SRE Economics Lecture 9

Financing Sustainable Real Estate at the Asset Level

Siqi Zheng

(MIT Center for Real Estate)

Course Structure – after Spring Break

ECONOMICS	BUSINESS	DESIGN	PANELS + Final Project
ECON 1-2 Green Buildings	BUS 1 Winthrop Center	**DES 1 Building and Urban Design Strategies**	**P 1 Green Transition and Data Strategy**
ECON 3 Healthy Buildings	BUS 2 425 Park Ave	**DES 2 Operation and Data Management**	**P 2 ESG Performance**
ECON 4 Green Cities	BUS 3 EDGE	**DES 3 Process and Modeling**	**Final Project**
ECON 5-7 Climate and RE	**BUS 4 Taurus**		
ECON 8 Policy	**BUS 5 Boston Properties**		
ECON 9 Asset-level Financing			
ECON 10 Portfolio-level Financing			
ECON 11 Broader capital market			

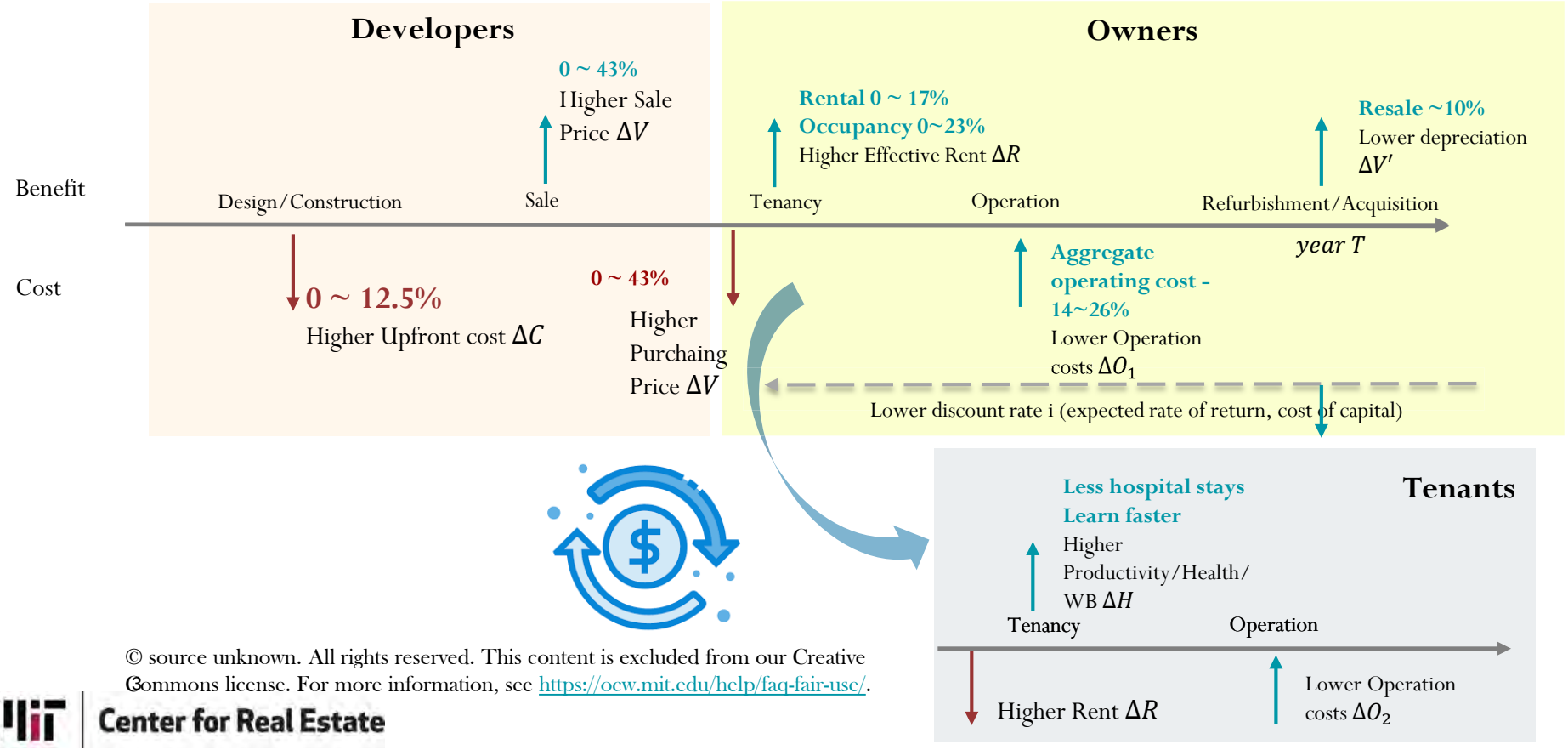
Carlos Davila (guest-instructor)

Environmental Performance Director at KPF New York

Charles Steelman (guest-instructor)

MSRED 2016 Graduate, MIT; Co-Founder and Partner, Cobalt Development Partners

Is There a Business Case for Sustainable RE?



Outline

- Big picture: Sustainable finance + RE

- Debt: Mortgage markets
  - Mortgage markets and climate risks (-) : default risk and securitization
  - Mortgage markets and sustainable buildings (+): default risk and green mortgages

- Equity: Private equity funds for sustainable real estate

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LARRY FINK'S 2020 LETTER TO CEOS

A Fundamental Reshaping of Finance

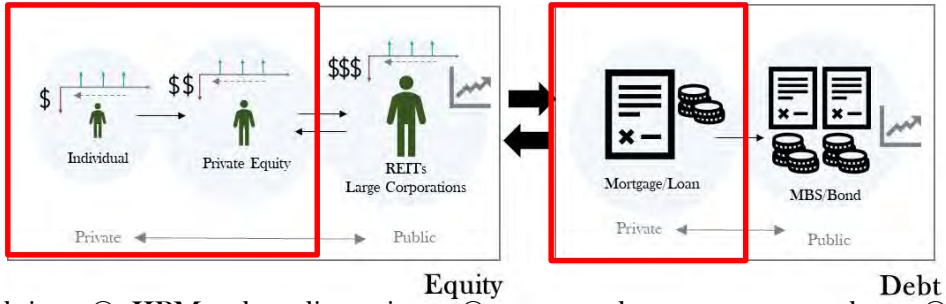
Dear CEO,

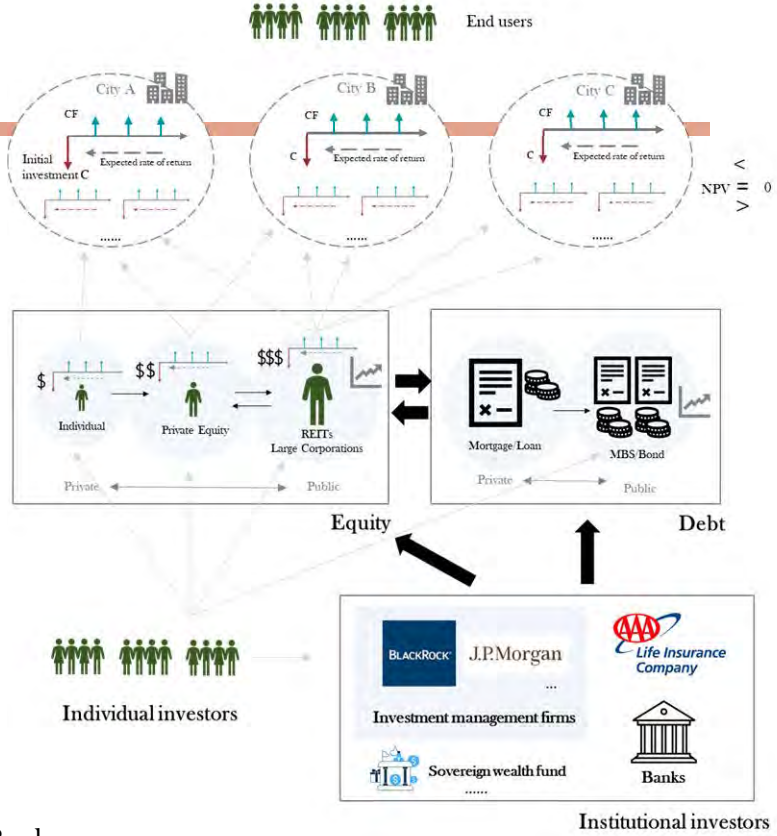
As an asset manager, BlackRock invests on behalf of others, and I am writing to you as an advisor and fiduciary to these clients. The money we manage is not our own. It belongs to people in dozens of countries trying to finance long-term goals like retirement. And we have a deep responsibility to these institutions and individuals – who are shareholders in your company and thousands of others – to promote long-term value.

