluation is typically 3 to 5 years after the registration deadline. The result is available within 3 months from the day the applicant applied for evaluation.

III Data

This study uses data from the USGBC website[3] on a sample of 30,227 building projects that registered on the LEED certification system from November 2013 to October 2019 and have applied to be evaluated for a LEED certification. Each observation represents a building and contains basic information such as the address, the owner type and the owner organization of the building. This data set contains 25,223 buildings registered under the LEED v3 system from November 1st, 2013 to October 31st, 2016 and applied for certification and 5,004 buildings that registered under the LEED v4 system from November 1st, 2016 to October 31st, 2019 and applied for certification. This data set also includes details on the certified date, the level of certification awarded, and the points achieved. Figure 1 depicts the number of projects registered and have applied per month.

The data set is then transformed into time series. Each observation represents each month from November 2013 to October 2019. There are 72 observations (12 month * 6 years = 72 months) with 6 variables. Failed, Certified, Silver, Gold, and Platinum, each represents the distribution of the certification level in the corresponding month in percentage terms. logApplicantCount represents the natural log of the total number of projects registered and have applied in each month. Summary statistics is shown in Table 3. Month dummy variables are included from May 2016 (5 months before October 2016) to March 2017 (5 months after October 2016). A dummy variable, IsV4, representing months with the LEED v4 system is also included. The graphs showing the distribution of the 5 different certification level over time are shown in the appendix.

[3]https://www.usgbc.org/projects

IV Empirical Strategy

A Manipulation Test Based On Density Discontinuity

I use the manipulation test developed by Cattaneo, Jansson and Ma (2018) to test for a discontinuity in the distribution of the number of applicants registered and applied over time. This manipulation test is a hypothesis test on the continuity of the density function *f(x)* of the observed sample (number of applicants, in this case) at the cutoff point x^* (November 2016, in this case):

$$H_o : \lim_{x \uparrow x*} f(x) = \lim_{x \downarrow x*} f(x)$$

$$H_1 : \lim_{x \uparrow x*} f(x) \neq \lim_{x \downarrow x*} f(x)$$

The discontinuity at the cutoff is then estimated as the difference in the value of the density functions on the two sides of the cutoff.

B Estimating Equations

Two empirical specifications are used to (1) examine the change in the number of applicants in October 2016 and after USGBC transitioned to the LEED v4 system and (2) understand the pattern in the distribution of each certification level over time. The estimating equations are:

$$LogApplicantCount_{month} = \alpha + \gamma_1 * IsV4 + \sum_{t=September2016}^{November2016} \gamma_t * MonthDummy_t + \epsilon_m \quad (1)$$

$$ProportionCertLevel_{level,month} = \delta + \beta_1 * IsV4 + \sum_{k=May2016}^{March2017} \beta_k * MonthDummy_k + \varepsilon_{l,m} \quad (2)$$

In equation (1), the dependent variable represents the log of the number of applicants that registered in each month. γ_1 and γ_t are the coefficients representing the effect of the implementation of the LEED v4 system on the log of the applicant count and month effect on the log of the applicant count from September 2016 to November 2016. The coefficients of interest here are γ_1 and $\gamma_{t=October2016}$.

In equation (2), the dependent variable represents the distribution of each certification level, Failed, LEED Certified, LEED Silver, LEED Gold, and LEED Platinum, at each month. β_1 measures the effect of transition to the LEED v4 system on the distribution of each certification level. β_k are coefficients for the month effect on the distribution of each certifications from May 2016 to March 2017. The coefficient for September 2016 (One month before the last month to register for LEED v3 system) is omitted so we can interpret the coefficients for the month effect relative to September 2016. The coefficients of interest in this equation are β_1 and $\beta_{t=October2016}$.

These two estimated equations are first used on the data set with all applicants to understand how an average applicant reacts to the implementation of the LEED v4 system. The two equations are then used on three subsets of the original data set: (1) individual applicants, (2) private sector applicants, and (3) public sector applicants to understand how applicants from each sector behave. The individual applicants include properties owned by individuals, the private sector applicants include properties owned by for-profit corporations and investors, and the public sector applicants include properties owned by local, state, and federal governments.

This two-step analysis allows us to understand the behavior of all of the LEED applicants as well as the behavior of applicants in each sector.

