[SQUEAKING]

[RUSTLING]

[CLICKING]

SIQI ZHENG: This class is the finance class to Finance Real Estate as an Asset Level. And then basically we recap. I think you are very familiar with this because it's also popped up in many, many of our sessions, and even in the midterm. So basically we are talking about the business case for sustainable real estate. For here we have green buildings, healthy buildings, and also climate-resilient buildings.

And in the mention of sustainable real estate, we know there is a chain process. So we have the developer, we have the owner, we have the tenants. We always see that the end users matter first. So that will be the tenants, the users of the space. If they really value this sustainable real estate, they are willing to pay a higher rent premium, either because of the lower operational cost of the lower energy bill or better indoor air quality and all the things.

And that will be translated to this rental premium for the owners, then later will be translated to the higher purchase price and to the developers. So at that time, we only look at the cash flow. We look at this, we understand rationale. We understand the benefit cost analysis. Now we need to understand capital.

So that's our finance, right? You only really need capital to build, to buy, to invest in those sustainable real estate. So that will be the focus of these three finance sessions is money, money, money. So that's the idea.

So basically, I want to cover three parts, if possible. And first is a big picture. So big picture, I want to first let you know what's the current status of the discussion, not just in real estate field, but also in the general finance field. So the general finance field now is an emerging very, very hot area, very new area called sustainable finance.

So then there's a general finance, sustainable finance. All the finance principles, how that will be applied to start a ESG and sustainability. And how we plug in, how we plug in real estate asset as one of the many, many assets into this sustainable finance big picture and how to think about this. So that's a big picture.

And then we will talk about the debt side, basically mortgage. That's mortgage. And mortgage and then equity side will be private equity. For the last part, I will try to invite our guest speaker today actually to talk about PE because I know little about PE, I know so little and you know more than me.

So basically, I think the birth of this sustainable finance field, in academia and also in industry, I think the early days was from 2020 when this Larry Fink, the CEO of the BlackRock, each year he wrote a letter. Each year he wrote a letter to his clients and all the asset managers. So in that year, 2020 letters to CEOs.

So his theme was a fundamental reshaping of finance. So he was one of the first business people who raised this point and say, OK, now we need to be very clear. Climate risk is a financial risk. So that's basically his main idea, the point of in his letter to all the other CEOs saying, we are, BlackRock, is an asset manager and is a fiduciary. And basically people, all our common people, will put money in the fund and BlackRock, they are managing the fund on behalf of these individual investors so that fiduciary responsibility. So we really, this is all the old people's pension fund-- not old people-- all our pension funds and later we need to use when we retire.

So we really have the clear, very important responsibility to look into the future risk. And we need to understand the financial climate risk is a future risk. We need to have a deep responsibility to better manage and control that climate risk. So from this letter, then it's a trigger to all these discussions, conversations, in the entry and later some research on this sustainable finance.

So think about how to plug in real estate in this big picture of the sustainable finance. So I showed this diagram from the beginning of our class to show you the layers. So it's a kind of a sandwich model. Remember sandwich. And this investor in the middle.

And then we talked a lot about the physical side before the midterm, before spring break. So that's the end users, the tenants and households. So those individuals. So they choose which city to live and work, and they choose which building to live and work in. And some are green and some are not green. So that is they choose in the physical city.

And then if they are willing to pay higher rent, then that building, that green building, will get more, like, higher return. So that's the upper side end users. And those people are also those people, the same people, all of us. So we have money, we have our salary, we have our 401K, all the money in the pension. So we put our money in this institutional investors insurance and all those managing firms like that.

And then they start to invest. They become giant guys, but their money is from us. That's why they call them selves as a fiduciary, right?

And then there are two roles, equity and debt. On the equity side, you have small guys, rich people, medium-sized guys, private equity, and the big guys, big company has the rates, and that you have more than the MBS. So anyway, those, our common people, we can invest directly into stock market. If we are rich enough, we are individual, or we also invest in private equity, or we just put money in our pension or insurance, and they will invest on behalf of us.