Big Picture

- Where we are for this class?

  Asset level financing!

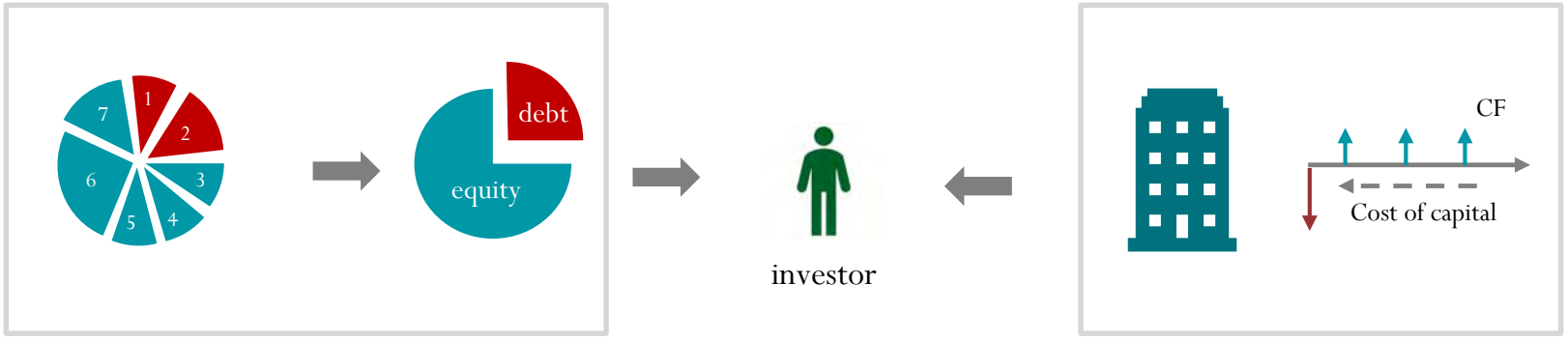




	Private	Public
Equity	• Private Property Assets • PE	• REITs • Stock
Debt	• Mortgage • Loan	• Bond • MBS

r = WACC (weighted

Capital Market ⟷ Space Market



$$\bar{r} = \sum_{i=1}^{n} r_{c,i} \quad \begin{matrix} < \\ = \\ > \end{matrix} \quad r_{market}$$

(YES) / (NO)

Cost of capital
(capital's requirement)

Market fundamentals

$$NPV \quad \begin{matrix} < \\ = \\ > \end{matrix} \quad 0$$

(NO) / (YES)

Cost of capital in real estate investments

- **WACC (weighted average cost of capital)** describes the required return associated with an investment.
- The investment capital consists of a **debt** share and an **equity** share:

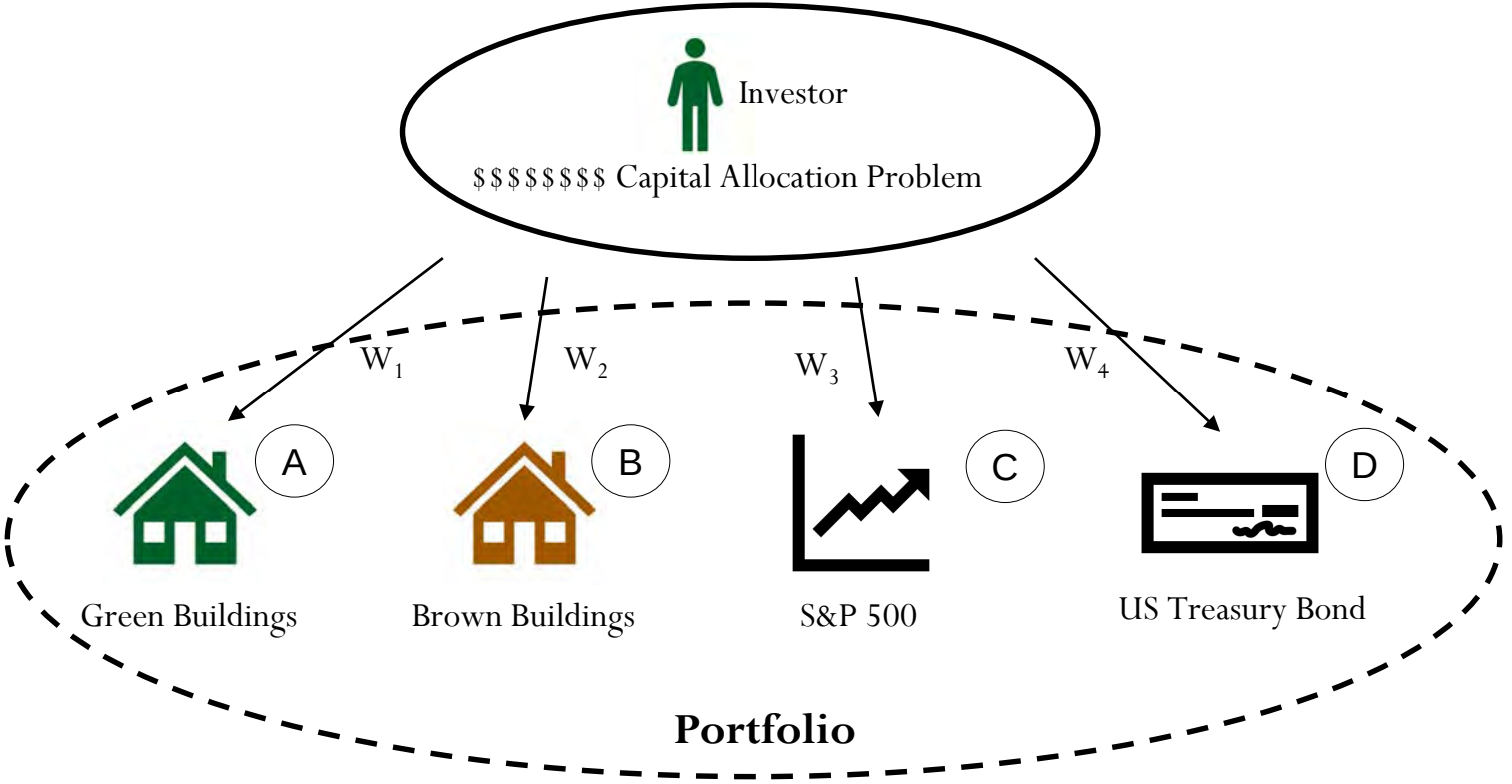
  Investment = Debt + Equity

  Cash Flow = Debt Cash Flow + Equity Cash Flow
- In the WACC formula, the return to each component is simply weighted by that component's share of the underlying property asset value:

$$r_p = (LTV) * r_D + (1 - LTV) * r_E$$

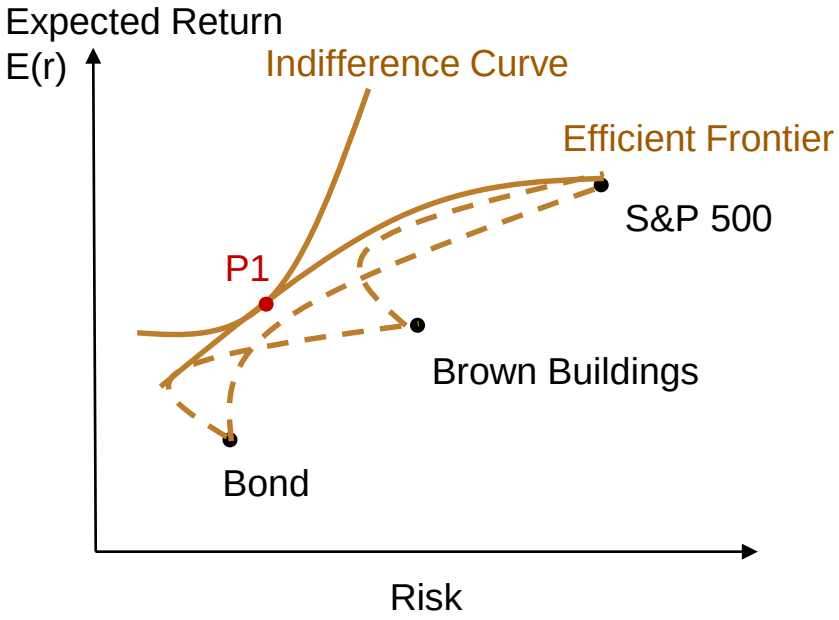
$\bar{r}$ is the required return on the underlying property free and clear;
r_D is the return to the debt on the property;
r_E is the return on the levered equity in the property;
LTV is the loan- to-value ratio: L/V