V Results

The manipulation test and the two empirical specifications in this paper offer five results: (1) The applicants bunched starting from two months before USGBC transitioned to the more technically stringent LEED v4 system on November 1st, 2016. On average, the applicant count is 103.8% higher in September 2016, and 260.7% higher in October 2016. (2) The number of applicants per month decreased significantly after USGBC transitioned to the LEED v4 system. On average, the applicant count per month is 97.8% lower under the LEED v4 system compared to applicant count per month under the LEED v3 system. (3) The proportion of applicants receiving the lowest LEED certification, "LEED Certified", is significantly higher for applicants who registered in October 2016. (4) Individually owned properties account for the majority of applicants that bunched before the transition. (5) For properties that registered in October 2016, only the individual group saw a significant increase in the proportion of applicants receiving the basic certification, "LEED Certified."

A Main Results: All of The Applicants

Figure 1 presents the number of applicants to LEED per month starting from November 2013 to October 2019. There is a significant jump in the number of applicants in October 2016, which is the last month to register for the LEED v3 system. Figure 2 depicts the result of the manipulation test based on density discontinuity. The T-statistic is at -77.19 and the P-value is nearly 0. We reject the null hypothesis and conclude that there is a discontinuity in the density of the number of projects per month in November 2016. The density graph increases significantly as time approaches November 2016, indicating the number of applicants increases before the transition month, November 2016. According to column 3 on table 4, the coefficients for Sept16 and Oct16 are 1.038 and 2.607. We can conclude that the number of applicants is 103.8% higher in September 2016 (2 months before the transition to the LEED v4 system) and 260.7% higher in October 2016 (1 month before the transition

to the LEED v4 system) compared to the average number of applicant per month. Both results are statistically significant and indicate that the applicants manipulated their time to register leading up to the transition to avoid the more stringent LEED v4 system.

The number of applicants to LEED also decreases significantly after USGBC transitioned to the LEED v4 system. Figure 3 depicts the estimated sample mean of the number of applicants per month. The average number of applicants before the transition is approximately 700 projects per month; however, the number drops to around 150 projects per month under the LEED v4 system. Column 3 on table 4, which depicts the result of regression (1), provides further evidence of the drop in the number of applicants. The coefficient of IsV4 is -0.978. On average, the number of applicants decreased by 97.8% after USGBC transitioned to the LEED v4 system. This result is statistically significant at the 1% level. We can conclude that the more rigorous environmental standards enforced by the LEED v4 system discouraged building owners from applying to be LEED certified.

Table 5, which depicts the result from regression (2), and figure 4 provide insight into those applicants who bunched and registered in October 2016. On column 3 of table 5, the coefficient on Oct16 is 32.73, meaning compared to September 2016, the proportion of applicants who receive the lowest LEED certification, "LEED Certified", is 32.73% higher for projects that registered in October 2016. Each column of table 6 depicts the result of running regression (2) on all five different certification tiers. The coefficient on Oct16 for Failed, Silver, Gold, and Platinum are all negative, meaning compared to applicants that registered in September 2016, less applicants that bunched in October 2016 received Failed, Silver, Gold, and Platinum certification. These coefficients are not statistically significant; however it demonstrates that a larger portion of projects that registered in October 2016 got "LEED Certified" instead. This result indicates that LEED applicants not only manipulated their time to register before USGBC transitioned into the more technically stringent LEED v4 system, a significant amount of the building owners also only attempted to get the basic certification; they attempted to be LEED certified with minimal effort toward LEED's

standards on sustainable building design.

These three results demonstrate that building owners adjusted their behavior to incentives created by the change in the environmental standards of LEED. In light of a more stringent LEED v4 system, many building owners actively avoid it by registering their buildings under the LEED v3 system. The decrease in the number of applicants after the transition indicates the more stringent environmental standards discourage building owners from participating in LEED. A significantly higher proportion of applicants in October 2016 receiving "LEED Certified" suggests many building owners understood the financial benefit of a LEED certification and attempted to get certified with minimal effort before the rating system upgrades to the LEED v4 system.

B Extension of Main Result: Individual Applicants, Private Sector Applicants, and Public Sector Applicants.

The previous section highlights the avoidance behavior of LEED applicants when a more stringent LEED v4 system is implemented. This section examines the avoidance behavior on a sector by sector level to provide further analysis on how different groups of applicants reacted to the more stringent environmental standards. I examined three different sectors by creating three subsets of the original data set: the individual group, the private group, and the public group.

Column (2) to (4) in table 7 represent the result of running regression (1) on the three different groups of applicants. The coefficient of interest is Oct16, which indicates the percentage change in the number of applicant that registered to LEED in October 2016 compared to the average number of monthly applicant, and IsV4, which depicts the percentage change in the number of applicants that registered to LEED after LEED v4 system is implemented. The coefficient for Oct16 is positive and significant for all groups, which demonstrates a significant increase in the number of projects registering in October 2016 for all three groups. The coefficient for IsV4 is negative and significant for all groups as well, meaning the number

of applicants dropped significantly in all groups after more stringent environmental standard were introduced.

