Poor Energy Efficiency May Predict CMBS Default Risk

A study released by the University of California at Berkeley and Lawrence Berkeley National Laboratory, funded by the Department of Energy concludes that there is a connection between energy efficiency for commercial real estate buildings and the likelihood of defaults. The report evaluated the impact of actual energy use and prices in six metro areas on default performance of CMBS loans between 2000 and 2012. According to the study, the tight correlation reveals that poor building energy efficiency may be a significant predictor for commercial loan defaults.

Dr. Paul Mathew of the Lawrence Berkeley National Laboratory and Dr. Nancy Wallace of UC Berkeley who jointly led the study that was funded by the Department of Energy's Building Technologies Office say the data collected will help lenders collect "baseball-like statistics that evaluate and quantify the risk of mortgage default based on a building's energy metrics." You could say this study serves as the *Moneyball* for potential CMBS default.

The Approach and Rationale

The analysis was based on commercial mortgage data trends provided by CMBS data provider Trepp, LLC and energy use statistics from benchmarking disclosures. The researchers utilized energy benchmarking ordinance data for Boston, Chicago, Minneapolis, New York, Philadelphia, and Washington, D.C. They also geo-coded the building-level disclosure data and merged it with loan-level and historical performance data from a sample of Trepp loans originated between 2000 and 2012. The result is a data set that measures building-level energy efficiency alongside information on the CMBS loan contracts, the collateral's leasehold structure, property value and characteristics, as well as the time-series performance of the loan.

Wallace says that the idea for the study arose from a lender survey that was carried out by the study team. The survey results indicated that lenders needed measurement tools to assess a commercial building's energy consumption profile. This finding suggested that lenders would benefit from information such as a building's Site and Source EUI (energy use intensity) because these measures indicate the overall energy efficiency of a property and whether or not it is well-maintained. Buildings that are less energy efficient, or have higher energy costs would be less attractive to lenders. Currently, buildings' efficiency records are not part of standard underwriting documents, so lenders just don't have that data. Where this information is most useful is metros that have cold or hot/humid climates and/or higher energy prices.

The Results

The study finds that building-level energy use and price are statistically and economically associated with commercial mortgage defaults. Building asset characteristics and operational practices that affect energy use have very important effects on the likelihood of default. Overall these results suggest that building-level energy efficiency and energy price risk do move the needle on default risk. Since commercial real estate investors are the residual claimants on this risk exposure, these results show the potential importance of accounting for energy efficiency and price risk as part of the loan risk assessment process in new mortgage originations.

The Details

Important energy-related metrics used in this study are *Source EUI* (Energy Use Intensity) and *Electricity Price Gap*. *Source EUI* is defined as the primary energy usage per square foot, and the *Electricity Price Gap* is

the difference between the realized and the expected electricity prices since loan origination. Instead of fully accounting for these energy factors, current practice typically calculates NOI based on historical average operating cost data. In the study's linear probability model for office and retail properties, the researchers found that the higher the property's *Source EUI* is, the higher the likelihood of default. The same went for the *Electricity Price Gap*, as those with larger gaps come with a higher likelihood of default.

ENERGY USE VOLUME

Electricity kWh/kW, fuel therms, etc.

Driven by bldg. features, operations, climate

ENERGY PRICE

$/kWh, $/kW, $/therm

Set by rate structure

ENERGY USE VOLATILITY

+/- change over mortgage term

Driven by bldg. operations, weather variation

ENERGY PRICE VOLATILITY

+/- change over mortgage term

Driven by rate structure, forward price curves

Although the study draws a clear correlation between energy efficiency, NOI, and default risk, the magnitude of the effect is still in question. In other words, how much do these energy factors truly "move the needle" on default risk? In the linear probability model for office and retail properties, the estimates for both the Electricity Price Gap and Source EUI are significant (better than the 0.05 level of statistical significance). However, these results are somewhat limited: the research only pertains to CMBS debt; the Source EUI data is only measured via an annual snapshot; and the matched data scope is limited by location, building types, and size.

The study includes a breakdown of impacts on specific cases, in which the researchers develop a range of scenarios that have different energy factor risks. The scenarios vary by location, building features, operations, climate, and other similar classifications. Within building features, a wide range of operational factors affect year-to-year energy use variations, and vary based on facility management, maintenance, and occupant behavior.