A Simplified Framework for Sustainable Finance (1)



A Simplified Framework for Sustainable Finance (2)

Portfolio Theory – when there is no green building



Efficient Frontier: Risk/return possibilities associated with the set of all possible efficient (i.e., undominated) portfolios. -- No other possible portfolios to the northwest

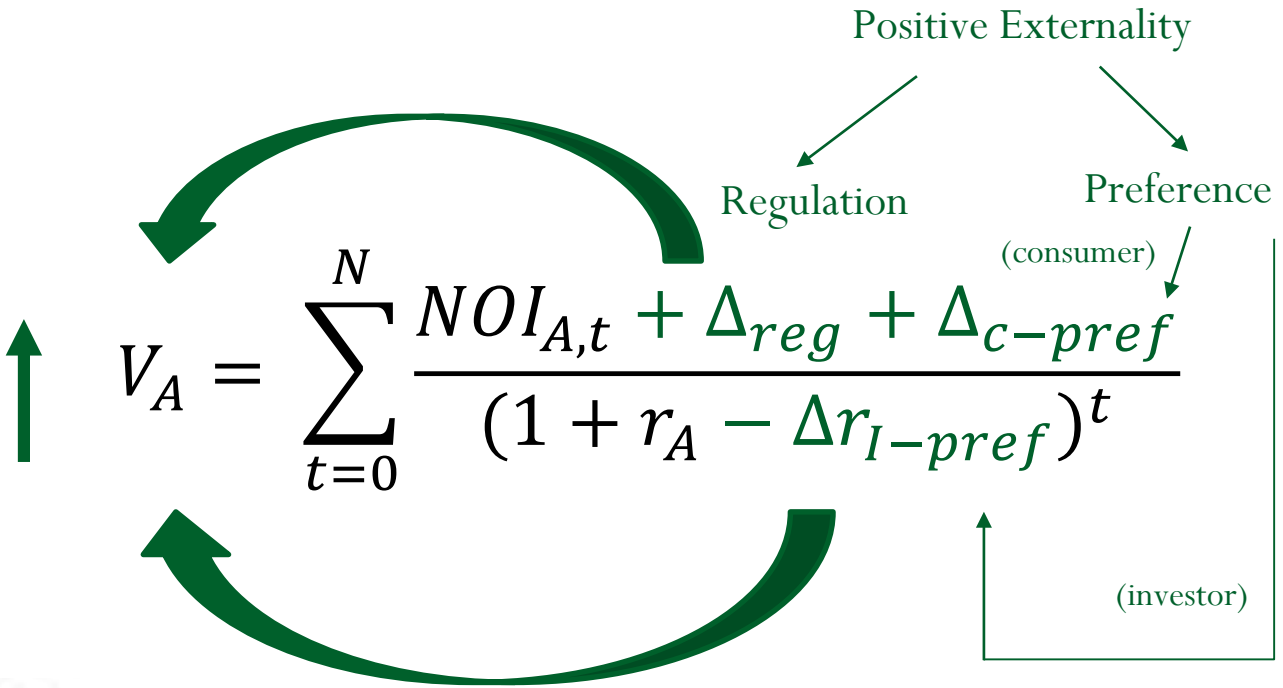
Maximum Risk/Return Indifference Curve: Measure investor preference.

P1: Equilibrium allocation of capital.

$$P1(W_1^1=0\ ,\ W_2^1,\ W_3^1,\ W_4^1)$$

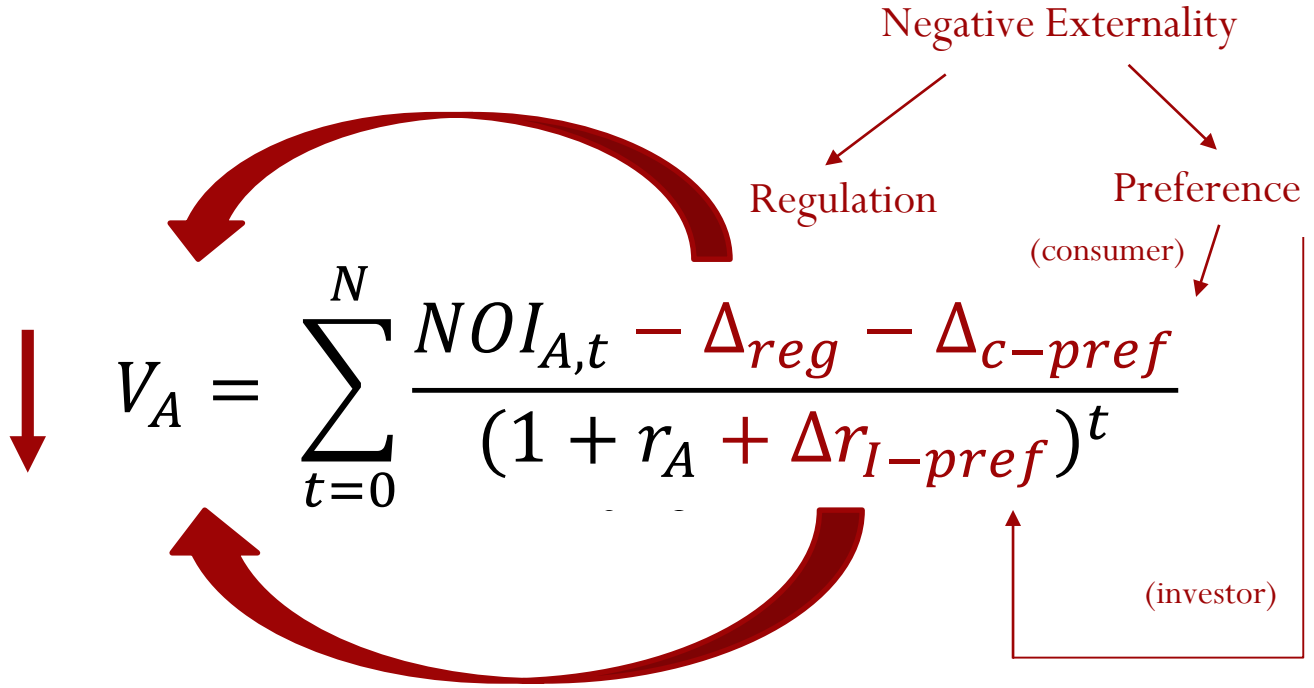
A Simplified Framework for Sustainable Finance (3)

Think about Asset A (**Green Building**)



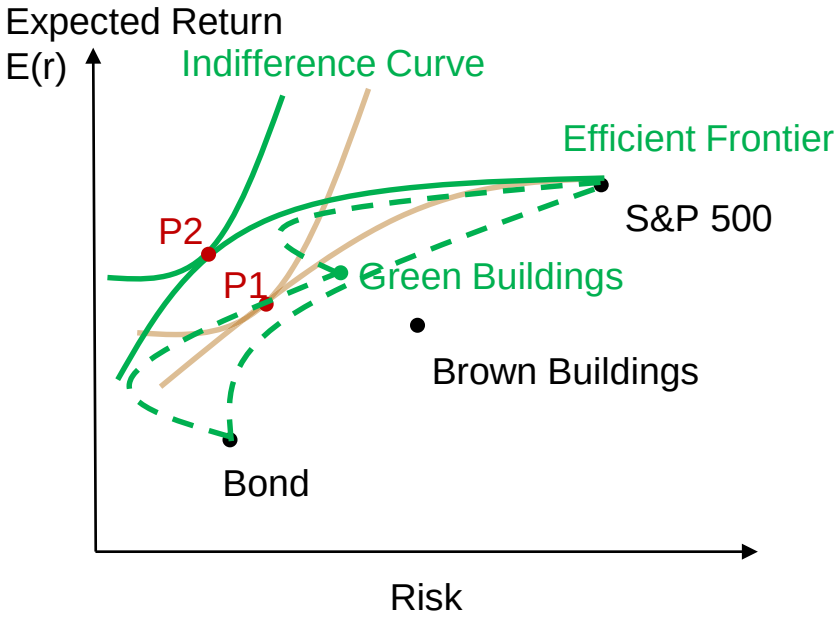
A Simplified Framework for Sustainable Finance (4)

A reverse example: **Brown** building or buildings in **floodplain**.



