[SQUEAKING]

[RUSTLING]

[CLICKING]

GARY GENSLER: So this FinTech course-- this is for those who want to explore FinTech, how the technologies are disrupting financial services. That's the core of it. Technology is disrupting finance.

And we'll talk a lot about this, that finance and technology have lived in simpatico, in some relationship together for thousands of years. In fact, money and ledgers were initial financial technologies. And we'll talk about what makes something in this faculty's mind a financial technology that's really changing the world and then just the technology that exists. The telephone, for instance, at one point, in that time, in the 1920s, was, in essence, a financial technology that rapidly changed the world of finance. Or even in the 19th century, the telegraph rapidly changed parts of finance, when you could send your first money gram-- or in those days, it was called something different, but it was a telegram attached with money in the 1870s and 1880s.

But this course is going to be about the cutting edge. We're going to be talking about business models and the like around AI, deep learning, blockchain technology, OpenAPI. 10 and 20 years from now, OpenAPI will not be taught, by my view, in a FinTech course. But it's the relevant topics of the day. And we'll be looking at the competitive landscape.

Those of you that have decided to take this course on top of consumer finance course, the half-semester course that was at the same time, you will know that I usually teach in the concept of business strategy. What is the strategy that these startups which big tech, which incumbents are looking at this point in time, in this day and age, in this sector? And this course is also, I should say, being recorded. It's being recorded for some students who can't join us simultaneously or what's called synchronous learning.

And these recordings will be posted on Canvas within a day or two. Lena and Romain and I just have to remember how to do that and actually post each of the recordings. They also might be shared, just to alert you, in OpenCourseWare in the fall or later. I've chose with MIT that if we're recording them anyway, maybe if they come out being anywhere valuable, that we would up to the broader community. So these might be shared more broadly come the fall as well.

It's also really to gain critical reasoning skills around the ground truths of FinTech, separating hype from reality. Every week, there's a posting of three or four readings. I understand that even if we were all on campus, you might not read every word of that. But they really are sort of the foundation. And I hope that in each lecture, in each class, we can go beyond that.

But this week, the Bank of International Settlement Working Paper and the Financial Stability Board are two papers that a lot of people turn to. The Financial Stability Board is a group of 20 countries, the G20 countries, that have banded together and their treasury secretaries or finance ministers and central banks and securities regulators have formed this thing called the Financial Stability Board. And they publish very good work.

This paper came out in 2017. It feels a little dated right now. But it still felt quite relevant. And then, of course, the Bank of international Settlement is 60 or 70 central banks out of Basel. And they write very good work.

I thought it was also interesting to take the current chair of the US bank regulator, the Federal Deposit Insurance Corporation, Chair McWilliams, and her view as to the future of banking, what's going on right now. So that's why I grabbed these three as an intro. If you've not yet read them, I think go back, try to at least skim them, get your sense of what they are.

And each class, I will also list study questions. And the goal of my listing study questions is not just for you to think about these questions beforehand, but you will also see where do I want to land the class? Where do I think these are the central learning objectives?

And this is usually in a classroom setting, where I'll say "let's pause here and I'll

engage in some conversation." Now, I do cold call in the regular classroom. I don't know if anybody wants to raise their hand now and answer any one of these questions, but it would be great to get a little bit of life and community in this, if anybody can address themselves. What are the major technological trends materially influencing finance right now that you think about, whether it's in the US or anywhere around the globe?

And this course will be taught from the perspective around the globe, even though I'm more knowledgeable in the US. We will be talking about Europe, Latin America, Asia throughout, a little bit about Africa as well. Romain, I'm pausing for you to do your--

ROMAIN DE SAINT PERIER: We have our first volunteer. Thank you very much, Luke. The floor is yours.

AUDIENCE: I'll answer the first question. The main technological change that we see in US and outside of US is versus open banking, use of a lot of APIs. They can be applicable to other websites.

GARY GENSLER: All right, and we're going to spend a whole class on OpenAPIs in two weeks. But this is an important part of marketing, opening up the banks' ledgers and their data. And data, as people would like to say, is sort of the new oil in the business. It's very valuable for us. Anybody else, Romain?

ROMAIN DE SAINT PERIER: Yes.

AUDIENCE: The natural language processing so that we can have the robotic advisors.

GARY GENSLER: Right. So natural language processing is the concept that you can take something that's in human language and put it into machine or computer language or go the vice versa. And it's not actually new in 2020. Some form of natural language processing has been around for decades, just in terms of reading-- reading computer code and putting it into an audio voice or going backwards. Or every postal service of a major country around the globe has had something to read our scribbled handwriting and trying to read that handwriting and then put it into something where they know which post box to send it to. But natural language

processing, we'll spend a fair bit of time, and robotics. Romain?

ROMAIN DE SAINT PERIER: And now we have Ivy, who raised her hand.

AUDIENCE: Yeah, so I think we've seen a lot of digitization in the e-commerce space as well, especially in places like China. And you see this kind of divergence between China and, say, the US and the way we use mobile pay and the way that they've really adopted like Alipay and WePay as well.

GARY GENSLER: And Ivy, why do you think it happened so, as you say, at this divergence, why it happened maybe a little faster in China?

AUDIENCE: So I think it's pretty interesting, because I think a place like China, as an example, is probably less developed in terms of even just their financial structure, whereas the place like the US, it's quite dominated. And it's really competitive. But it's also really consolidated.

So you see these countries where-- I mean, I think the way I think about it is the subway systems in China or Taiwan or a lot of these developing countries are much better because they were just-- they came a little bit later. And I just look at that analogy similarly to kind of where payments are, because you kind of go from 0 to 100 versus we are kind of something--

GARY GENSLER: No, I think Ivy's raised a good point. There's times when a country is growing rapidly. And China, for instance, had been growing at 8% to 10% GDP growth a year. And before corona, it had come down to still a robust 6% a year.

But within that context, many things leapfrogged incumbents in Europe and in North America. And in the payment space in particular, two big tech companies-- Alibaba, that really is the dominant online retailing company, and Tencent, which was the dominant online sort of social networking and messaging company-- leapfrogged the banking system, the traditional banking system, and now with WeChat Pay and Alipay control well over 90% of retail payments, small dollar, and small and medium-sized enterprise payments. They don't dominate large wholesale payments, but put in the retail space, absolutely.