Focusing on the regression result on the individual group, the coefficient of Oct16 on this group is significantly higher than the rest of the groups' coefficients. The result shows a 360% increase in the number of individual applicants that registered in October 2016, which is more than twice as much as the 141% increase in the number of private applicants and 178% increase in the number of public applicants that registered in October. This result demonstrates that individual applicants exhibited a stronger avoidance behavior as significantly more individual applicants bunched and registered in October 2016 compared to private and public applicants.

Column (2) to (4) in table 8 depict the result of running regression (2) on the three different groups of applicants. This regression result helps us understand how the proportion of applicants that registered in October 2016 and received "LEED Certified" changed in all three groups. The results show that the coefficient on Oct16 is only significant for the individual group. We can conclude that individual applicants account for most of the increase in the proportion of applicants receiving "LEED Certified" that we found in the main result section.

This section provides a sector by sector analysis on applicants to LEED to further understand how applicants with different incentives react to the more stringent LEED v4 system. The result demonstrates that individual applicants account for a large portion of the increase in the number of applicants that registered in October 2016. This section also illustrates that it significantly more individual applicants tried to avoid LEED v4 system and take advantage of the sheepskin effect by obtaining the most basic LEED certification before a more rigorous rating system is in place.

VI Conclusion

Since the building and construction sector are responsible for the majority of energy and process-related carbon dioxide emission, it is important to understand the property owners' behavior response to new environmental standards. This understanding can inform future implementation of a new standard, and the outcome of implementation.

This paper studies the effect of a new and more stringent environmental standards introduced by the LEED v4 system on its applicants' behavior. USGBC transitioned from the LEED v3 system to the more technically stringent LEED v4 system on November 1st, 2016, which created an incentive for applicants to manipulate their registration time to avoid more rigorous environmental standards. The result shows that compared to the average amount of monthly registered projects, the number of registered projects is 103.8% higher two month before the transition date, and 260.7% higher one month before the transition date. The average number of monthly registered projects also decreased dramatically after the new system is in place. This paper provides further evidence that the proportion of applicants receiving the basic certification, "LEED Certified", is significantly higher for applicants that registered one month before the transition month. A sector by sector analysis demonstrates that projects owned by individuals account for most of the registered projects that bunched before the registration deadline. Individual applicants are also the only sector that saw a significant increase in the proportion of applicants receiving the lowest certification, "LEED Certified," one month before the transition.

This paper brings ideas from literature on avoidance behavior and on the sheepskin effect into the market for green buildings. The avoidance behavior is often observed when a more stringent standard or regulation is implemented. The regulated individuals tend to respond by exploring ways to avoid being governed. This paper provides evidence that the applicants attempted to avoid the more stringent environmental standards by bunching before the registration deadline for LEED v3 system. This paper also shows that the bunched

applicants, specifically the individual applicants, understood the financial benefit of a LEED certification, and tried to only obtain the basic certification, "LEED Certified," to take advantage of the sheepskin effect. The empirical approach of this paper does not allow for the exploitation of state difference in the behavior of LEED applicants. As states such as Delaware, Hawaii, Illinois, Maryland, Nevada, New Mexico, New York, North Carolina, Pennsylvania, and Virginia provide tax benefits and subsidies to building owners for achieving a LEED certification, exploring the state effect on the change in the number of LEED applicant and the change in proportion of applicants receiving different LEED certification can potentially yield significant result and is left for further research.