A Simplified Framework for Sustainable Finance (5)

Portfolio Theory



Brown buildings are dominated by green buildings (higher risk and lower return).

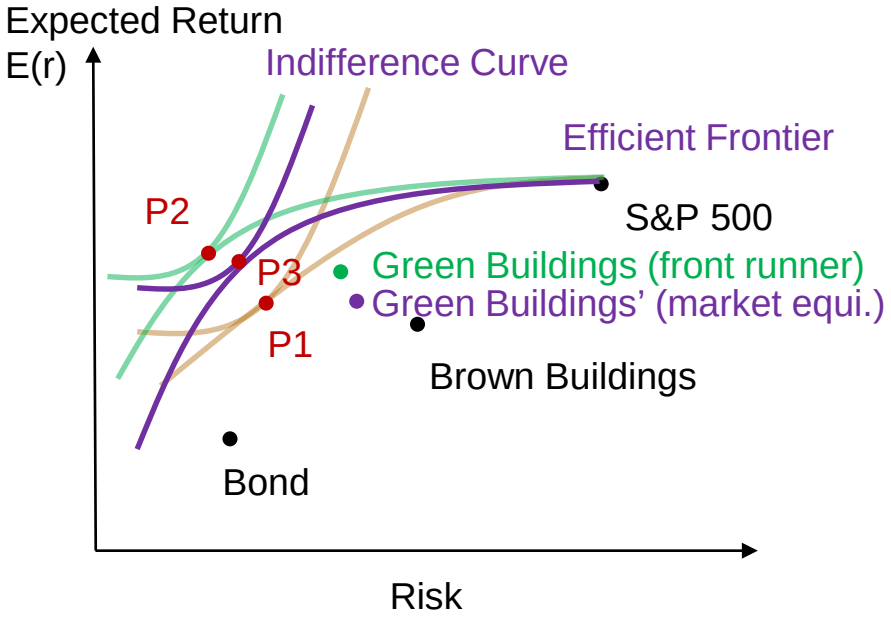
P2: Equilibrium allocation of capital for the front runners in green building investment.

$$P1(W_1^2, W_2^2, W_3^2, W_4^2)$$

Where $W_2^2 < W_2^1, W_3^2 < W_3^1, W_4^2 < W_4^1$.

A Simplified Framework for Sustainable Finance (6)

Portfolio Theory



Increased demand for green building reduces its equilibrium expected return.

P3: Equilibrium allocation of capital in the final market.

$$P3(W_1^3, W_2^3, W_3^3, W_4^3)$$

Where $W_1^3 < W_1^2$, $W_2^3 > W_2^2$, $W_3^3 > W_3^2$, $W_4^3 > W_4^2$.

Real Estate Investment Vehicles

There Are Multiple Ways to Invest in Real Estate beyond Buying a Building

	PRIVATE	PUBLIC
EQUITY	• Private property assets • Private equity (PE) fund	• REITs • Corporate stock
DEBT	• Loans • Mortgages	• Debt securities (MBS) • Corporate RE Bonds

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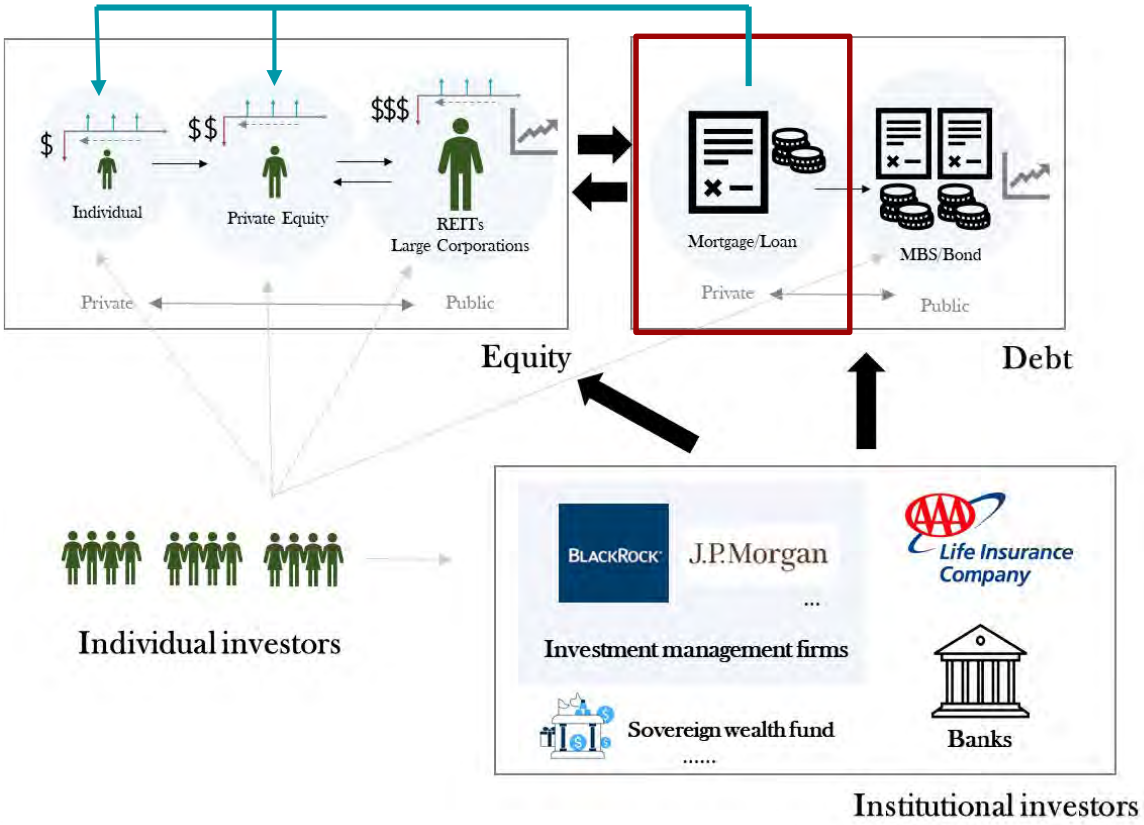
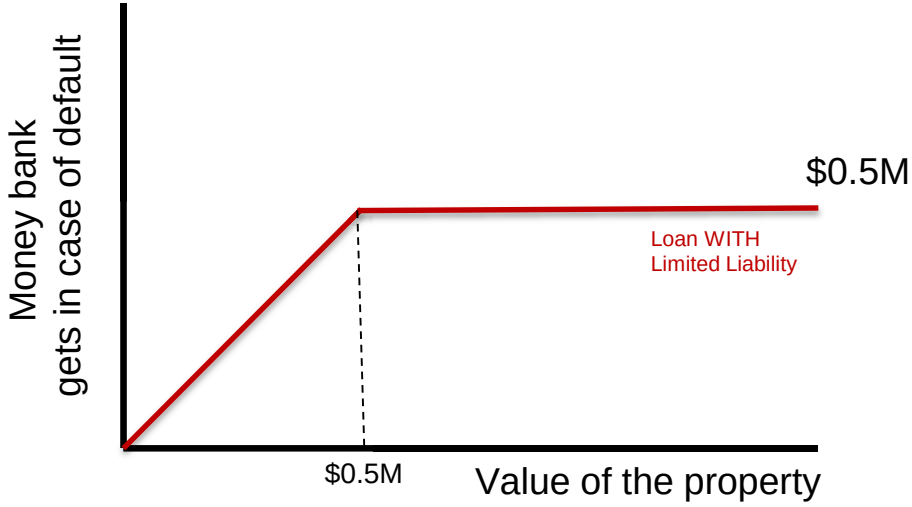
Debt Financing of Sustainable Real Estate (asset level)



Climate Risks in Mortgage Markets

How do we evaluate risks in mortgages?