So they are in the middle. So this individual is all of us. If we have a preference for sustainable real estate, we will direct our capital to those investment firms and all those places that are more sustainable, greener. So the capital flow from the lower layer, the people's choice of the physical space, the upper layer, then they will push into the middle and push those investors to invest in sustainable real estate as an asset. So that's the big picture.

And today we are looking at small guys. Thursday, we look at a bigger guys. Today, the small guys means asset level, either an individual, wealthy family, family business, or private equity, on the equity side or the mortgage or the loan, individual loans. So that's an asset level financing.

So how to connect? The thing is, how to connect this side, physical side, before the spring break, and now the capital market side, the lower end money? So just want to show you a basic idea of this, how to connect capital market and space market. That's basically a four quadrant model. If Professor Albert Saiz taught this in real estate economics, a four quadrant model, we touched a little bit on that.

So that's a connection, that's a unique feature of real estate is in the middle, capital market and the space market. So we talk about lot of building. Cash flow is cash flow. Then we use the cost of capital as a discount rate to calculate net present value. So that's this side. So this is the investment asset. You can put money in this.

And then as an investor, the investor is looking at this building, that building, different buildings. So that's different buildings. They have different features of the risk and return. And this person, unless you are so rich, otherwise you need to raise fund. You need to go to the capital market to raise fund so that you can invest, right? When [INAUDIBLE] found, it's like you think about this, it's a pizza, it's a big pie.

And always you have some your equity, then you go to the bank to get loan, that's a debt, right? And equity even, like, you can still have many slices. And this person, that person, you put together money. So that's like several investors put together money and you go to several loans. So that's the combination of this.

So the idea is the following. The logic is very clear. The logic is the following. The investor, there's a two criterias, there is two sides of a coin. It's the same, equivalent, two sides of the coin. And so you go to this investor as yourself, this investor, go to the capital market to raise and these seven pieces. And then you will have a weighted average of cost of capital, which is seven pieces.

These are two banks and the five equity investors. And then you have a weighted average. Some of the banks, they require lower interest rate because they are debt and they require higher returns because their equity. So you have an average. So that's a capital requirement.

There are seven people behind this pie, and each of them, they have a required return. You go to them, this person go to the seven entities to ask for money. They say, OK, my required return is how much, how much, how much, right? So then you do a weighted average of your pizza. Then you have the cost of capital. That's from the seven people's overall requirement.

And then you compare that with this asset investment. This is the market, right? This is the market. This is an objective thing. This is the San Francisco Office. We can see it's so high. But maybe in Dubai or in Middle East, good. And so like that.

So this is a market demand, demand, supply, all the things, now you compare. If the cost of capital is larger than your market, no go, because you can only make this much of return. But your seven guys behind you asking for this, so you cannot afford. The cost is much higher than what you can make. So, no go.

And if this is smaller, then go. Why? Because you get money from the seven guys at this rate, and then you can make much higher return. So you can own your own money, you can make your own money. So that's on this side. That's the idea.

Or another way to think about this. OK, I raise fund from seven guys. I have a weighted cost of capital. Then I use this weighted cost of capital to discount my cash flow of this asset. Then I get NPV. Then if I get NPV, NPV is positive, go. NPV is negative, no go. So that's the same, two sides of the coin, as you learned from the basic 101 of the finance.

So that's basically just a weighted average. So I don't need to talk too much. OK, now we jump to sustainable finance and how to plug-in real estate into this thing. So this is very high level. This is a very simplified framework, but I think that's very useful for us to understand why we are talking about this, because we are talking about money. We are talking about now capital flow is not like buildings, but it's money.

So we need to have a broader will. We cannot disregard all we can invest about real estate. Not true. We have so many other alternatives. So think about this, now we have a portfolio. Everyone in the capital market, they have a portfolio.

Now I still simplify. It's like 1,000 of assets, maybe, on a menu, but now we only have this. We have the bond, relatively lower return, but lower risk, bond. Then we have stock market, higher return, higher risk. That's this. Then we have real estate.

So now think about real estate. In general, we can say, real estate, simplified. One is a brown building, the other is a green building, it's a traditional one, conventional one, or relatively sustainable one. So now the idea is, this investor has so much money, this may be BlackRock, and this may be a insurance company, or this is just some Ritz.