And I would agree with Ivy. They kind of leapfrogged us. But even Kenya

leapfrogged us with M-Pesa, a technology that was pushed forward by a telephone company, Safaricom, when they noticed that folks were trading mobile minutes as a form of money.

ROMAIN DE SAINT PERIER: Gary, we have two more hands that are up. We can start with--

GARY GENSLER: All right, why don't we do those and then move on? So who are the two people? And they can just go in turn.

ROMAIN DE SAINT PERIER: So we had Laira, but she just disappeared. So we'll go with Alida.

GARY GENSLER: All right, one, thank you.

AUDIENCE: Yeah, so I, to kind of add on to Ivy's point, is a lot of financial institutions in emerging markets did not typically cater towards the mass-market consumer population. And so it really allowed very quickly for these big tech companies to jump in a way that you couldn't do so in the-- in more developed markets, where the financial institutions already were catering to the large majority of the consumer population.

GARY GENSLER: Right, so it's about actual financial inclusion and reaching out and so forth. So what I'm going to do today is try to cover, in the minutes we have, a little bit about the financial world. What do we mean, FinTech shaping the future of the financial world? What do I what do I think of it, having spent my life-- first, I was 18 years at Goldman Sachs. Then I worked in the public sector, but always sort of around finance, with the US Treasury Department, with Paul Sarbanes doing Sarbanes-Oxley, and then later running a market regulator, the Commodity Futures Trading Commission, in the Obama administration.

What do we mean by the financial world? A little touch on FinTech-- that's the whole class, of course, but just a little touch on FinTech. Thirdly, again, just a little review of these three big trends-- of AI, open banking, blockchain technology-- what do these trends mean? And then the actors-- and the actors, I think that some people will use the word FinTech to mean these disruptors, companies like Toast getting into the payment space for restaurants or Lending Club and peer-to-peer lending or

Robinhood, an app you can download and trade stocks.

A lot of people constrain the study and the topic of FinTech just to the disruptors. I think that that's too narrow. I think that we really need to think of the actors and the field, more broadly about the incumbents. This is sort of big finance, we might say, the Barclays banks and the JPMorgans and so forth.

And we need to think of big tech, as we just talked with Ivy about Alibaba and Tencent getting into this business. But we see Apple Credit Card and others and Facebook trying to stand up a world currency. And then it's the disruptors. So I think it's a much more robust conversation and an important conversation, the strategy amongst these three pieces. And then, of course, we've got to do a little bit on our teaching team, our schedule and assignments and so forth.

So what do I think of is in the financial world and what it is? Well, finance basically stands, like this hourglass in the top-right-hand corner, stands right at the neck of an hourglass, intermediating, standing between people that have money and need money, people that have risk and want to get rid of it, lay it off, and somebody that wants to pick it up. And I have for decades, since I was at Goldman Sachs, thought where we were, we were at the neck of the hourglass.

And for good or for bad, that's also part of why finance in many countries is able to collect economic rents. Economic rents is that classic conceptual framework of collecting profits or revenues in excess of what classic economics might tell you would be a competitive supply and demand space. But if you stand at the neck of an hourglass, between trillions of money flowing from those who want it and those who have it, and effectively trillions of risk between those who have risk and want to lay it off and others who are willing to hedge it-- if you're at that neck of the hourglass, so to speak, if you just collect a few grains of sand for the trillions that go by, it can collect a lot.

In the United States, for one, for instance, our financial sector takes about 7 and 1/2% of our Gross Domestic Product. Nowhere is it written it has to. In fact, in the 1950s and '60s, it was more like 3 and 1/2% to 4%. But persistently, it's grown as a percentage of our economy, standing, intermediating money and risk. Let's just see if I can get this to work.

There, so the functions, the functions are intermediating credit. That's lending. Investments, we all know that. Risk transformation-- think of any time one of us buys insurance on an automobile or a car or on our life, but also risk transformation that investment banks do, even between somebody that's issuing stock and somebody that's buying stock. That's a transference of risk in terms of whether that startup will do well.

Of course, there's the capital markets. And at the center of the capital markets is the price, the money and risk that's flowing through the system. And there's plenty of advice to go around.

Now, we usually think about it in sectors. And every one of these sectors, whether it's commercial banking, asset management, insurance, investment banking, advisories, we will touch upon during this semester. And please, interrupt. If your keen interest is about insurance companies or your keen interest is about investment banks, then pull the community into that in these discussions.

But we're going to try to talk about multiple sectors, multiple functions, as contrasted to the half-semester consumer finance course that was really just about one slice, household lending, and largely the commercial banks and investment banks around that. This is a much broader topic. And I hope the learning objective is ultimately to understand how technology can transform finance at any particular given time. Romain, are there any hands up? I'm sort of every once in a while looking to you to see if I keep going or pause.

ROMAIN DE SAINT PERIER: No hands at the moment, Gary.

GARY GENSLER: All right. The financial world, in this, I think, four key things to think about. And this is sort of in a framework of thinking about financial technology.

Data-- of course, data is that new oil, so to speak, for investing, for market-making, for marketing, trying to get new customers. I mean, how many times do we get a pop-up ads. I found in teaching about student loans, I was researching student loans. And my god, the last six weeks I've got more advertisement for student loans, even now I'm a professor at MIT. It's because I was researching the topic of student

loans, and all of a sudden, now I am getting a lot of unsolicited ads and emails, even, on the topic.

The financial world it always has to think about the management of their balance sheet. And if you're starting a FinTech company, are you using your balance sheet or somebody else's balance sheet? And just as there's cloud computing, that today, cloud computing has dramatically shifted the ability of startups, a disruptor can come into a business and basically the rent versus bill decision changes. I can read somebody else's data storage capacity. I can basically rent the cloud instead of building my own data warehouse.

That was a big change about 15 years ago. And it's made startups more viable in the 2020s. Also, the ability to raise money in the capital markets, what's called securitizations, which started decades ago, really took off by the 1990s, also allows a startup like Lending Club and others to say I'll raise my money elsewhere. I don't have to have a balance sheet.