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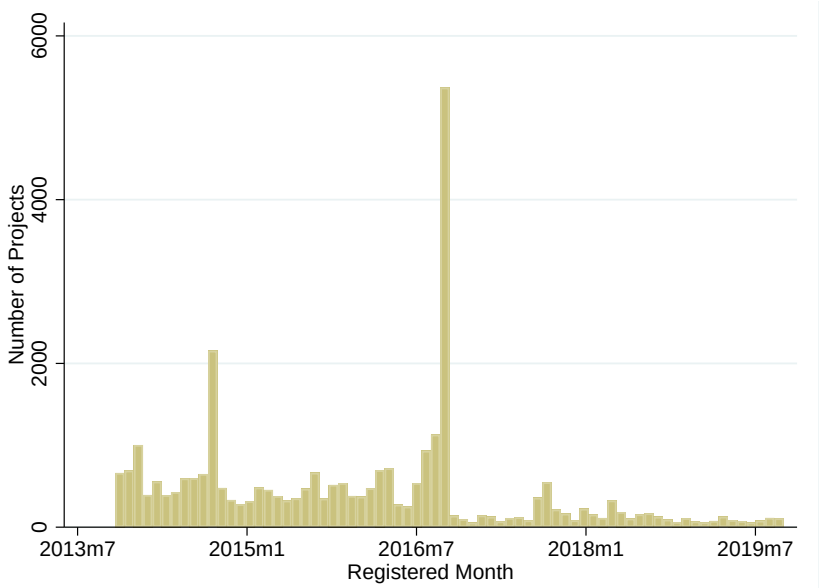
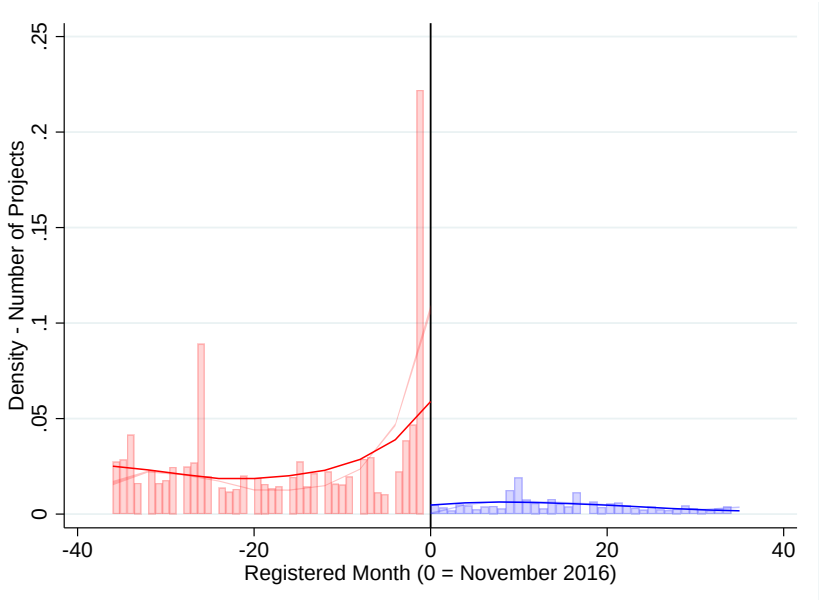
Figures

Figure 1: Number of Building Projects Registered and Applied



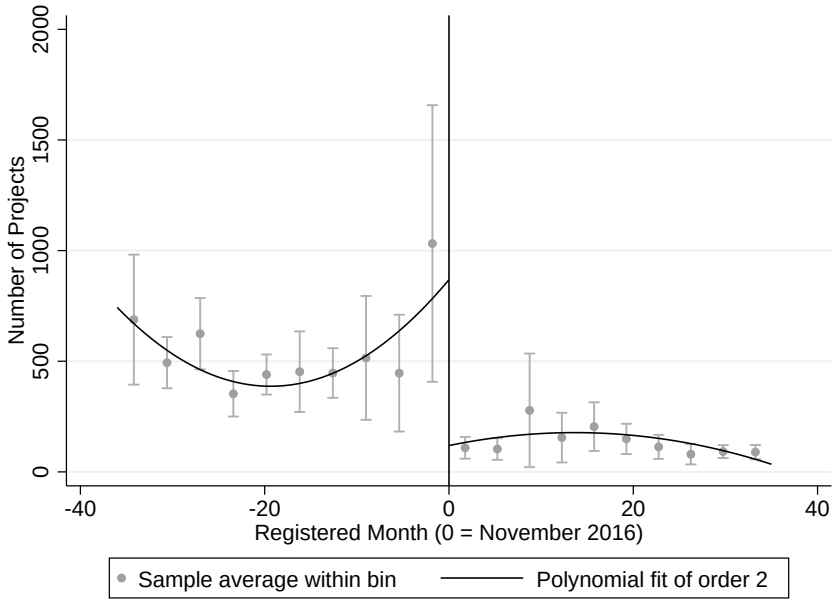
This figure shows the number of applicants registered and have applied in each month from November 2013 to October 2016. There is a significant increase in the number of registered properties in October 2016, the last month to register under LEED v3.