So this investor has so much money, then he need to sell. He need to sell. Well, capital allocation problem. He has so much money, to put which money on which, the capital flow. So that's basically the sustainable finance one to solve this problem is, the weights, W1, W2, W3, W4, altogether will be 100%. 100% of money to put in which, which, which, which.

So that's the portfolio theory that we learn from finance. So the key thing is, we just differentiate in the general thing, in the general, when you read David Geltner's textbook of real estate finance, you will see three things real estate stock bond as very three typical baskets. Now we just differentiate this real estate into two. One is green and the other is wrong. And then what will happen?

So basically the portfolio theory, suppose let's think about this step by step, right? Well, there's no green building. Like, 30 years ago, 40 years ago, at that time, no green buildings at all in the entire world. Then we have this space of the risk and return. We have this space of the risk and return space, and we put these three assets, at that time, no green building yet on this risk and return space.

We have this stock market index as SP500, we have a bond thing, and we have the building. So overall, the perception is like this. The order is like this. Bond is the safest. So that's a lower return, lower risk. And the stock is very high risk. And the building real estate in the middle. So that's the idea.

So we know from the portfolio theory that we have this efficient frontier. So this is a concave curve. So if you mix these two together, you have this. If you mix these two together, you have this. If you mix these two together, you have this. But if you mix three things together, you have this called efficient frontier, is the most, most northwest possibilities, the most northwest.

Northwest means higher rate and lower risk. So because always diversification is good. So it will reduce your risk and increase your return. So you mix them together in a certain weights, then you have this. This is the efficient frontier.

And this concave curve means on each point, you cannot find another possible combination of the three assets can go to the northwest. Northwest means better. It's not northwest, it means better. All the points on this efficient frontier, so-called undominated. So all the inside of this part, dominated. Always you can find a better one to go to here.

And then for the investors, you have the indifference curve. Now, this convex thing means the investors are indifferent on this. Also higher return and higher risk. So then you have a tangent point here. That's the optimal allocation of your portfolio money into this point, because in this point, you are indifferent, but then you see what's the best, the best combination of the three things. This tangent point here highers the return lowers the risk given the return, because no other point can be achieved beyond this.

So that's the idea. Then you just solve this. So that's the traditional portfolio theory.

AUDIENCE: In order to get to P1, how are you supposed to diversify the portfolio?

SIQI ZHENG: So then you use a formula to calculate W1, these three ways. Then you combine these three, then you get P1.

So think about now suddenly, it's not three assets, but then you plug-in a new asset, a new thing, which is a green building, which is a green building. Then think about this green building. This is totally brand new asset to the Wall Street, for example. At first, the investor didn't know anything about this. Then they suddenly have the fourth choice instead of three.

Then the investor are looking at this formula. You are so familiar with this. And how this knew how to price that asset, how to price that asset. Then we look at this formula, and then think about this. What parts in this formula will change if this is a true green, not greenwashing, true green asset? Please.

AUDIENCE: [INAUDIBLE]

SIQI ZHENG: All right. And a denominator. Which one? This part?

AUDIENCE: Right. [INAUDIBLE]

SIQI ZHENG: OK, will it go up or go down?

AUDIENCE: It'll go down?

SIQI ZHENG: Why?

AUDIENCE: Process safer, less risk.

SIQI ZHENG: Less risk. Yes. [INAUDIBLE]

AUDIENCE: NOI should go up.

SIQI ZHENG: Why?

AUDIENCE: Because if it's a true green building and there's not information [INAUDIBLE] our willingness to pay for an extra property.

SIQI ZHENG: Yeah, and other things. So, yes, that's true. So basically, it will say this. So the entire thing of the system of sustainable finance, now I'm talking about general. If you go to Sloan School, they have the sustainable finance, a small group. Now we are a part of that group to talk about sustainable real estate. But in general, the sustainable finance group, they are talking about externality.

So they say, traditional finance they don't consider externality, right? Now sustainable, we talk about externality. Now it's positive externality because this is green building. If it's a brown building, that is a negative externality.