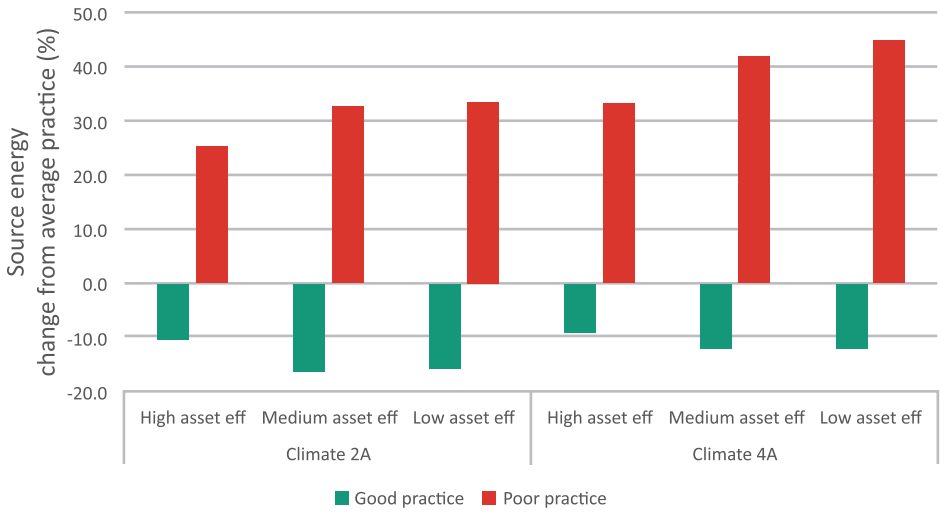
CHART 1: RANGE OF PRACTICE FOR VARIOUS OPERATIONAL FACTORS

FACTOR	GOOD PRACTICE	AVERAGE PRACTICE	POOR PRACTICE
Lighting Controls	Daylight-dimming + occ sensor	Occ sensor only	Timer only
Plug Load Controls	turn off when occupants leave	Sleep mode by itself	No energy saving measures
HVAC Schedule	optimal start	2hr +/- Occupant sch	n/a
Thermostat Settings	68°F heating and 78°F cooling Setback: 60 - 85	70°F heating and 76°F cooling Setback: 68 - 80	72°F heating and 74°F cooling No setback
Supply Air Temp Reset	SAT reset base on warmest zones	SAT reset based on stepwise function of outdoor air temperature	Constant supply air temperature
VAV Box Min Flow Settings	15% of design flow rate	30% of design flow rate	50% of design flow rate
Economizer Controls	Enthalpy	dry bulb	none/broken
Chilled Water Supply Temp Reset	Reset chilled water temperature based on cooling demand	Linear relationship with outside air temp (OAT)	No reset with constant year-round
Chiller Sequencing	Kick on the lag chiller when the lead chiller reaches its peak efficiency	Kick on the lag chiller when the chilled water temperature cannot be maintained	Always running two chillers
Hot Water Supply Temp Reset	Reset the hot water supply temperature according to heating load	Linear relationship with OAT	No reset with constant year-round

Source: Trepp

The resulting range of variation due to operational factors has the following combined effects:

GRAPH 1: COMBINED EFFECTS OF OPERATIONAL PARAMETERS



Source: Trepp

For each scenario, a combination of the observed and simulation approach is used to determine energy consumption and price volatility, and the hazard model coefficients are then used to determine the impact on default risk. The results of the scenario analysis broken down by asset type, and climate and efficiency statistics are as follows:

CHART 2: IMPACT OF DEFAULT RISK – SCENARIO ANALYSIS

CASE	SOURCE EUI CHANGE FROM BASECASE (%)	SOURCE EUI (kBtu/sf.yr)	DEFAULT RISK CHANGE (BASIS POINTS)	DEFAULT RISK CHANGE FROM TREPP AVG (%)
2A Baseline	-	172	-	-
2A Poor practice	+32.5%	228	+90	+11.2%
2A Good practice	-16.5%	144	-57	-7.2%
2A Low asset efficiency	+0.8%	173	+3	+0.3%
2A High asset efficiency	-20.3%	137	-72	-9.0%
2A Weather 2001-15 high	+1.4%	174	+4	+0.6%
4A Baseline	-	169	-	-
4A Poor practice	+41.7%	239	+111	+13.9%
4A Good practice	-12.2%	148	-41	-5.2%
4A Low asset efficiency	+2.1%	173	+7	+0.8%
4A High asset efficiency	-15.6%	143	-54	-6.7%
4A Weather 2001-15 high	+0.8%	170	+3	+0.3%

Summary

The results of this study highlight the potential importance of taking energy efficiency and price risk into account when developing risk evaluations of new mortgage originations. Looking ahead, the project team envisions that energy factors will be fully and routinely incorporated in commercial mortgage appraisals, which will accelerate demand for buildings with lower energy risk. LBNL and UC Berkeley's end goal over the next several years is to incorporate this process into industry standards. In the meantime, this research suggests that owners and lenders can benefit from providing data on energy costs (both historical and anticipated) and risks, and from accounting for energy efficiency when setting mortgage terms.

A link to the full report and related resources is here.

For inquiries about the data analysis conducted in this research, contact press@trepp.com or 212-754-1010.
For more information about Trepp's commercial real estate data, contact info@trepp.com

About Trepp

Trepp, LLC, founded in 1979, is the leading provider of information, analytics and technology to the CMBS, commercial real estate and banking markets. Trepp provides primary and secondary market participants with the web-based tools and insight they need to increase their operational efficiencies, information transparency and investment performance. From its offices in New York, San Francisco and London, Trepp serves its clients with products and services to support trading, research, risk management, surveillance and portfolio management. Trepp is wholly-owned by dmgi, the information publishing division of the Daily Mail and General Trust (DMGT).