Figure 2: Manipulation Testing Based on Density Discontinuity



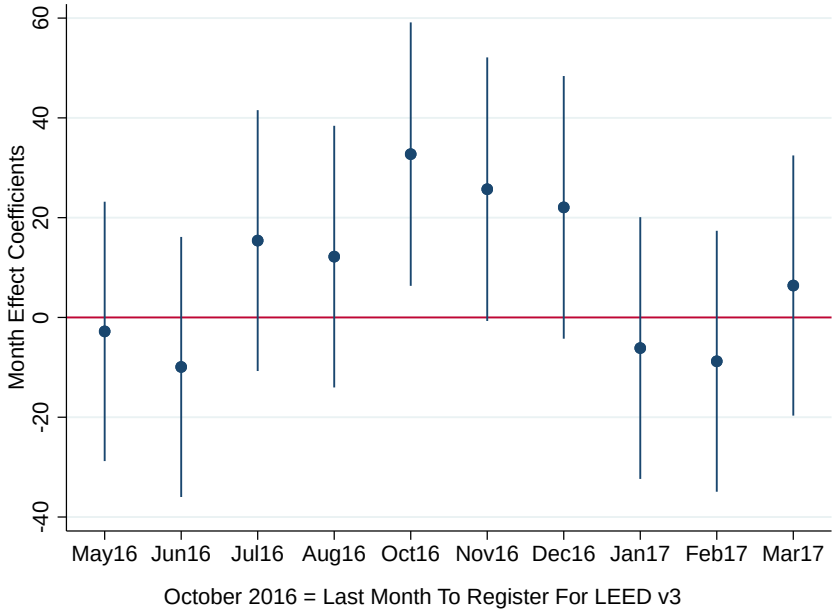
This figure shows the result of the manipulation test. The red bars represent applicants under LEED v3 and the blue bars represent applicants under LEED v4. The red solid line is the density function of applicants under LEED v3 and the blue solid line is he density function of applicants under LEED v4. These is a discontinuity in the density function at 0 (November 2016).

Figure 3: Discontinuity in The Estimated Sample Mean of Number of Applicants Per Month



This figure is made using STATA command "rdplot" created by Calonico et al. (2017). This graph shows the number of applicants decreased significantly after USGBC transitioned to LEED v4. The number of applicants also increase right before the transition. 95% confidence interval is included.

Figure 4: Coefficient Plot - Month Effect on Certified (Table 5 Column 4)



Dummy variable for September 2016 is omitted for interpretation purpose. This figure shows the coefficients of the month effect variables. The dependent variable is Certified, the proportion of applicants with "LEED Certified" in a given month. The coefficient on Oct16 is significant at 32.21. 95% confidence interval is included. The unit is in percentage points (%)

Tables

Table 1: LEED v4's Credit Category and Description

Category	**Description**
Location and Transportation	Surveys the location of the development. Aims to reduce the environmental impact from the location of a building on a site. Promotes transportation efficiency and reduction in vehicle distance traveled.
Sustainable Sites	Examines the environmental aspects linked to the building site. The goal is to limit the construction impact and verify meteoric water outflow.
Water Efficiency	Inspects the water use, management and disposal in the buildings. The reduction of water consumption and meteoric water reuse are promoted.
Energy and Atmosphere	Building energy performance improvement, the use of renewable sources and the energy building performance control are promoted.
Materials and Resources	The environmental subjects associated to the material selection, the reduction of virgin material use, the garbage disposal and the environmental impact due to transport are considered.
Indoor Environmental Quality	Examines indoor environmental quality, taking into account healthiness, comfort, air renewal and air pollution control.
Innovation in Design	Identifies the design that improve on the sustainability operations in the building construction.
Regional Priority	Encourages the design groups to focus the attention on the local characteristics of the environment.

Table 2: LEED Rating System: Certification Level

LEED Level	**Points Achieved**
Platinum	80+ Points Earned
Gold	60 - 79 Points Earned
Silver	50 - 59 Points Earned
Certified	40 - 49 Points Earned

Table 3: Summary Statistics

VARIABLES	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
Failed	72	18.18	15.02	0.974	62.71
Certified	72	26.50	13.38	2.299	60.46
Silver	72	23.18	11.01	1.835	57.17
Gold	72	24.64	10.45	6.140	71.31
Platinum	72	7.505	6.648	0	43.97
ApplicantCount	72	419.8	676.0	54	5,369

This table shows the summary statistics. Failed, Certified, Silver, Gold, and Platinum each represents the proportion of applicants from each month getting each certification. The unit is in percentage. ApplicantCount represents the number of projects that applied in each month.