Anyway it's because of the externality, this pricing equation will change. How that will change? So for this green building, just now we already talked about a lot about this. So we have regulation, for example, Local Law 97. All this Europe, that thing, say if you cannot reach like a Level E of the energy efficiency, you cannot lease out, this kind of regulation.

So which means compared to our conventional building, this green building will have a higher cash flow, NOI, right, because you can lease out. You can still lease out and you don't need to pay penalty. Then you compare it to the conventional one. You have this incremental income.

And then that's a regulation. That's true no matter whether you care about the environment or not. That's very clear. That's a very important distinction. The distinction is, no matter whether you care, whether you internally care about the society or the global thing, good or not, this is such a harsh thing. This is real. So no matter whether you are environmental, you are climate deniers or climate believers, no matter what, you will have this objective thing here.

And then another thing is preference. That one is subjective. Subjective means that depends on whether you really prefer whether you have that preference. So if you are consumer, like tenants, they really prefer, for example, they really think this is so important for their value or this is so important for their employees' health, all those things they prefer. So they are going to pay higher rent. So you will have other incremental positive saying.

And the investor, if you really from your heart, you really think that's so important and you understand from your investor fiduciary point of view that's less risky because think about long term, it's less risky. Later, the gas price will skyrocket and then the climate risk will be so high. So we understand this is such a safe investment. We are willing to accept a lower cost of capital or lower expected return. So that means this is a negative.

So altogether, we will change the formula in a way that the value, the pricing asset, pricing model value, will go up. Positive? Negative, it'll go up. So that's the fundamental thing of this sustainable finance. When they talk about this, they use a stock as an example. Now we are using a building as an example, but it is very similar, a stock like Tesla or a stock like that.

So you have this positive thing. You have this negative thing as a discount rate. Then you have your stock price go up. Now we have the building asset price go up.

Then think about the negative externality, like a brown building. You are so dirty. You make so much carbon emission or something like you are in a flood plan. You have the hurricanes. You have the flooding, like a Boston seaport, your final product. So in this way, we have the negative externality.

That's a similar thing, regulation, or penalty, or it's like you cannot lease out. You lose your revenue and no one wants to get here, then no one wants to lease, rent your space. All the tenants, they are fleeing your building. And then the investor is so bad as that, so risky, then have a risk premium. And then all those things say, go down.

So that's the key thing is how to plug in from the sustainable finance perspective is how to plug in this externality thing into this asset pricing model. Question?

AUDIENCE: Yeah. So is delta c then a preference, like separate variables?

AUDIENCE: [INAUDIBLE]

SIQI ZHENG: Customer. C, customer. Yes. So preference is two people, two groups of people. Customers, like tenants. They don't want to rent. All the investors, they don't want to buy because it's bad. Any questions?

OK, now think about this. At first, there were only three assets in the space. Now we have the fourth one with a new asset that all this portfolio thing is, there's so many assets, there's this new assets, and how the capital will like that asset will flow to that asset.

So then, as you know, the green building is superior to the brown building. It has lower risk. It has higher return. So it will be to the northwest, northwest, above the brown building. The brown building is here. Pushed to here. Northwest. Lower return. Lower risk, higher return here.

Then because one, two, three, four. Now four assets, money still that money, then you will push this efficient frontier towards that direction, northwest direction. This is the original one. Now it's here. Then of course, the investors will choose here and that will be combination, then you'll calculate the combination.

Then this green building will absorb capital, will absorb capital because it's a superior asset, absorb capital, which means money flow into that. So that's basically this, we call this brown building asset will be dominated by the green building because bad, worse. But this is not the end of the story.

This is like we are talking about the frontrunner, means the first, the first wave of the investors, the first investors who identify this good. It's a good asset. And then the initial several first wave of investors running into this green building asset and they allocate the capital. Julio.

AUDIENCE: Wouldn't you have a higher return on the brown building because you increased the hurdle rate and decreased the value? So the investment in the end would yield a higher return, right?

SIQI ZHENG: No, you cannot just increase by yourself. You need to raise fund from the market. So that's an equilibrium rate of return as your required return.