And then there's the various risks that you have to manage. And most importantly, we're going to spend a lot of time doing this class on this fourth point-- user experience, user interface. Much of what's happened with mobile phones, with apps that you can download for free have given all of us a better user experience than online banking.

Online banking has been around for over 20 years. Most of the major banks around the globe had a viable platform for online banking by the naughts, whether it was 2005 for some or 2008 or others or so forth. But by the naughts, most had online banking. And yet, their user experience wasn't what we all wanted, and certainly wasn't what-- maybe if the newer users, as millennials, were coming into the marketplace, to do it on your mobile phone, to do it conveniently. So the user experience and the user interface is the critical competitive place.

So what do we mean by FinTech? I like going back to that 2017 Financial Stability Board report. That doesn't mean that they have it quite right. But they basically talk about that it's technology-enabled innovation in the financial world that's going to some new business and it's material.

So, as I mentioned earlier, the telegraph in the 1830s comes along. And by the

1860s and 1870s, we're starting to see digital money. The first form of digital money is already about 140 years old. I mean, we think we're living in this digital age, and we are.

And I would note this about the corona crisis that we're living in-- the corona crisis, in my opinion, will accelerate this digitization. We've already, in the last 30 years, significantly digitized our world. And if we were all together in a classroom, I would ask by a show of hands how many of you have used paper money or currency in the last two or three days. And maybe a quarter of you might have said you had used paper money in the last two or three days. But let me ask you in the middle of the corona crisis-- and Romain, you can tell me if any hands go up-- we'll you use the blue hand, anybody that's used paper, physical money in the last two days.

ROMAIN DE SAINT PERIER: Thank you, Alida, for volunteering. The floor is yours.

AUDIENCE: I have for grocery shopping and so forth.

GARY GENSLER: So you actually-- and they'll still take the paper money behind the counter without wiping it down with some cleaner?

AUDIENCE: Yes. And I took out a lot of cash before everything happened, so--

GARY GENSLER: Ah, ah. Alida, may I ask, was that just sort of insurance, managing risk, as we say, as part of finance, where you're--

AUDIENCE: Yes.

GARY GENSLER: --managing the risk that the banking sector and the ATMs and things might not work?

AUDIENCE: Yes.

GARY GENSLER: And do I see Devin's hand?

ROMAIN DE SAINT PERIER: That is correct.

AUDIENCE: I can only do laundry using cash. So I use it for now, but--

GARY GENSLER: But see how few of us, of 80 plus people, two people. Now, we're in the middle of a corona crisis. I would predict that as we come out of this, whether this is-- whether this is a matter of a couple of few months or whether this is, unfortunately, as long as couple of years, wherever we come out, that the corona crisis will accelerate an already existing trend. And that already existing trend distorts further and further digitalization of commerce, that that laundromat that Devin goes to will take a QR code or a swipe of a phone more readily.

And yes, I think it was Anita said that she took out cash before the crisis. And that's true. There is still going to be some people that probably also went and bought gold. And we should respect that, that that's sort of an insurance policy against the digital world collapsing.

ROMAIN DE SAINT PERIER: Gary, it seems like Devin has a follow-up.

GARY GENSLER: Yes, please. No, and maybe Devin just left his hand up.

AUDIENCE: I apol--

GARY GENSLER: Maybe after you speak, you actually then take your hand down.

AUDIENCE: All right.

GARY GENSLER: So what are the technologies of our times? What's sort of rolling with it now, no longer the telegraph or so forth? Well, I put up my favorites. And then I kind of think, well, maybe I shouldn't have put the cloud there. Maybe the cloud really isn't a technology that's pushing us forward right now.

And yet, what's interesting is finance uses the cloud less than most industries. And this is particularly the case of incumbents. Country by country-- it doesn't matter whether we're in Brazil, whether we're in Europe, whether we're in the US-- big incumbents, like JPMorgan and Bank of America and Barclays, tend to still have their own data centers.

Now, that's shifting. I think the 2020s will see them shift over. But they've tended to want to sort of control their destiny. I think they will shift because it's lower cost and better cybersecurity generally if you have it, frankly, at Baidu in China or Microsoft or AWS and so forth here. But startups dramatically use the cloud.

This is this buy versus build sort of scenario. Why build my own data center? I can rent it. I can use somebody else.

But all the others we're going to talk about-- and I should say that there's a little-- a little sleight of hand by my list, because many of these are actually artificial intelligence and machine learning, which is part of artificial intelligence. Natural language processing, in essence, is artificial intelligence. Chatbots are sort of that as well, and robotic process automation. But I split them out because I think it's relevant that we kind of have a chance to talk about each of these as we go.

I'm pausing every once in a while, Romain, but you can let me now. I like to think of this in the context of history. Maybe that's just because I've always loved studying history.

But what's the customer interface that we've seen all the way back from sort of prehistory, that the customer interface was in tents or bricks and mortar later, all the way up through where we got credit cards invented in the 1940s and '50s? That was a FinTech. That was a new financial technology.

Visa, here in the US, was a network of banks started by a California bank called Bank of America. And they wanted to have a nationwide network. And other banks joined it. That became the Visa network. But where are we now? What are the technologies now that-- I want to make sure I'm clicking on the right.

So the base that you might be thinking about-- mobile payments, the internet, even contactless cards-- I would say that was kind of a last phase. That was the phase that really shifted finance in the naughts and early teens, and that we really are in terms of customer interface is now conversational interfaces, chatbots and conversational interfaces. That's the cutting edge.

Yes, contactless cards are important. Yes, of course, we need mobile payments. No doubt about it. But if you're starting a new business right now, you're going to start

a disruptor and say I'm going to do online banking, that's yesterday.

You have to find a way to do that online banking in a way that has such a better customer interface. And you might be using some form of OpenAPIs or robotic process automation and chatbots to do it. But these are all kind of build up on each other.

Then there's risk management. So one is the customer side. One is the funding and risk management side. And you can look throughout history.

And I spent a lot of my life in my career around the capital markets. I was at Goldman Sachs for 18 years. And I had to think a lot with hundreds of other people about risk management and what we were doing. And in the 1980s and the 1990s, a big thing was asset-backed securitization and interest rate swaps and even, yes, credit default swaps that helped bring down several economies in 2008.