- Delinquency: Failing to make payments as required in the loan documents.
- Default risk: You do not pay back your mortgage. The bank gets the house as collateral, the bank has to sell it, with the risk of losing money



Source: https://www.sciencedirect.com/science/article/pii/B9780124017436000020#f0025

Climate Risks in Mortgage Markets

How do we evaluate risks in mortgages?

Impacts climate risk on households and housing markets:

- Local labor market

  Health: Higher mortality/morbidity rate.

  Income: Lower productivity.

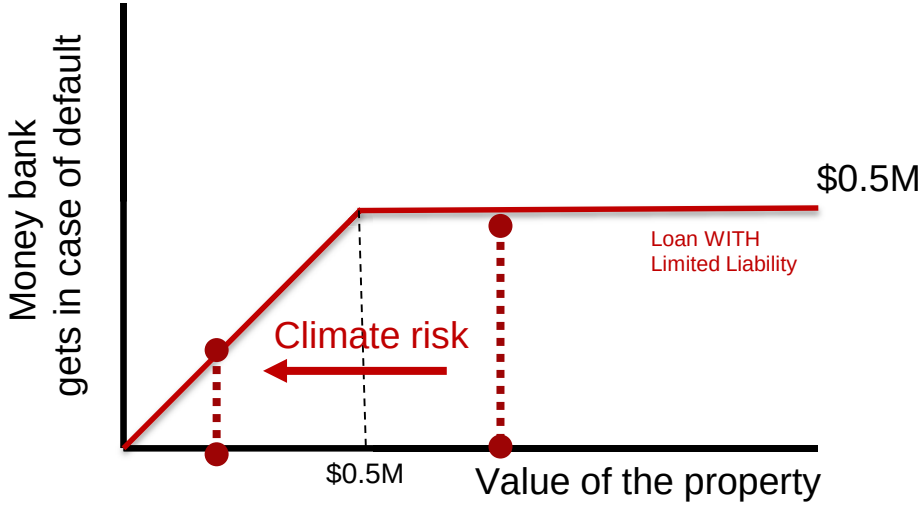
- Local quality of life

  Lower subjective well-being because of air pollution, extreme temperatures, and disasters.

- Lower demand for real estate

  Higher migration away from the area.

  Lower rent, occupancy, and real estate prices.



Source: https://www.sciencedirect.com/science/article/pii/B9780124017436000020#f0025

Climate Risks in Mortgage Markets

Impact of wildfires on mortgage default and delinquency

- Comparison of mortgage performance in fire zones (the treatment group) with that in 1- and 2-mile rings around the fire.
- After a fire, the probability of **delinquency/default increases by 1.03%** in the treatment group.
- Those increases are larger in small fires where insurance are less coordinated.

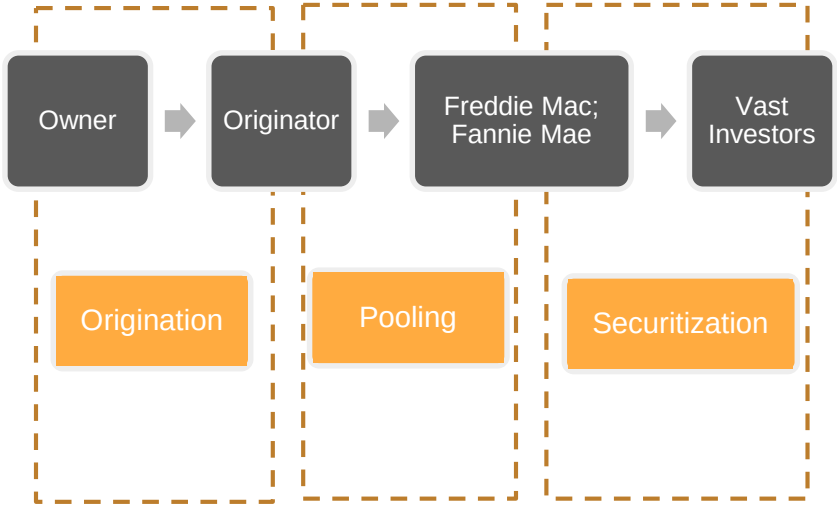
Figure 1: **Wildfires in California from 2000 to 2018**

Source: http://www.freddiemac.com/research/insight/20200910_unravelling_perceptions_of_flood_risk.page?

The Impact on Freddie Mac and Fannie Mae

What is the impact on Freddie Mac and Fannie Mae?

- Hurricane Harvey resulted in significant home price discounts inside the 100-year floodplain.
    - Before Harvey, homes inside the flood zone in Harris County, which is home to Houston, sold for 2.3 percent less than those outside the area. After Harvey hit, that discount more than doubled to 5.5 percent.
- Fannie Mae and Freddie Mac, the government-sponsored, taxpayer-backed enterprises that stand behind roughly half of the nation's $11 trillion in residential mortgages.
    - Their willingness to purchase the loans on homes provides local lenders with a steady flow of cash to invest in the community.



FannieMae

FreddieMac

Climate change threatens U.S. mortgage market

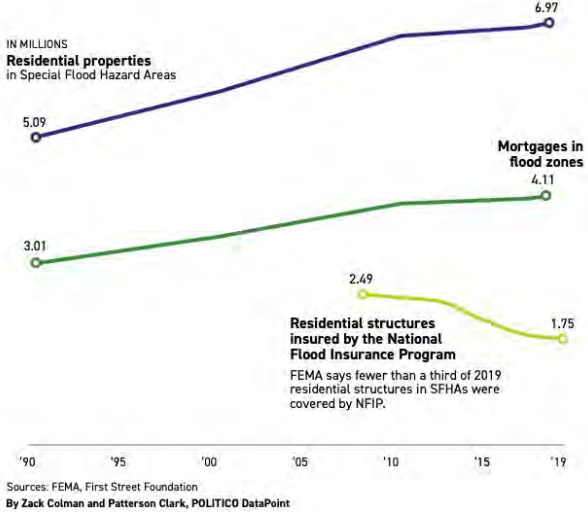
Are we creating a new housing bubble?

- Fannie and Freddie rely on another government enterprise, the **National Flood Insurance Program**, to cover the cost of flood damage to homes with their mortgages.

- The flood insurance program itself is insolvent after years of paying out more than it collects. Homes in flood plains are **overvalued by $34 billion** because homebuyers don't fully price in the high risk of climate-related disasters.

- Mortgage in floodplains are rising steadily from 2006 to 2018:
  - Nearly 600,000 houses were built in 100-year floodplains, bringing to 7 million homes
  - 300,000 mortgages were added to homes in floodplains, bringing the total number of loans to 4.1 million.

- However, insurance policies in floodplains shrunk:
  2.5 million residential structures insured in 2008.
  Which had fallen to fewer than 1.8 million in 2019.



SUL Research: Climate Risk and Appraisal Values

How climate risks lead to mis-valuation of single-family homes in climate-vulnerable neighborhoods in the appraisal process

- **Step 1**: comparing the appraisal value of homes under high climate risk with homes with low risk and otherwise similar attributes. By comparing the "climate risk discount" in the appraisal value and in the transaction value, we can examine how climate risks affect the deviation of appraisal value to the transaction value, i.e., **appraisal bias**.
- **Step 2**: studying the heterogeneity in the appraisal value difference regarding information provision, actual climate shocks, and neighborhood attributes.