AUDIENCE: No, yeah. But on the previous slide, we were playing with the NOI and the [INAUDIBLE]. We said the hurdle rate for the brown buildings, which was higher, right?

SIQI ZHENG: Yes. So that means higher risk, right?

AUDIENCE: They added penalties as well.

AUDIENCE: But higher return, too, because you're decreasing the value. So ultimately, you're [INAUDIBLE]

SIQI ZHENG: No, if you think your asset holder, you are holding this and the value is going down, and you already bought that, and later the value goes down.

AUDIENCE: But for the next investor, it would be higher return on investment.

SIQI ZHENG: If you can do an arbitrage, right? No others want to pay that higher money to you.

AUDIENCE: All right.

SIQI ZHENG: So now this is the first of several we call the frontrunners who can make this actual return because they identify, they put the money into that. And then if there's so many new investors, all the investors just found out. It's no longer very new. And increased demand, all the capital want to flow into the green building, they will push down the equilibrium expected return.

So then the frontrunner will get some actual return for the first several information advantages and things like that. And then if later all the information is so transparent, so then you will go back a little bit, but not to go to the brown building point. It's still here. It's better still building better, but the market equilibrium will have a lower return, a lower risk. So that will go back a little bit.

So that is market dynamics, right? I don't know. For each market, it's not very clear now which market is in equilibrium. But overall, you are thinking like this. When some new asset first emerge, good, and push up, push to the northwest of this frontier. And then if too many capital, too many investors, and too much capital just flow into that asset, then you push back a little bit, but it's still better.

So that's the overall idea how to plug in sustainable real estate into this diagram. So you are thinking, when you invest in, where you are in this diagram and how you allocate your capital into those assets? So when you locate, we have this 2 by 2 matrix as vehicles. So that's basically private and the public. I think you already know this structure.

Equity side and that side. That side is basically the loans from the banks and the securities. And the equity market will be your own money and without a guarantee of the return. And then on both sides, you have the public. Public go to public, means stock market or the bond market.

AUDIENCE: Oh, if the green building is better to brown building, why is that manager put the brown building in there?

SIQI ZHENG: Information asymmetry, and all these market frictions, and also not enough supply of those good, better assets. It's not an unlimited supply. If you have limited supply of the better assets, then money all push into that, then the price will go up, then the return will go down. That will become an equilibrium.

AUDIENCE: I mean, if the asset manager can put the total [INAUDIBLE] building in their portfolio, but no.

SIQI ZHENG: Because all the investors are thinking the same way. So they are competing for limited supply of green buildings. So now we are focusing this class, we are focusing on private sector, not to go to the public sector. Public sector will be the stock market and the bond market.

So now going to do that part. So basically, this cell, this cell, that, but mark it here. So in this cell, two things. One is brown thing, the other is green thing. So think about this, I'm talking about vehicles, remember? The space of the risk return. And what are the assets you can put your money on?

And then this one is climate risk, bad. Default risk go up and so bad. And then the flow, the capital is leaving. The capital is leaving.

This green building, good. The capital is moving in. So that's the two assets, two opposite things.

So the mortgage actually, and we already talked a lot about this in the climate third session, remember? So I will just quickly go through. So the key thing is default risk. I want you to understand the rationale, the default risk thing.

So basically what I'm talking about, for those areas with higher climate risk, you name, what kind of risk? Flooding, hurricane, wildfire, all the things. And the key thing is the mortgage market, when you price a mortgage, very important thing is the risk. There's a major three risk not opposed to two because those two are relevant. Do you know what's the third one, the risk?

AUDIENCE: [INAUDIBLE]

SIQI ZHENG: No. Prepayment risk, right? So I'm not sure whether this was taught in the finance class. So we have a delinquency, basically temporary. You cannot pay your monthly payment or finally, you default. Or you prepay, if you prepay, it's also a risk for the bank because you prepay, then bank has your money and no other ways to invest.

But for this climate risk, basically delinquency and the default, temporary or permanent, you just cannot pay your default. Think about this value of a property. If you borrow money from the bank, which is half million money. And then because of the climate risk, that area is declining. It's not a rich town like Miami, but it's a poor town. And the cities cannot do anything to help.