But those innovations of the 1970s, the 1990s were dramatically shifting, dramatically shifting what was going on. But I would say now, it's really about machine learning. Machine learning is an ability to extract correlations, extract patterns from data in a way that we couldn't before. And many of you have studied linear algebra. We're blessed in this class to have remarkable science technology and math folks. Not all of you-- we accept all the English majors and history majors as well.

But I'm saying that you know that from linear algebra and basic statistics, you can do a lot of regression analyses. Machine learning is going a little beyond that and extracting patterns from that which was more difficult to extract when you were just doing regression analysis. And so there's patterns that we might see in the data that says you're a good risk or a less good risk that you wouldn't quite say in a traditional credit scoring systems. I think that's where we're going right now. Romain, anything in the chat rooms? Or I'm going to pause for a second.

ROMAIN DE SAINT PERIER: Nothing so far, Gary.

GARY GENSLER: All right. So it's fertile ground. And we talked a little bit about this before. But the fertile ground of finance is we've basically digitized money securities and credit

over the last 30 years. The corona crisis is just going to push that further faster, in my opinion. We have this vast amount of data.

And we're starting to see patterns in that data that we didn't recognize before. I mentioned this in the consumer finance course that some of you were with me on, but somebody has actually studied something like this to say that if you charge your phone overnight every night, if you charge your phone every night, you apparently are a better credit than if you don't charge your phone every night. You might think, oh my gosh, I'd better be charging my phone because Apple is watching. They're going to be watching whether I charge my phone.

And in China, there's a whole social credit system that takes data from many of your online apps. It's not just taking your payment information from Alipay or WeChat Pay, but that social credit system is checking even your participation in dating websites. I kid you not. I kid you not.

So that social credit system in China or the private sector's approach to collecting data in the West have sort of the same goal in mind-- to understand the customers more and to basically provide more marketing, but also to assess risk. And, by the way, the corona crisis might change even the West's view of data sharing, because when we have Google and the US partnering up to say we can track everybody to see how this disease, how this disease is propagating through society, that we need the modern technology of our position location trackers. A position location tracker is called a cell phone. A smartphone is tracking where we are if you go running with it, if you go driving, hiking, all of that data. But now here, even in the US and in Europe, we're starting to say do we partner, as the official sector, with that data to keep our societies maybe a little safer, and then, of course, the rapid expansion of computation power and so forth.

Now, I think it will change something. This disruptive potential, I think, has a dramatic change. We'll be talking about this slide the whole half semester. But managing risks, updating the customer user interfaces, and financial inclusion are the three that I want to focus a lot on, managing risk. And AI is also about targeting products as well.

I think the interesting challenge is, near the bottom, will some revenue models shift?

We saw a company called Credit Karma start here in the US. Credit Karma started basically with the idea to get a free-- free is the operative word-- a free credit score.

The founders of Credit Karma couldn't get their credit score from the traditional companies-- TransUnion, Experian, and the like. And so they started an app just in the last 10 years. And in January, they sold Credit Karma for $7 billion.

Now, Credit Karma is still a free app. And you might say how can Credit Karma commercialize a free app? In 2019, there was $1 billion in revenue for Credit Karma because they basically had built files on 106 million Americans. They built data files on 106 million Americans providing a free app.

And, by the way, they do not have 106 million customers. They even built credit files on people that weren't their customers. And they were able to commercialize and build revenues around that data stream and, in essence, referencing. They get referral fees when somebody then does buy a loan or takes out a loan through the Credit Karma platform.

ROMAIN DE SAINT PERIER: Gary, we have a question from [INAUDIBLE].

GARY GENSLER: Please. You might need to unmute yourself. We--

ROMAIN DE SAINT PERIER: So I am normally unmuting?

AUDIENCE: I'm just--

ROMAIN DE SAINT PERIER: Yeah, OK.

AUDIENCE: I'm just wondering, what is the difference between big tech and FinTech, and why it is important preparing and learning the FinTech now?

GARY GENSLER: So I understand the second part of the question. You said the difference between what and FinTech at the beginning?

AUDIENCE: Big tech.

GARY GENSLER: OK, big tech. So by that, I think of-- I use the word FinTech in the broad way the Financial Stability Board does. I use it as is the intersection of finance and technology where the technology is new-- so not the telephone, not the internet, but it's something new, like AI and machine learning, that may materially change the provision of finance. So I use it to capture the whole field.

Why it's important is I think it's important every decade. I don't think it's just important now, because I think technologies will come along each half decade, each decade that will materially change finance and provide the entrepreneurs in this class an opportunity to break into the wide margins. In the US, 7 and 1/2% of our economy or $1 and 1/2 trillion is the revenues of finance. So if you're an entrepreneur, you want part of that $1 and 1/2 trillion. You want an opportunity.

And usually, it's technology that's changing business models. When the internet came along in the 1990s, that provided an opportunity for PayPal to start and say maybe we can provide a better payment solution. And subsequent payment solutions, like Venmo and TransferWise and Square, have all been opportunities to chip away a little bit. I would say only in the opportunity-- the opportunities came because technology was changing the field.

What's the difference between big tech and FinTech? Big tech, to me, are big platform companies-- in the US, the Facebooks and the Amazons and the Apples, in China, Baidu, Alibaba, Tencent, in Africa, even, Safaricom got in. We could go country by country. India, the big tech has gone into payments as well.

I think that big tech companies have dramatic advantages. And then I separate what I would call FinTech startups or FinTech disruptors. I always put the second noun in there, disruptor or startup, because to me, the word FinTech is the whole field. I hope that helps.

ROMAIN DE SAINT PERIER: And we have another question from [INAUDIBLE].

GARY GENSLER: Please.

AUDIENCE: Yeah, hi, Professor. One question that I have is actually one concerned with privacy.

At some point, do you think that we would have up give up to some extent our privacy in order to-- for me to get a credit from a startup or get a credit from somebody?

GARY GENSLER: Well, I think you've raised a dramatic issue for society at large. And finance is one example of it. But yes, we have-- we have shared our personal data much more broadly in the last 10 years, and certainly in the last 30 years, than we did in societies before that. And in terms of getting credit card, yes, we've been sharing data for 50 years through various credit-- consumer credit companies.