Table 4: Regression Results: Number of Applicants

VARIABLES	(1) logApplicantCount	(2) logApplicantCount	(3) logApplicantCount
IsV4	-1.375***	-1.100***	-0.978***
	(0.264)	(0.233)	(0.242)
Sept16			1.038**
			(0.489)
Oct16		2.533***	2.607***
		(0.497)	(0.490)
Nov16			-0.0492
			(0.489)
Observations	72	72	72
R-squared	0.657	0.752	0.767

This table shows the effect of LEED v4 system dummy, and September 2016 to November 2016 dummy on the log of the applicant count per month. Robust standard errors in parentheses. Constant term is not shown. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 5: Regression Results: Proportion of Projects Receiving "LEED Certified"

VARIABLES	(1) Certified	(2) Certified	(3) Certified
IsV4	-5.699	-2.070	-4.826
	(6.222)	(6.160)	(7.845)
May16			-2.795
			(12.99)
Jun16			-9.925
			(13.03)
Jul16			15.41
			(13.06)
Aug16			12.19
			(13.10)
Oct16		33.34**	32.73**
		(13.15)	(13.19)
Nov16			25.71*
			(13.20)
Dec16			22.06*
			(13.15)
Jan17			-6.134
			(13.11)
Feb17			-8.783
			(13.07)
Mar17			6.398
			(13.03)
Observations	72	72	72
R-squared	0.055	0.137	0.272
SE is robust			
Unit is Percentage (%)			

Dummy variable for September 2016 is omitted for interpretation purpose. This table shows the effect of LEED v4 system dummy and month dummy on the proportion of applicants receiving "LEED Certified". Robust standard errors in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 6: Regression Results: Proportion of Projects Receiving Different LEED Certifications

VARIABLES	(1) Failed	(2) Certified	(3) Silver	(4) Gold	(5) Platinum
IsV4	1.310	-4.826	4.518	7.469	-8.471**
	(5.613)	(7.845)	(6.140)	(6.431)	(4.224)
Aug16	-10.26	12.19	2.488	-9.061	4.648
	(9.377)	(13.10)	(10.26)	(10.74)	(7.056)
Oct16	-12.29	32.73**	-8.561	-7.313	-4.567
	(9.440)	(13.19)	(10.33)	(10.82)	(7.103)
Nov16	-14.59	25.71*	-7.183	-6.656	2.719
	(9.444)	(13.20)	(10.33)	(10.82)	(7.106)
Observations	72	72	72	72	72
R-squared	0.704	0.272	0.341	0.197	0.145
SE is robust					
Unit is Percentage (%)					

This table uses the same specification as Table 4, Column 4. Dummy variable for September 2016 is omitted for interpretation purpose. This table shows the effect of a LEED v4 system dummy and month dummy on the proportion of applicants receiving different LEED Certifications. Robust standard errors in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 7: Regression Results: Number of Applicants - 3 Subgroups

VARIABLES	(1) logApplicantCount	(2) logApplicantCount	(3) logApplicantCount	(4) logApplicantCount
IsV4	-0.978***	-2.306***	-1.003***	-1.416***
	(0.242)	(0.535)	(0.236)	(0.259)
Sept16	1.038**	1.710	0.784	0.685
	(0.489)	(1.021)	(0.476)	(0.522)
Oct16	2.607***	3.597***	1.412***	1.783***
	(0.490)	(1.024)	(0.477)	(0.523)
Nov16	-0.0492	2.515**	0.724	0.600
	(0.489)	(1.022)	(0.477)	(0.522)
Observations	72	72	72	72
R-squared	0.767	0.743	0.724	0.769
Groups	All Applicants	Individuals	Private	Public

This table shows the effect of LEED v4 system dummy, and September 2016 to November 2016 dummy on the log of the applicant count per month. Robust standard errors in parentheses. Constant term is not shown. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

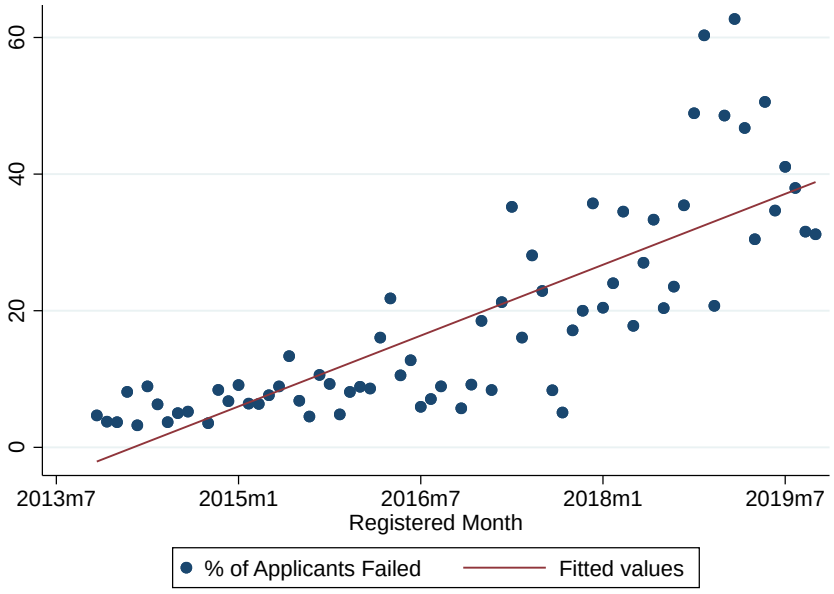
Table 8: Results: Proportion of Projects Receiving "LEED Certified" - 3 Subgroups