So people are leaving, jobs are leaving and declining. No public service, it's bad. Then the lower demand of real estate. Real estate price will go down, for sure.

So basically the conceptual level thing is the value of the property at first is higher than 0.5, half million. That's why, for example, your property value at first is 0.8 million. Then you borrow 0.5 million from the bank. And then suddenly, because of all the things going on, your value is pushed down to this low, even lower than your loan value. Then from a rational perspective, not because you are bad.

It's not moral perspective. It's a rational perspective. If your value of your house is lower than the loan, what's the rational choice? Is to default, right? You default, you give the house to the bank because if you still keep paying back, you need to pay back one half million. But if you give the house to the bank, say I default, then you don't need to pay back.

And the bank has your house, but it's only 0.3 million value. The bank has to resell your house, get 0.3 million. That's a big damage to the bank. So the bank, of course, the banks, they don't like default. It's too bad. Especially when you default, when the value is so low in the flood zone and flooded.

So there are many, many new research in this area. Last December, I hosted the climate real estate symposium here, and some scholars came and they present this. Nancy Wallace is a professor at UC Berkeley. They have very good, strong group to study this.

And then they studied the wildfires because they are in California. They studied a wildfire and they compared the performance in the fire zone, not a flood zone, but a fire zone, and no fire zone. Then you see the default really increase by 1% in the treatment group. So that's basically very clear.

This one is a wildfire. You just decline your property value. Then all the people, 1% of the people, they chose to default.

So then we talk about Fannie Mae and Freddie Mac. And Ed Golding from Sloan last time gave a very brief, quick overview of their role. So you understand if the mortgages all went default, went bad, then this bank, this mortgage based securities will also lose value because all default, then they will be in big trouble. So that's why now we have the big problem about all the things the mortgage and all the flood insurance, they are all backed by the federal government. That's all subsidized.

So especially for middle and low-income people's houses, they got subsidized loan from the government. And then because they are marginalized, they couldn't get the good location. They live in relatively risky location. So they have higher flood risk.

And then they have the national flood insurance program, also subsidized by the government. And they have higher risk. They need to insure their house, but this national program also no money, run out of money. And they had to go to Congress to get more money, but they couldn't get enough money. This will result in a lot of uninsured properties in the flood zones.

So double subsidized, one by the government, by the mortgage, the other is subsidized by the insurance national program. So that's all the problem. Then we understand the counterpart of this is, they still don't know how to assess this climate risk in the mortgages. That's why our new project is now working with Fannie Mae to do this appraisal thing, to say, OK, the traditional model, not enough.

We need to incorporate climate risk into the traditional appraisal model to assess the impact of the climate risk into the properties so that when you do this later for your new mortgage, you'll know how to price climate risk. So after we do the research, we'll go there to train the appraisers so that they understand.

And then we know there is a counter-argument that say, OK, we understand this is science, but we also need to understand this social side, because if the Fannie Mae and Freddie Mac, they really price very, very accurately the climate risk into when they make the loans, and then the poor people, they will suffer because they need to live in those places. And they are poor, they cannot afford then at first the subsidized. Now you are saying because they are high risk, I'm going to charge you a higher interest rate. So that will have a burden on them. So I feel it's a dilemma.

And that's the equity, social justice side of this dilemma. And we also know from Ed's talks that it's not just a social justice problem. It's also a politics problem because it's very hard to say in the Congress that in some areas of the city, in some areas of the country, you have different interest rate for mortgages. It's very hard. You will face a lot of pushback on this.

But my other point is, as the scholars, as MIT, we first establish a science and to see these models how to work and how to really do the science in your real work, that's a long way to go.

Finally, I want to use a few minutes to talk about the positive side. Remember, we have bad asset, inferior asset which is some higher risk. And then we have a good asset, a superior asset is a sustainable building. So here is a very clear rationale is the following. I just want you to understand the rationale.