The Fair Isaac Company was founded almost 60 years ago by two people out of Stanford, actually, one named Fair and one named Isaac. And that led to something called FICO scores, which are used in over 30 countries around the globe. These FICO scores took some personal data, as to whether you were paying your bills on time.

But now, we can go beyond that and capture alternative data. We can capture somebody's digital footprint. And in China, they are doing that with social credit scoring and Alibaba is with Alipay and WeChat Pay.

But Amazon is capturing our data as well. Amazon captures any Amazon Prime customer. And I'm sure amongst at of us, there are many Amazon Prime customers. That data is being captured in some way.

Now, it leads to more financial inclusion. But it also raises all sorts of issues around privacy that we're grappling with as societies. In Europe, they passed something called the GDPR, Global Directive on Privacy Regulation. Here in the US, only California's stepped into this and passed something that went into place last year, the California Consumer Protection Act.

So these are things that society will grapple with. Technology can enable privacy as well as take away privacy. Technology actually can enable us to keep our privacy. But the technology companies and the financial companies want our data. So they're not going to necessarily want us to keep our privacy. So it's an interesting-- technology can enable it, but technology can take it away as well.

So just moving on a little bit, this three big areas-- we're not going to spend a lot of

time, but artificial intelligence, machine learning. I love to give a shout out to another MITer, or Lex Fridman, who has a wonderful set of online courses, if you wanted to take Lex's courses. This was online before online became such the vogue now that we're all doing it.

But Lex has this wonderful course. And I captured his one slide. What is AI and machine learning? It's extracting useful patterns from data.

You don't have to be a computer scientist. But it's basically that's the key thing, and something that might not be linear, something that might not fit into that old statistics class and regression analysis or linear algebra that we think about. It all relies on good data, cleaning up data, and good questions.

Where do we see it? We see it in facial recognition, image classification, speech recognition, et cetera, this list from Lex's list that you can see online, medical diagnoses-- in the midst of the corona crisis, a lot are turning to AI and machine learning to see what patterns can we see beyond the patterns you can see by classic statistics? It's going beyond that.

But in this field, in this field, in finance, we're seeing it in every one of these areas. And we have two classes, so I won't dive into it now. But whether it's asset management, where BlackRock is literally taking-- and all the news items for the top companies, every quarter that a company reports its earnings, BlackRock is listening digitally to their shareholder meetings and their shareholder conference calls and seeing which words in there, which words relate to stock markets going up or stock markets going down, using machine learning and asset management.

We talked about call centers and chatbots and so forth. I don't know how many of you are Bank of America customers. But bank of America has millions of its customers using Erica. Think the Siri of banking. Think the Alexa of banking, a virtual assistant called Erica-- Bank of America, get it? All right, that was their marketing thing, I guess, now.

So AI and machine learning is dramatically shifting. The question in FinTech for the big incumbents, how do I do it to raise my revenues, lower the amount of capital that I have to use, raise my profits? The question for big tech is how do I do this maybe to get into the business, to leapfrog, as Ivy said, that Alibaba and WeChat

Pay leapfrogged the Chinese banks and payments? If I'm big tech, can I leapfrog big finance?

Because, frankly, if I'm Google, I'm better at it right now. Google has a comparative advantage. Can I maybe use my comparative advantage and AI and leapfrog? If I'm a startup, maybe I can give a better customer interface. I can do something with this to better manage risk with alternative data.

So that's how I think of it. OpenAPI-- I should pause. Romain, any questions or hands up?

ROMAIN DE SAINT PERIER: Yes, we have one from Laira.

GARY GENSLER: Please.

AUDIENCE: Yeah, so I was just curious to know how, internationally speaking, regulation hampers the capacity of FinTech companies to expand, just on an international level. So for the US, is it more regulated and, hence, more harder for FinTech companies to expand than for in China?

GARY GENSLER: Great question. And again, who asked? I just didn't rem-- is Leia?

AUDIENCE: Laira.

GARY GENSLER: Laira, all right, Laira, good to see you again. I'm sorry that I don't physically see you. But good to see you remotely.

Every country is taking a little bit different approach. And the range of approaches here could be from you're a-- let's call them a startup or a disruptor. You're starting something. You'd better just come into whatever our traditional regulatory framework.

If you're taking deposits and offering loans, you've got to be a bank. If you're just doing payments, you might come under a European, US African e-money law and just have to do the things around money laundering and anti-money laundering. If

you're like Robinhood here in the US, you would need to register as a broker-dealer.

And there's been this big debate around cryptocurrencies. Are they securities or not? And in some countries, like the US, they generally are, unless you're like Bitcoin and Ethereum.

But the debate, Lyra, is really country by country, is are these startups and these technologies, do they fit into the current regulatory regimes? By and large, if you take deposits and you make loans, you're a bank pretty much anywhere around the globe. If you facilitate the movement of money, you're probably in some e-money laws around the globe.

Securities, if you're actually facilitating the raising of money and the selling of securities, you usually have to register as a securities broker-dealer somewhere around the globe. But a lot of places also have this concept of some form of regulatory forbearance called sandboxes. The idea is let's promote some innovation, whether it's in Hong Kong, whether it's in Asia, whether it's in the US, promote some motivation by saying if it stays small enough and it's new enough, you might not have to comply with all of the regulatory regimes.

The other interesting challenge is sometimes things come along that don't fit in a box. They don't quite fit in to something. So the internet came along in the 1990s. Internet in the 1990s was facilitating a rapid change in finance.

The internet comes along and then the question is literally a question that the securities regulators around the globe had to deal with-- what if I put a bulletin board up on the internet that offers people to buy and sell securities on the internet? Now, it wasn't a traditional exchange. It didn't look like the Tokyo or Shanghai or London or New York exchanges of old, where there were humans yelling and screaming on the floors of stock exchanges around the globe. It was just a bulletin board where buyers and sellers could meet. And usually they were insurance companies and various asset managers.

That question was a ripe question in the 1990s. And over time, we ended up with two tiers of regulation for exchanges. We had fully-regulated exchanges, and this was true in Europe and the US at the time. China sort of got there a little later.