Data:

1. Appraisal record and transaction record
2. Climate risk/shocks data
3. Regulatory and socio-economic data

Team: Siqi Zheng (MIT), Nils Kok (UM), Juan Palacios (MIT/UM), Dongxiao Niu (UM)

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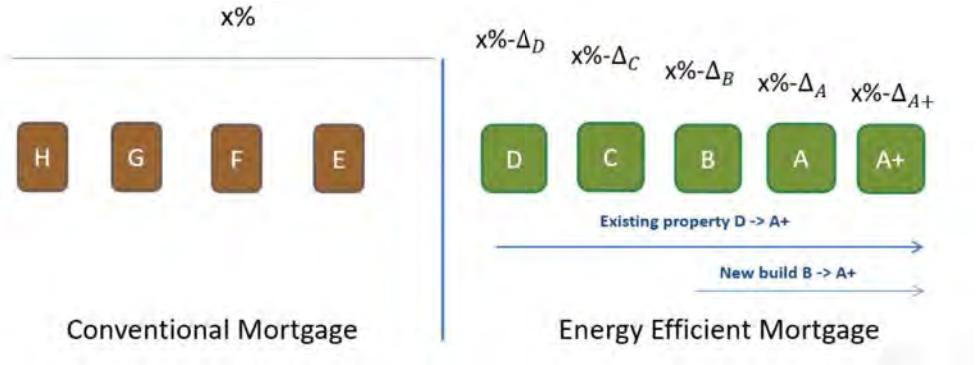
Role of green financing

What is a green mortgage?

- As an incentive for the borrower to either buy a green building or to renovate an existing one to make it greener.
- The bank would offer either a lower interest rate or an increased loan amount.

Why are lenders interested?

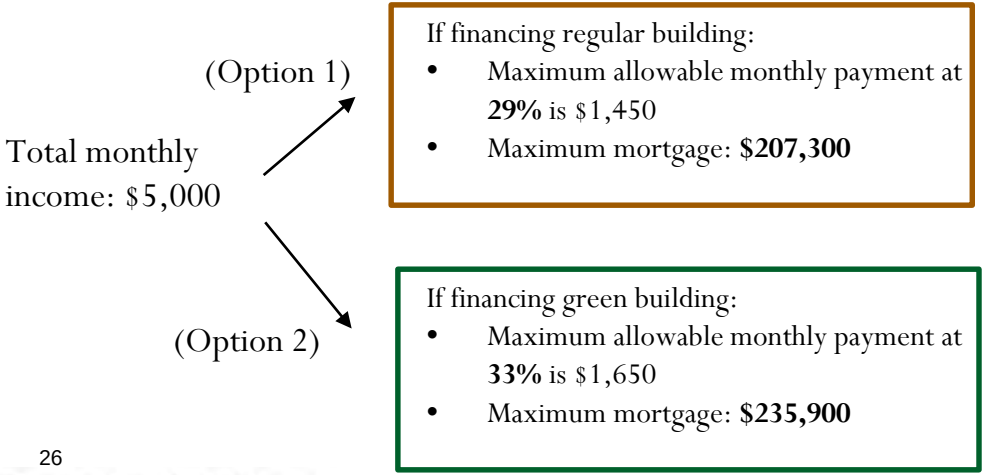
- Lower utility bills for households: The borrower is in a better financial position to be able to repay their loan, reducing the 'probability of default'.
- Green premiums (vs. brown discount): Decrease in loan-to-value ratio.



A real example

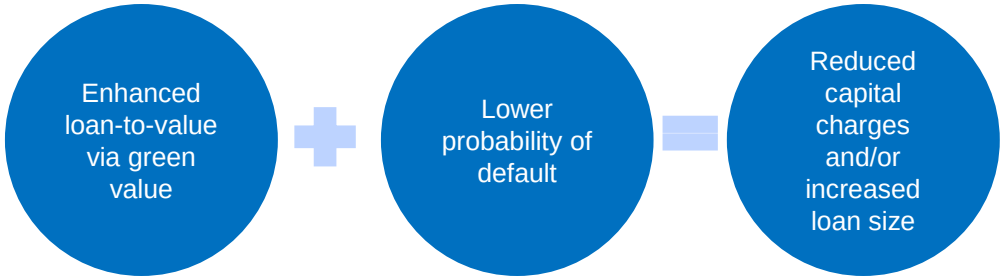
Real-world Example:

Home buyers in the US go to a bank to get mortgage. They find that they might be able to use **FHA's Energy Efficient Mortgage (EEM)** to finance their purchase.



Require a **Home Energy Rating System (HERS) report** from trained Energy Rater (cost $300-800).

Rationale of green financing



Retrofitting impacts positively on property value ensuring **wealth conservation** & **loss mitigation** by preventing "brown discount"

EE leads to a reduction in the impact of energy costs to income, reducing borrowers' **probability of default**

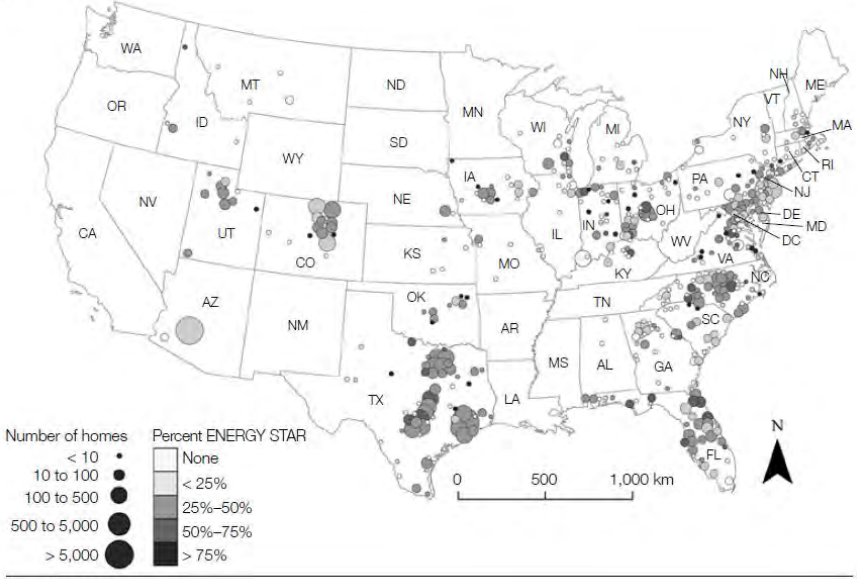
Mortgages & Sustainability: Homes

Energy Efficiency and Mortgage Performance. Evidence from US

- Research Question:
  Energy Efficiency → Default Risk
- A national sample of 71,000 loans from CoreLogic (38 states and the District of Columbia)
- Results:

  Energy Efficient houses are one-third less likely than those non-energy efficient houses to default.

Geographical Distribution of the Sample (ENERGY STAR and Non-ENERGY STAR Homes)



km = kilometers.

Mortgages & Sustainability: Homes

Why are green buildings less risky? Improvement in borrower's income

- Research Question:
  Energy Efficiency → Default Risk
- Results:
  - Energy efficiency is negatively related to default risk.
  - Effect size larger for low income people.
- Mechanisms:
  Improvements in building performance helps to free-up the disposable income of households.

Table 5 This table presents logit regression estimates to determine the propensity to default on mortgages backed by energy efficient buildings

Dependent variable: Default dummy	(1)	(2)	(3)	(4)
EE (A/B rating)	−0.7150***	−1.3408*	−1.6523*	−1.6523**
	[0.0966]	[0.7977]	[0.8515]	[0.7319]
Current LTV		2.4457***	2.8159***	2.8159***
		[0.3838]	[0.4403]	[0.4080]

Dependent variable: Default dummy	(1)	(2)	(3)	(4)
IncQ1×EE	−0.1806	−1.1425	−1.4613*	−1.4613*
	[0.1956]	[0.8148]	[0.8689]	[0.7566]
IncQ2×EE	−0.5048***	−1.3979*	−1.7147**	−1.7147**
	[0.1718]	[0.7936]	[0.8469]	[0.7330]
IncQ3×EE	−0.7319***	−1.4155*	−1.7450*	−1.7450**
	[0.1575]	[0.8531]	[0.9272]	[0.8224]

Left to right: increasingly stringent controls and FEs.