The rationale is green financing. Now it's many banks, they are doing so. They are doing this is the common business right now is that if you the conventional mortgage, and then they have the energy efficient mortgage, called green mortgage. So if you go to a bank, you show some evidence, show your house is more energy efficient, they are willing to reduce their interest rate.

They say, OK, come, I will lend a mortgage to you and I will charge lower interest rate. So that's the current business, common business is called green mortgage.

Give you an example. I think it's a very tangible example. For example, a household, a family in the US go to a bank to get a mortgage. Then they found they have two options. So this household, this family, has a total monthly income, like $5,000. $5,000, that's this family, typical family.

Then if you finance, if your house is regular, then the bank says, OK, the maximum allowable monthly payment is 29%. I think we got this data from Massachusetts. So the bank says, we can only lend you this maximum mortgage as 207K for you to buy the house. And if you show them your HERS report, a Home Energy Rating System, HERS report, say my house is energy efficient. So you show them.

And then the bank says, OK, good. Now I'm willing to lend you 33% of your income. That's this money. Then you can get a loan of 235K. So there's two options.

So you can say that that's a bank's choice. The bank says, OK, no, good. So since you give me, you show me you have an energy efficient house, we are willing to lend you a higher loan to value ratio, basically a higher loan, like this. Then this household, if you choose this option, is able to buy a bigger house, a more expensive house. A bigger house. A house in a better location.

So now I'm going to pause a little bit to ask you, why this bank? This bank stupid or the bank is smart? I'll give you these two options. Why for this green option, the bank is willing to lend you more money, like in this way, the same household with the same income? Any thoughts on this? Yeah.

AUDIENCE: Is it backed by a lot of searching. Like a lot of banks [INAUDIBLE].

SIQI ZHENG: What's your point? Andy?

AUDIENCE: The assumption could be that once you have the home, HERS rater come in and assess the house, they're going to show it's more energy efficient. So utility cost could be less. So your overall carry cost of your house over the course of a month would be lower on a green building. So you could attribute that extra $200 a month to your mortgage payment instead of paying for utilities and repairs, et cetera.

SIQI ZHENG: Yeah. Good. Yeah. Sal?

AUDIENCE: Isn't it just because option two has less default risk because there's no climate?

SIQI ZHENG: Nice. OK, you two cover the two major points. I'm not sure. Maybe also your point is following. The same points is the following two aspects. See?

Because you are a green house, a green housing, right? So there are two aspects. One is your value will go up, if the market is efficient. If the market efficient. So if the green building, the same building, the same location, all the things are same, then you will have a higher value. If you have a higher value, then the bank is willing to lend a higher loan to you, a bigger loan to you, because they always look at the loan to value ratio. So this is a very key thing is loan to value ratio.

The bank always look at this as a way to control the risk. So they say, OK, if you are green, this one goes up. And then I'm willing to loan you, lend you a bigger loan because this one go up. If we say, OK, this must be 80%, always say 80%, 75% like that, your loan to value ratio. Now the value is higher, then good. I'm going to lend you a bigger loan.

Another thing is the energy bill. That's monthly thing. This is a total value thing. Then it's a monthly thing. Monthly thing says, OK, now your energy bill will go down. So although you are the same income, right, the same income, but now you spend less money on energy bills, so you are able to pay back more.

You won't go, like, no money for food. You still have food money and all the daily necessities, but you can pay back more. So because you can pay back more, the bank is confident and feel comfortable to lend more money to you.

So that's the logic. This logic is backed by some science, scientific research. So for example, this 2014, one of the first papers they evaluate, they evaluate the energy efficiency. They got a lot of mortgage data from CoreLogic. They got so much data from CoreLogic for 71,000 loans. Then they evaluate each of the house. They know their Energy Star rating.

So they run a regression, as you did. The regression, they show energy efficient houses are one-third less likely to those non-energy efficient to default. So that's big. One-third of the default risk deduction. So less likely to default, then we are happy to offer you a lower interest rate.

Now a new paper. This paper also has similar results, but with more data, I guess. So this is "The Journal of Real Estate Finance and Economics" paper to study the same thing, energy efficiency to default risk. And then they also found a very interesting thing is not just the overall effect, but also they look at different income households, different disposable income groups.