But in Europe and the US, it was like all right, there's going to be these fully-regulated traditional exchanges. And then there would be another tier. In the US, we called them broker dealers, alternative trading systems, ATS's. In Europe, there were various rules that became known as MiFID, which now I can't remember what it all stands for. But electronic trading platforms were regulated a little differently.

So I hope that gives you a sense and puts it in a historic concept. I think over the 2020s, AI and machine learning will lead to tremendous challenges around regulation, about if you see a pattern in the data but you can't explain why the pattern is there, you fall into some challenges of explainability. And for the last 50 years, or in many countries, if you deny somebody credit, you're supposed to be able to explain why you deny them credit.

We talked about privacy earlier. It bumps up against privacy issues. And a third area it bumps up against is biases. What if there is a bias in the data, like when Apple Credit Card just rolled out and it seemed like husbands were getting more credit than wives in the same household? So biases, privacy, explainability are the three sort of cutting edge, when I call the big three public policy issues around AI and finance, though there are other issues as well. Romain, did I see you-- were you--

ROMAIN DE SAINT PERIER: Yes, sir. We have Carlos, who has his hand up.

GARY GENSLER: All right, and then I'm going to keep going, because I want to talk about where we're going in this class as well. Carlos?

AUDIENCE: Hi, how are you? Just a comment on regulations, sort of to build up on that. So I think ironically, for example, in Latin America, a lot of countries have an issue where the big banks have a massive concentration of deposits. But, for example, if you look at the Mexico FinTech law, which was passed end of 2018, it actually raised the barriers to entry for other FinTechs. So sort of ironically--

GARY GENSLER: I'm sorry, Carlos, it raised what for FinTechs?

AUDIENCE: The barriers to entry.

GARY Barriers to entry, OK.

GENSLER:

AUDIENCE: And so--

GARY GENSLER: I think our faculty member, Luis Videgaray, who helped work on that when he was finance minister of Mexico, we should ask him. And I'll see if I can get his answer for the next Wednesday or next Monday's class. But keep going.

AUDIENCE: OK, that would be great. But the question is do you think there is a risk that new regulations in the FinTech scope are actually going to perpetuate some of the problems that we saw before with the more traditional banking sector?

GARY GENSLER: Great question. Carlos, can I hold that for a minute, because I'm going to do that when I do the actors? But I think yes, incumbents in every field-- and these would be incumbents in the pharmaceutical field, in the tech fields, in airlines, whatever-- incumbents tend to be able to deal with regulation a little easier. They're big. They've got great resources. They can build systems to comply with those regulations.

Now, they don't necessarily embrace new regulation. But once those regulations are put in place by an official sector, they tend to have the resources to embrace them. And startups sometimes have more challenges.

And thus, you may be seeing that regulations become a barrier to entry. They're kind of grains in the sand of innovation at times. So there's always a public policy tradeoff-- protecting the public, whether it's protecting the public against consumer fraud or investor protection or protecting the public against systemic risk, that big banks will fail and hurt the rest of the economy, also comes with some tradeoffs, that it could raise the barriers to entry. You're absolutely right there.

We're going to talk a lot about OpenAPI and open banking. We have a whole class on that. So I'm going to keep moving on just so that we finish by our 10 o'clock deadline.

Blockchain technology-- you've heard about it. We're going to have a class on this, about cryptocurrencies and blockchains. Some of you actually were in our fall blockchain and money class. Some of you are in the crypto finance class that starts

in about 30 minutes.

But we will talk about blockchain technology. I want to say and lay it out right from the beginning, these two issues, AI and machine learning, in these eight areas are dramatically more relevant. And OpenAPI and open banking, dramatically more relevant than blockchain technology potential use cases as of 2020.

The interesting question is will that shift? Is there an overabundance of investment in AI and machine learning and not enough in blockchain technology? You get to decide for yourselves. But I'm saying as of 2020, sort of the real potential that we're seeing and the dramatic changes around user interface an OpenAPI and machine learning and natural language processing are more dramatic in this space.

And yet cryptocurrencies have dramatically changed what central banks are doing. And we saw Facebook trying to stand up a worldwide currency last year. So I don't think you can adequately discuss and have a course on financial technology without really having some slice of blockchain technology.

And it is shifting. Everything that's on this list, it is a catalyst for change. I would say my takeaway on blockchain technology, it is definitely pushing the financial sector in places that wouldn't be pushed otherwise. I guess that's really saying OpenAPI and artificial intelligence, machine learning are so much bigger in terms of what's happening in 2020. Romain, unless there's a question, I'm going to do the actors quickly. Anything?

ROMAIN DE SAINT PERIER: We have one specific question from [INAUDIBLE] on whether machine learning and AI can cause a dark box, or creditors could deny and approve credits based on unreasonable grounds. How do you see that?

GARY GENSLER: That absolutely is a risk. Our first big data revolution in the US, and then it was about a decade later elsewhere, was in the late '50s and early '60s, credit cards came along, invented really in the late 1940s and then popularized by the mid 1960s, came along. And then the official sector passed laws. And two of the first laws we passed in the US was something called the Fair Credit Reporting Act and the Equal Credit Opportunity Act.

And why I speak about those two and this question 50 years later is this was a

question with the first big data analytics at that time. And the idea was you couldn't-- you couldn't use data analytics to deny somebody credit because of their race, because of their color, because their ethnicity, because of their gender and other protected attributes. And that was called the Equal Credit Opportunity Act. That same act is important now as we move into machine learning credit decisions.

Fair Credit Reporting Act also said in the US, and Europe did some similar things elsewhere later, said if you deny credit, you have to be able to explain why. So to this question, just because you have a black box, you still need to have those basic tenets of explainability and fairness or lack of bias. And that's why I say the three big challenges are explainability, bias, and then privacy. There's also challenges of robustness and so forth, but great question.

The actors-- I think of the actors-- we've talked about this a little bit in several buckets. I think of big finance-- I apologize, I sort of borrowed this a little bit from the central bank governor of Brazil. I met with him last year. And he and I were talking about Brazilian banking.

And he said they're like fortresses. So this was actually his kind of articulation of Itaú and the others in Brazil. And I said how do you see them as fortresses? And he says they all have their moats, towers, and they have sovereign protection.