VARIABLES	(1) Certified	(2) Certified	(3) Certified	(4) Certified
IsV4	-4.826	21.22	12.39	7.072
	(7.845)	(14.41)	(9.100)	(4.655)
Aug16	12.19	-9.379	20.57	-1.871
	(13.10)	(12.14)	(16.20)	(7.749)
Oct16	32.73**	36.51**	-11.93	2.468
	(13.19)	(12.39)	(15.30)	(7.803)
Nov16	25.71*	22.27	22.70	-1.940
	(13.20)	(13.33)	(17.31)	(7.800)
Observations	72	72	72	72
R-squared	0.272	0.576	0.255	0.330
Groups	All Applicants	Individuals	Private	Public
SE is robust				
Unit is Percentage (%)				

This table uses the same specification as Table 4, Column 4. Dummy variable for September 2016 is omitted for interpretation purpose. This table shows the effect of LEED v4 system dummy and month dummy on the proportion of applicants receiving "LEED Certified" in different subgroups. Robust standard errors in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

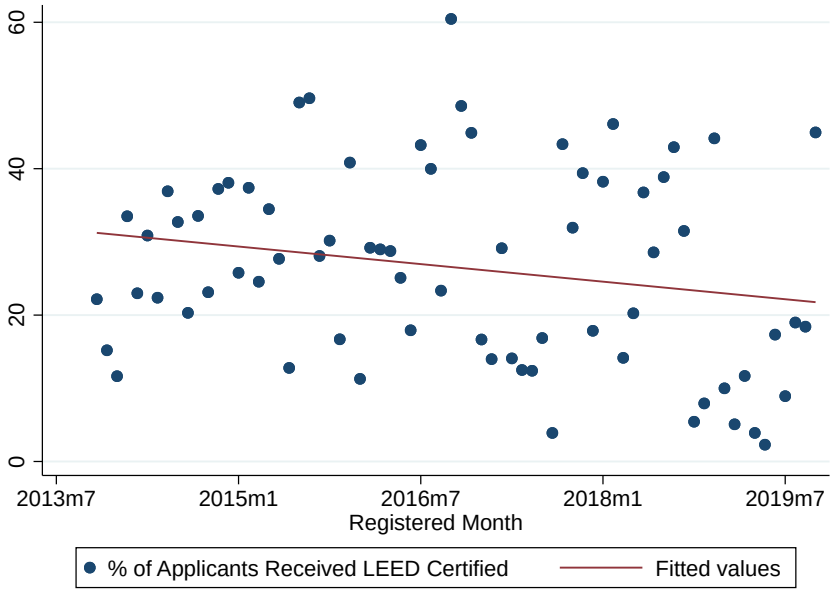
A Appendix

Figure A.1: % of Applicants Failing By Registered Month



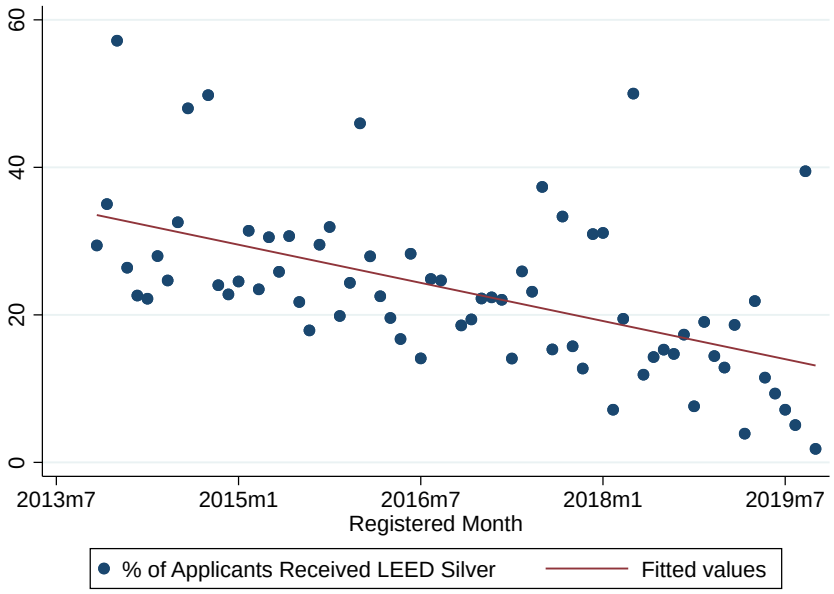
This figure shows there is a upward trend in the percentage of applicants who failed to achieve any LEED certification.