They found this effect is much larger for the low-income households because very clear, low-income households, they have very big budget constraints. So then this energy bill deduction really matters a lot to low-income households. They free up their income for them to do other things. So they keep paying back the loan.

And in commercial real estate is not about household. But my friend-- first also is my good friend-- and they publish a new paper to look at commercial real estate, office buildings, all the things and the shopping centers. They find the same thing because they are looking at companies. For the companies, if they have a more energy efficient building, like Energy Star, and the LEED, all these ratings because they have commercial buildings. And they also found lower default risk.

So that's because the companies, they also have budget constraints. So if they have less operational expense on energy-related things, they free up money, they pay back the loan. So that's the idea.

So then, final idea is the following. Given this logic behind, given this logic behind, if it's a greener building, your value will go up, your loan to value ratio will go down, your default risk will go down. And also another channel is the income will free up. Then you have lower monthly energy bill, you can pay back your loan.

So all the things altogether, then there's a new idea. I think it's very innovative. No, it's not new, but at that time, by Juncker, he's a European commissioner. And many years ago when he pushed his agenda, when he advocated for his agenda of the green renovation, remember? EU has this renovation wave. They put a lot of money for the existing buildings to renovate. And they have a logic as the following.

Traditional way, you alternate a loan, like your house is $100. You borrow $80 from the bank. Then your loan to value ratio is 80%. That's very traditional.

And then after a year, you pay back $3. Now you have $77 balance. But your house, because you have some renovation, your house appreciated to become $110. So then your loan to value ratio decrease a lot. You pay back a little bit and your house appreciates more, then your loan to value ratio go down a lot.

Let's say, OK, let's take advantage of that. This is exposed, right? First, do this and then you go up like that. Now think about this because we understand that if you renovate, your housing price will go up. Then the bank feel more confident to loan you money upfront for you to do the renovation with the expectation after the renovation, your housing price will go up.

So that's the following. Now you go to the bank, the same house, but you can borrow $88 instead of 80. You borrow $88. At first, the bank says, I can only lend you $88 because your house is 100. Now the bank says, OK, although your house now is 100, but I understand after renovation, your house will cost 110, so now I'm willing to lend you $88.

Then you have $8 more actual money. Then you use $8 to renovate your house because you need money to renovate your house. Then you renovate the house, the house really becomes 110. So the bank is happy.

So this is the logic of the story say, OK, given that we understand, later we will appreciate, now the bank should lend more money to the household to do the renovation. So that's the idea. This is a new, like, a financing vehicle for the household to do the renovation.

OK. Now, I talked about all the mortgage. Now I'm going to pass on to Akrisht to talk about private equity fund because I said, I know so little. And many of you took Norris class. I think many of much better than me. OK, can you stop a little bit? I have another slide to show. To show I still know some basics.

[LAUGHS]

I'm not that stupid. I still know some basics. So we will talk about private equity. That's a very important private side of the financing way, because next on Thursday, we will go to public totally, not on the private side. We talk about that mortgage.

Now we talk about equity. Then we know some basic of real estate, private equity. I learned from Charles last year and also from Norris class and the textbook, we have this direct investing and the indirect investing, and we focus on the investor. Many, many know the piece on the indirect investing type under the commingled fund.

We have a GP that have investment a little bit, 5 to 10% have a stake in that. And then you have many LPs put money as a passive investors, then the GP will manage all the things. And then so that's we focus on the commingled. My understanding is last year, right?

Then they do think ESG is important, not because they think this is a social value. They align social value with the business value because this equity will show you they think the green real estate will make higher return for the private equity. And actually, one student last year did his MSRED thesis that he went to interviews of all the private equity firms and also the CBRE. And then they have this report to show how this piece now is incorporating ESG in their investment memo. That's important because this is what you want to do for the final project.

Of course, like in this acquisition period stage, the due diligence and then later the management disposition, they have different actions. That's very practical actions. For example, investment memo, you need to produce at least one page on ESG, you illustrate. And then how you are taking actions to reduce your physical risk and to reduce your transition risk. They have all the tools. Later, we will discuss more.