Billio, M., Costola, M., Pelizzon, L. et al. Buildings' Energy Efficiency and the Probability of Mortgage Default: The Dutch Case. J Real Estate Finan Econ (2021). https://doi.org/10.1007/s11146-021-09838-0 .

Mortgages & Sustainability: Commercial RE

How do green mortgages perform after securitization?

- Research Question:
  Green certification → default rate in commercial mortgage-backed securities (CMBS) market.

- Method:
  Compare default risk of the same loans before and after their collateral buildings became green + cross-sectional differences between green and non-green buildings.

- Results:
  - Energy Star buildings have 35% lower default rate than other buildings
  - Buildings that were ever LEED had a 54% lower default rate than others.
  - Those that were ever both Energy Star and LEED had the lowest default rate of all; nearly 61%

Table 4 ■ Default rate differences for loans on certified/noncertified buildings after controls: logit model results.

	Modeled Difference in Default Rate			
	Model 1	Model 2	Model 3	Model 4
Energy Star	−0.423*** (−34.5%)			
LEED		−0.773*** (−53.8%)		
Energy Star or LEED			−0.417** (−34.1%)	
Both Energy Star and LEED				−0.929*** (−60.5%)
Control variables	Loan characteristics, building characteristics, nearby public transit, MSA-fixed effect and vintage-fixed effect.			
Model pseudo *R*-square	0.159	0.159	0.159	0.160

Notes: (1) Results from Logit models where the dependent variable is default or not during the life of the loan (up to the data collection point); (2) The list of control variables includes dummy for public transit within 1/4 mile of the building log loan balance, origination LTV, origination occupancy rate, amortization term, maturity term, property value per sq. ft., age of the building, MSA-fixed effect and vintage-fixed effect; (3) ** for $p < 0.05$ and *** for $p < 0.01$.

An, X. and Pivo, G., 2020. Green buildings in commercial mortgage-backed securities: The effects of LEED and energy star certification on default risk and loan terms. *Real Estate Economics*, *48*(1), pp.7-42 .

Mortgages & Sustainability

Why are green commercial buildings less risky?

1. Higher operating income: Higher rents or lower maintenance costs should lead to higher Debt Service Coverage Ratio (DSCR) and therefore default

$$\text{DSCR} = \frac{\text{Net Operating Income}}{\text{Total Debt Service}}$$

2. Lower default risk from green buildings could also come through an improved equity position or LTV channel (lower cap rates)

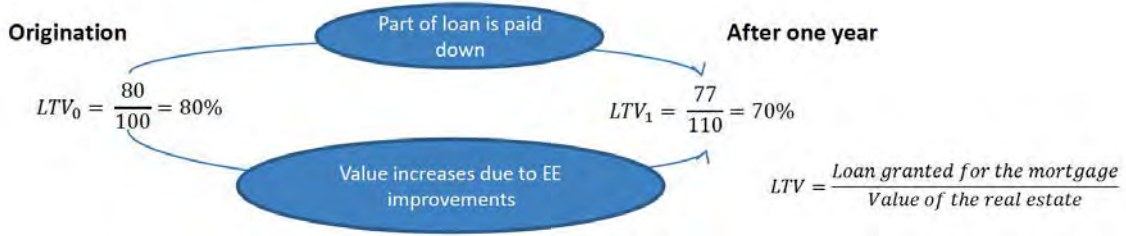
- Green buildings had property value appreciation higher than normal buildings

An, X. and Pivo, G., 2020. Green buildings in commercial mortgage-backed securities: The effects of LEED and energy star certification on default risk and loan terms. *Real Estate Economics*, *48*(1), pp.7-42

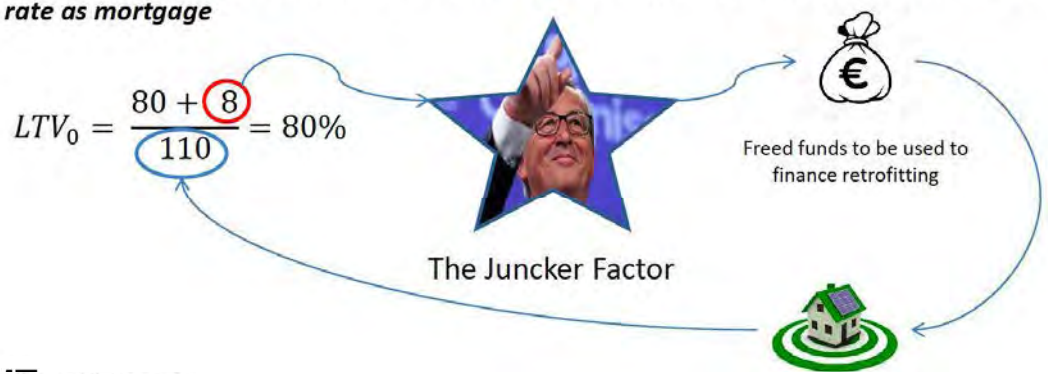
Mortgages & Sustainability

Impact of energy efficiency on LTV

1. LTV Calculations with and without "green value"



2. LTV remains at 80% & consumer receives additional funds for retrofitting at same interest rate as mortgage



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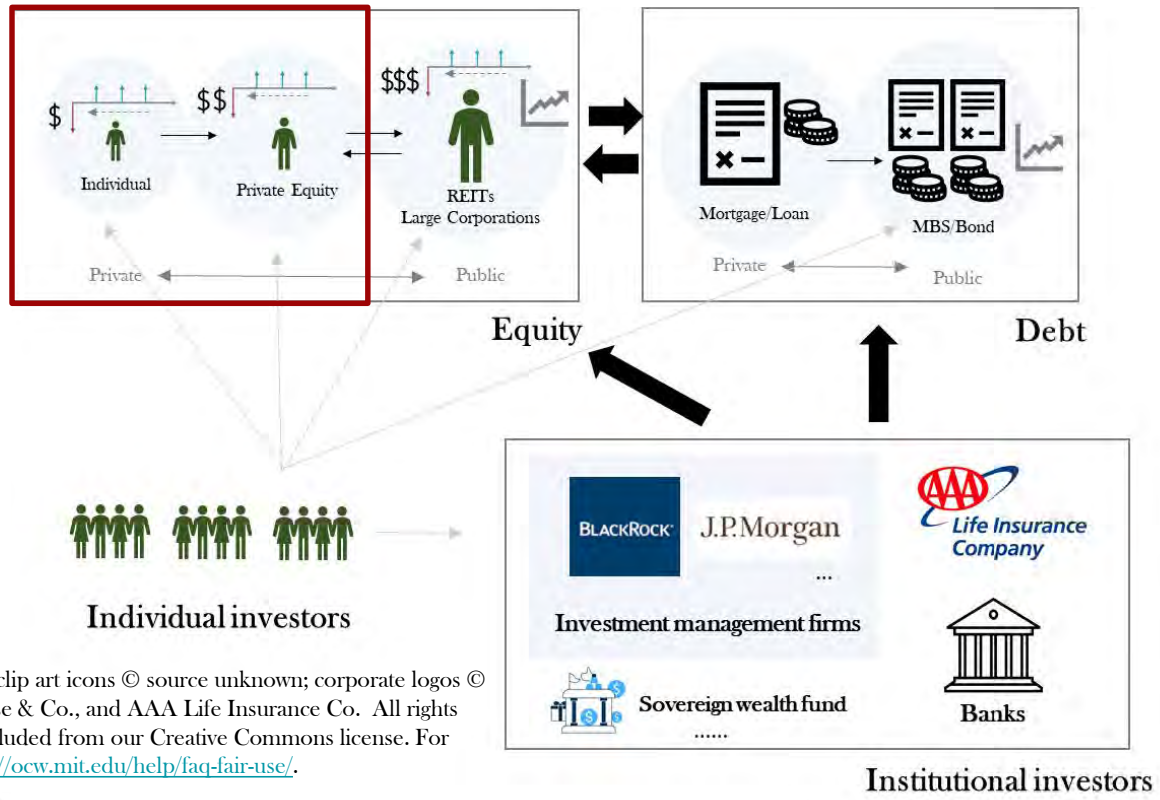
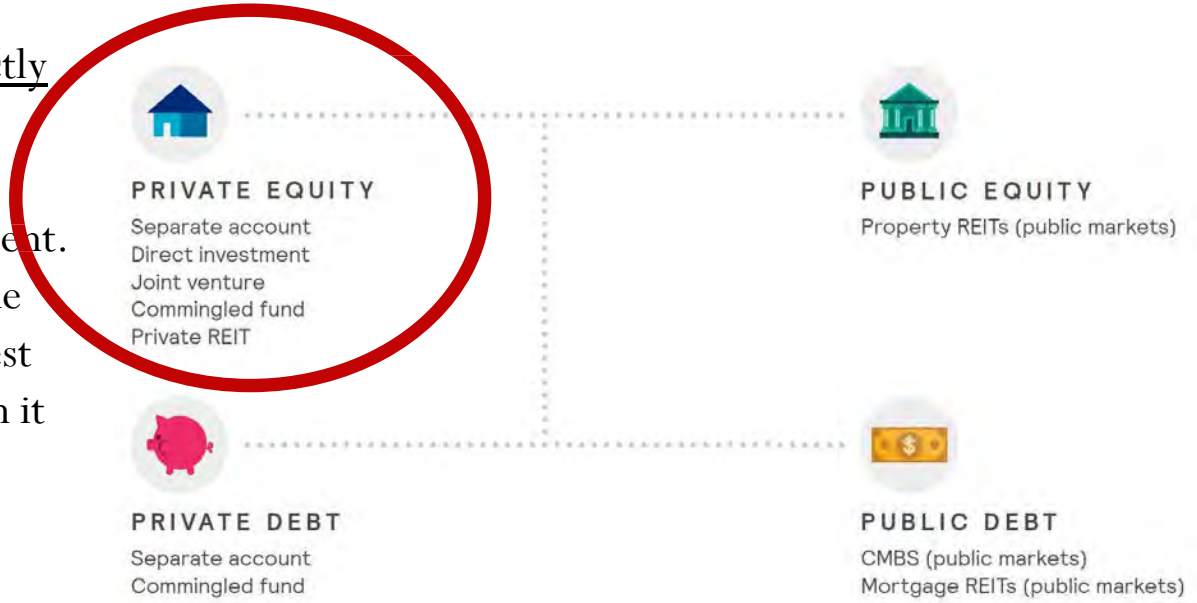
Equity Financing of Sustainable Real Estate (asset level)