Figure A.2: % of Applicants Receiving LEED Certified By Registered Month



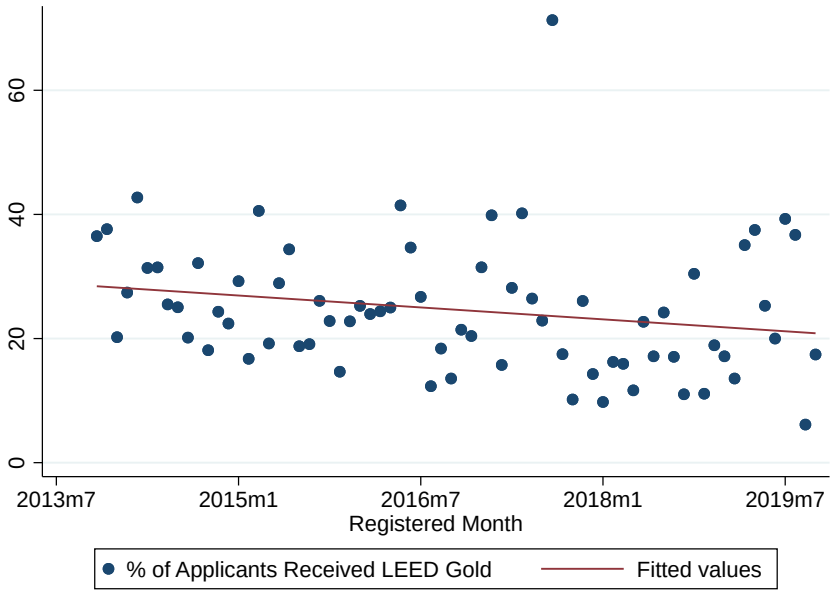
This figure shows more than 60% of applicants in October 2016 received the lowest LEED Certification "LEED Certified."

Figure A.3: % of Applicants Receiving LEED Silver By Registered Month



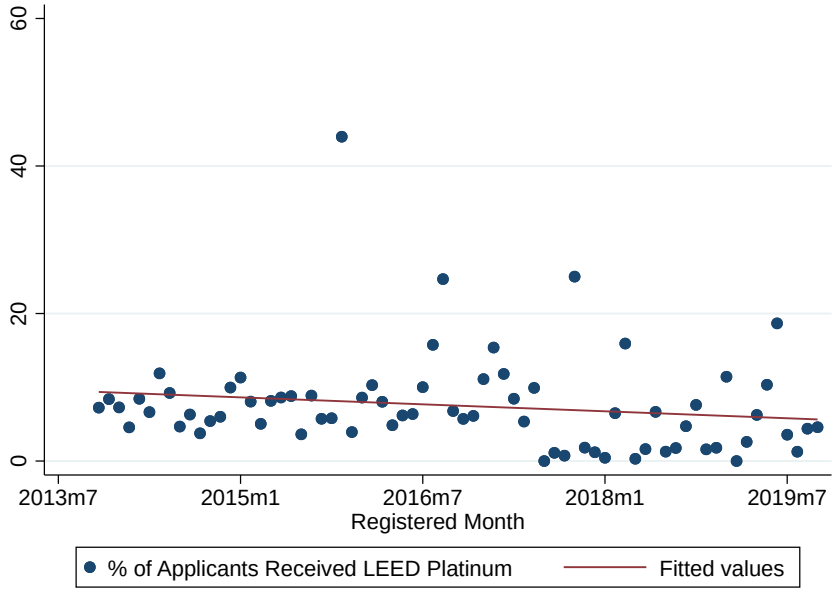
This figure shows a downward trend in the % of applicants receiving LEED Silver.

Figure A.4: % of Applicants Receiving LEED Gold By Registered Month



This figure shows no significant trend in the % of applicants that receive LEED Gold.

Figure A.5: % of Applicants Receiving LEED Platinum By Registered Month



This figure shows no significant trend in the % of applicants that receive LEED Platinum.