And to him-- and I liked it so much I repeat it-- their towers, their sort of basic tenets of sort of financial strength is around payments. They usually control payments. They have big balance sheets that they can use. And balance sheets allow you to lower your risk, frankly, and leverage. They have a lot of data.

And yes, they have hundreds of legal entities. Their corporate structure is one of their both complexities but benefits. A company like a JPMorgan or a Goldman Sachs or Barclays at a minimum has probably 1,000 legal entities and might have 3,000 or 5,000 legal entities.

When I left Goldman Sachs, which was already 22 years ago, I was the co-head of finance with David Viniar, who went on to be the CFO, we had 700 legal entities. But if I recall, in that quarter of a trillion balance sheet that we had to sort of help manage and fund, only about 70 or 80 of those were regulated companies. So we had a lot-- we did everything legal, I just want to say-- but we had a lot going on

amongst those 700 legal entities. That's kind of big finance from a sort of central bank governor of Brazil's point of view, like fortresses.

But then big tech-- the Bank of International Settlements did a wonderful report last year. And they said it's like DNA-- data, networks, activities. And if you're Alibaba or you're Facebook, you want to layer another activity on your network.

Facebook already has 2 plus billion people in their network. They have a lot of data already. They are supposedly a free app. They are free if you download it. But it's data for services.

And if they can put another activity on top of it, that means they get more data. So every time they add an activity, more data. And data they can commercialize. And so that DNA network is why you see big tech trying to get in payments around the globe, and then adding credit products on top of it.

Startups-- startups have advantages. Don't count them out. Some people would just call that the FinTech. But they're flexible. They're disruptive innovators. They can sort of rent their data storage on the cloud. In some circumstances, they can rent their balance sheets by doing securitizations.

They also have some asymmetric risks. And that asymmetric risk we'll talk about all half semester. The important asymmetries they have is one, they're not protecting a business model.

So let's just talk about payments and credit cards for a minute. The big banks are protecting a very profitable credit card business. And there's seven big banks in the US. There's seven big actors in the credit card space-- Bank of America and Chase and Citi, of course, but also American Express and Discover and the like, Cap One. They're protecting that business model.

But then somebody comes along. Maybe it's a small company like Toast in the payment system space for restaurant payments. And before corona crisis, Toast was doing pretty well. And they did a C or series C or D round at $4.9 billion valuation. Well, Toast can come along and provide a payment product for the restaurant business. They're not protecting any business model.

Or even Lending Club that came along 10 or 11 years ago can come into the personal loan space and say we're not protecting wider profit margins and interest rate margins in the credit card space. You can come into the personal lending space, which is growing dramatically. Personal lending in the US is about $170 billion asset class. Credit cards is $1 trillion. So it's only one sixth the size, but the personal loan space is growing rapidly, in part because those actors in the disruptive startup space are not protecting the trillion-dollar asset class, which is called credit cards. And then there's the official sector.

So I think of these actors as, importantly, all of them. And just some pictures, just for fun-- we don't need to stop, but big finance. And, of course, I left companies out. But to give you a sense, it's an asset management, like BlackRock and Fidelity and Vanguard.

It's in banking. It's in investment banking. It's global. If I left your country or your favorite company out, I apologize. But I could have put 200, 500 companies on this page.

But then there's also big tech, which I only picked six or seven at the top. And then the startups-- and we're going to talk about startups in every one of our classes. But I think you've got to sort of bear with me and think about it more broadly as well.

And then I'm just going to close before we talk about our actual course and so forth, is where's the investments? Accenture puts out this wonderful report, I think on a quarterly basis, as to the number of deals in different sectors and then the funding. And I don't ask you to study this on your screen now. But think about it. Maybe pull up the Accenture report itself.

But the big bulk of it is in payments and credit. If you look at the kind of purplish blue boxes, nearly 50% of the funding is in those boxes. Insurance, pretty good size, too. But it gives you the sectors that actual funding is going on in this marketplace. Romain, questions?

AUDIENCE: No questions.

GARY GENSLER: My god, Romain, where did you get this picture taken anyway that I grabbed off the internet?

ROMAIN DE SAINT PERIER: That was when I was working in the Middle East for BCG.

GARY GENSLER: I see, I see. All right, so you've met Romain. You've met myself. Lena is the course administrator. If you want to set up office hours-- and, yes, I am committed to office hours-- it's great to also copy Lena. You can probably do it with me, too. But Lena is going to be better to sign it up as well.

The course-- so after this intro, we're going to take the technologies. We're going to take two classes on artificial intelligence, machine learning, natural language processing and the like, and then talk about the customer interface on April 8 and then blockchain and technology. These three slices-- now, there are other slices we could address as well.

So then we're going to go through the sectors. We're going to talk about these sectors. And what I could see is payment and credit, trading, a little less on the risk management. So maybe on May 4, we'll squeeze that down a little bit as well.

And then, of course, we have the intro. I've just, [INAUDIBLE] and I, revised the syllabus this past week. I want to take the next-to-last class and just talk about corona crisis and how it might be shifting the landscape. I already said, I really do think this shifting, this deep trend towards online from bricks and mortar, that was already happening.

But we've even seen in the last three weeks, we've seen winners and losers. I asked each of you to think about this. Who are the winners and losers within the financial sector, big tech, and the financial startups?

I talked a little bit about Toast. Toast is a very successful Boston company that is providing payment services and credit to restaurants. For a moment, that would have to-- you'd have to say that's a company that's taking-- taking it on the chin, so to speak, not as badly as all those individuals that have health care worries, that are ending up in the hospitals and the families losing loved ones. But I'm saying from an economic perspective, there are some winners and losers.

Robinhood, an online app, mobile app for trading, has crashed several times in the last three weeks. And there's some data out of Europe already that online FinTech

apps as a sector have seen usage up 70% and 100%, and some apps up 700%. But not all will be winners. Not all will be losers. And so I thought we'll take one class towards the end and just discuss it and get your feelings and thoughts as well going forward how this might play out.

So MIT chose this as pass-fail. So welcome to not only remote learning MIT, but technically pass emergency, no-credit emergency, incomplete emergency. Just so that you understand what this is, it's almost pass-fail. Pass emergency, PE, will be on your transcript, hopefully for all of you. I can't commit to it, because it's up to you whether you pass. There are assignments.