Basics of Real Estate Private Equity

- Acquisition of property directly or indirectly.
- It is a private, equity investment. It is not publicly traded on the stock market nor does it invest in debt instruments, although it can take on debt against the underlying assets.



Basics of Real Estate Private Equity

Indirect investing – two types:

- **Commingled Fund** – many investors (LPs) collectively provide the vast majority (80-100%) of the equity through a variety of potential legal structures and the manager (GP) typically co-invests (5-10%) in the fund, while also earning asset management fees.
- Private REIT - same legal and corporate structure as public REITs, but shares are not registered with the SEC and therefore are not publicly traded.

Direct investing: Typically done by large, institutional investors who need to invest at-scale and are prepared to make targeted asset-by-asset investments. Three types: fully direct; separate account; joint venture.

Open Ended vs. **Close Ended**

The Role of ESG in PE Investment

- Conventional wisdom: "*Doing well by doing good*"?
  ESG is broad and amorphous, notoriously hard to define! And making a better world is not a common business rationale.

- "*ESG isn't about doing good for good's sake; it's about recognizing what customers really want and turning that into a strategy that* ***creates tangible value***."
  (source: https://www.bain.com/insights/esg-investing-global-private-equity-report-2021/)

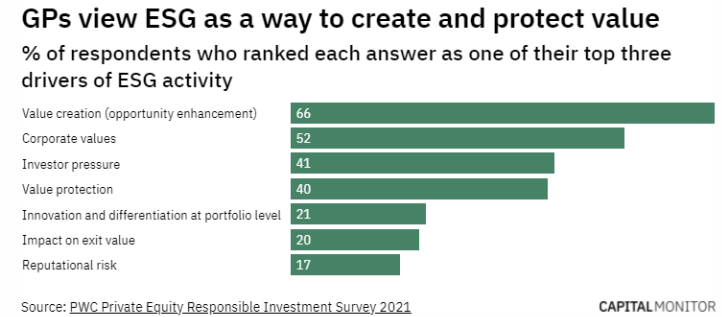
The Role of ESG in PE Investment

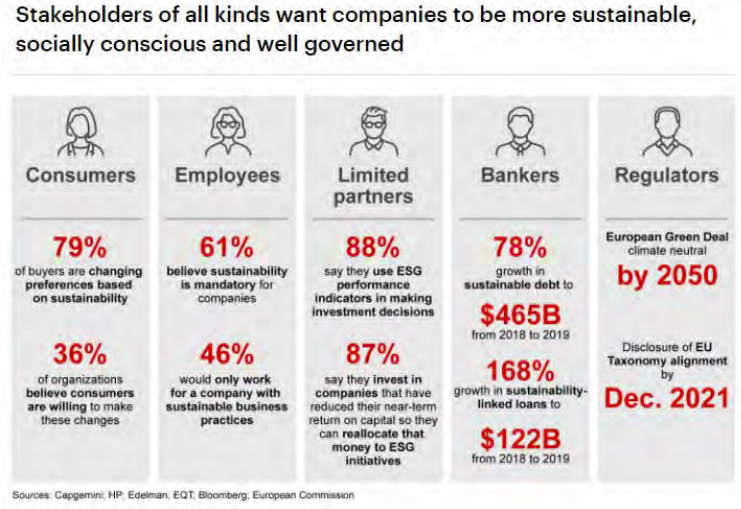
"Carrots": Value Creation.

- **Customer**: Grab market share.
  79% are changing preferences based on sustainability.
  Differentiation.

- **Employee**: Attract talent + loyalty.
  61% believe sustainability is mandatory and nearly 50% only work for a company with sustainable business practices.

- **Limited Partner (LP):** Get (cheaper) capital.
  Financial world views ESG = less risky. 88% of LPs globally use ESG performance indicators in making investment decisions. Can lower cost of capital.





CBRE Report: REPE's focus on ESG

- 60% of respondents to CBRE's 2021 Global Investor Intentions Survey stated that they have already adopted ESG criteria as part of investment strategies.

CBRE Investment Management

Investment benefits of sustainable assets:
-5% operating cost, +4% occupancy, +5% rental income, +14% sales price, -50bps yield

Due Diligence:

(1) **Questionnaire** asking transaction team to fill in environment related information (Energy, Carbon Footprint, Pollution, etc.)
(2) ESG team to run the **CREEM** model for carbon
(3) Benchmark against **GRESB** results for energy intensity

Acquisition:

(1) One slide on ESG in the **investment memo**.
(2) Prefer certified asset with little **physical risk**.
(3) Have a grasp of **Capex to mitigate risks**.

Asset management & Disposition:

(1) **Decarbonization audits** for asset level planning
(2) Coordinate the timing of retrofits to minimize disruption
(3) Hold and sell decisions are made with consideration of the **decarbonization Capex** required

PE team at Harrison Street

HARRISON STREET

ESG enhance the value of the building asset and increase the investor base.

Acquisition:

(1) Dedicated session on ESG in the **investment memo**.

(2) Evaluation through 3rd party. With asset manager for **retrofit potentials.** (smart meters, solar potential, etc).

Due Diligence:

(1) Checklist (questionnaire) to JV partner (GP)
ESG personnel; ESG program; Physical & transition risk assessment; Building certification; Renewable energy, etc.

(2) Mitigation plan if climate risks exist.

Asset management & Disposition:

(The firms (LP) doesn't operate the building, but do JV partner or 3rd party operating partner.)
Capture ESG practice as part of the marketing material when selling. E.g., LEED certificate, social programs.

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Akrisht Pandey's Real Estate Private Equity