And no credit emergency, you can think of is an F, but it's not going to be on your transcript. So this is an emergency circumstance right now. There's still assignments because we want to give you the most learning experience you can have.

You might say wait a minute, wait a minute, I thought-- I thought assignments were just about so that a faculty member can decide who gets A's and who gets B's and the like. I look at assignments in a different way than that. I look at assignments really as a way to help you engage in this subject.

And so in this class-- and those of you who know me, I do this in a couple of classes-- is one individual paper, one group paper. And it's all geared to writing a group paper for either a big incumbent, Bank of America, a big tech company, Jeff Bezos and Amazon, or kind of a startup company, a big VC company, Andreesen Horowitz, that you form groups and you decide on a sector. You can decide on credit or payment or trading. You choose, and it helps you engage in the subject. And then I ask you to split, if it's a three or four-person team, or even if it's a one-person team, if you choose to do that, because we're all so separated, then split up and write a three or four page paper, 900 words or so, on one of the topics that I lay out here-- the traditional competitors, the startup competitors and so forth, the technology that you're interested in.

Why do I still do assignments when it's PE NE? It's to help you engage in this subject. And Romain and I are committed, even if we slap a PE on most of these-- hopefully all of them-- we're trying to give you feedback so you engage in a subject. And yes, I'm willing to do Zoom group meetings, Zoom individual meetings. Look, this is not

an easy time for any of us. But I want to make sure that I deliver as much as I can and that MIT continues to deliver for you as we're going through this sort of challenging time.

Class participation is still important. If you can't sign up, if it's the time zone doesn't work or there's something going on in your family, it doesn't-- if you're interviewing for a job, God bless, then listen to the recording. We'll put the recordings up on Canvas as well. And so professionalism, I just want to say something.

ROMAIN DE SAINT PERIER: Gary?

GARY GENSLER: Yeah?

ROMAIN DE SAINT PERIER: Excuse me, just on the assignments, I'm being asked whether listeners also have to comply with these assignments.

GARY GENSLER: No.

ROMAIN DE SAINT PERIER: Thank you.

GARY GENSLER: I'm trying to get rid of the poll here. OK. I've never been asked that question. A little word on professionalism, just for my, God knows, 30 plus years in business.

And this is just sort of my closing thing, is my advice for all of us is success goes for those prepared, curious, and self-starters. If you read the assignments for this, you'll do better in this class. But if you go into a meeting, if you go into a pitch, you go into an interview, if you read about the person, you're going to learn more about them.

And, by the way, if you're curious, when you walk into somebody's office, whether it's a video office or a real office, look at the walls. What does it mean that Gary Gensler has this stuff behind him or not? I'm not asking you to analyze me right now. But I'm telling you, if you walk into somebody's office, whether they're a US senator, the president of the United States, some job interview, a colleague, and you look at their walls and you ask them about their families, show some curiosity. You'll do

better off.

As I said, respect and courtesy builds reputation and networks and so forth. Engage. It's going to be hard with this many students online, but engage in this class. You'll learn more if you engage with me also offline, Gensler@MIT.edu, but also engage by setting up office time.

I also think understanding both strategy and detail matter. Some people are really good tactical people, really good detail folks. They'll do fine in their careers. But if you step back and understand the trends as well, you'll do better. Some people are really global strategists and not really good at the details. They'll probably do OK.

But I'll tell you, my experience, whether it's in finance, whether it's watching people at MIT and the faculty, or my time in public service, the people that can merge both broad strategy and can execute on the details, those folks are unstoppable often. Those are folks that you really-- you want them on your team, that they can do a bit of both. So we're going to talk a lot about strategy and the trends. But we're going to get into the granular details as well. And then lastly, it's always better to stay true to your values.

Now, I do say this-- it's going to be a little-- we're in this pass-fail thing. But if you want to know one way that Romain and I, it will drive us a little nutty, we're going to try to put your papers through some plagiarism software. I use Grammarly. I actually check, yes.

And if you have one like eight or ten-word section that you pulled off of Wikipedia, and I've had students grab the first 15 words off of Wikipedia and put it right in their paper, that's kind of a sloppy thing to do. And usually, if I was grading, that paper would get like a C or a D and it wouldn't get an A or a B. And I'm not going to be a hard-nosed guy about 10 words.

But if you extensively plagiarize a couple hundred words in a 900-word paper, you're going to get an F on the paper. Now, you can recover on the group paper. But don't plagiarize on your group paper because you're also going to bring down your colleagues.

I don't know in pass-fail land what I will do. But if somebody really is trying to test

the limit, you would test it by extensive plagiarism. Enough on that. I've had it in the past occasionally. So I got to say it.

I would say speak up in class if you can. Keep your videos on, as most of you have. Keep your audios muted. But please speak up. I mean, don't be hesitant at all.

And then I do have office hours. And the crazy thing was I set up office lunches. So on those following Tuesdays and Thursdays, I had-- there's a spreadsheet. Romain, maybe we should send it around to this group. There's a Google Spreadsheet if you wanted to sign up.

And right before we left, before SIP week, a student said hey, I'm signed up for the 31. Will you still do the lunches? I laughed. I said listen, I'm willing to do it. I'm willing to do remote lunches. It's crazy.

So if you want it-- if nobody signs up, I'm fine. I'll go for a run. I live in Baltimore and I'm still able to run here. They might shut that down, too, at some point in time. But for now, I'm able to do my runs. So I think that's it on the slides.

And then I think I'm supposed to finish this class right now. I went over. I want to thank you all--

ROMAIN DE SAINT PERIER: Maybe just one--

GARY GENSLER: What's that?

ROMAIN DE SAINT PERIER: Just one clarification, because I'm getting a lot of questions on the group formation. So groups will be from three to four students, and you are supposed to group yourselves, right, through the Canvas function. If that doesn't work out for you, we're going to send out a link where you can find other team members who also are looking for team members. So do not worry about the group formation.

GARY GENSLER: And I thank you all. I know this is unusual. I see you on Wednesday morning, 8:30 AM. And please stay safe and be well.