EPISODE 1103

[INTRODUCTION]

[00:00:00] JM: Software companies can be funded in a variety of ways; venture capital, self-funding, and debt among others. In order to receive financing, a company is evaluated on its ability to generate future cash flows. After all, evaluation is a number that summarizes the present value of future cash flows. Determining that valuation number is a complicated, subjective process. If the valuation can be determined more intelligently and objectively, then smarter financing decisions can be made. And this is the reasoning behind the company Capital, which aims to build a better modeling system for evaluating companies.

Blair Silverberg and Chris Olivares are founders of Capital and they join the show to explore the modeling process for valuations and their strategy for doing this with their software models.

Before I start the show, I should mention we're looking for writers. If you're interested in writing for Software Engineering Daily, send me an email, jeff@softwareengineeringdaily.com. And also, I'm looking for companies to invest in. If you are running an infrastructure company or something for developers, send me an email, jeff@softwareengineeringdaily.com.

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[00:01:13] JM: Errors, and bugs, and crashes happen all the time across my software. Most often, these crashes have to do with obscure exceptions that come from React components, failing to render on the client device. Source maps and stack traces would be useful, but in many cases, I'm not able to identify the root cause because the error is occurring on a client device. It's not on my infrastructure. And what can I do about that? I can use Sentry. Sentry.io can quickly triage and resolve issues in real-time.

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the moment that they occur so that you can triage, and resolve, and keep your users happy with functional applications. If you're building an application and you want to monitor your errors and your performance, try Sentry by visiting sentry.io/signup. And new users can use code SEDAILY for two free months.

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[INTERVIEW]

[00:02:46] JM: Blair and Chris, welcome to the show.

[00:02:49] BS: Thank you. Good to be here.

[00:02:50] CO: Yeah. Good to be here, Jeff.

[00:02:52] JM: We're talking about capital allocation today, and I'd like you start off by describing the problems that you see with modern capital allocation for technology companies.

[00:03:03] BS: I'm happy to start there. I think it might be helpful to give the listeners a little bit of our backgrounds. I was a venture capitalist at Draper Fisher Jurvetson for 5 years. I worked very closely Steve Juvertson, and we were financing our very R&D intensive technology projects that became businesses. So things like satellite companies, companies that were making chips to challenge the GPU, new applications of machine learning algorithms, so on and so forth.

I think the most important thing to recognize is that the vast majority of technology funding does not actually go to those kinds of companies. The venture stays as a $250 billion per year investment space. The vast majority of that capital goes to parts of businesses that are pretty predictable, like raising money and then investing that in sales and marketing and inventory, or building out technologies that have a fairly low technical risk profile.

So the vast majority of tech companies find themselves raising money from an industry that was designed to finance crazy, high technology risk projects at a time where that industry because technology is so pervasive, really due to the great work of many entrepreneurs over the past 20 to 30 years, technology is now main stream. But the financing structure to finance those businesses has not really changed much in that period of time.

[00:04:36] CO: Yeah. I guess I'll talk a little bit. My background is I came from consumer education sort of background, so direct to consumer. Thinking about how to use tools and make tools that ingrain to the lives of teachers paired to students. I was founding engineer at ClassDojo before starting Capital with Blaire. When Blaire came to me, we were working on the early thesis. He was telling me a lot about this and he was like, "The data out there exists to make more data-driven and data-enriched decisions. How do we build software to make that easy to access and self-service and sort of surfacing the signal from the noise?" We [inaudible 00:05:14] the idea and I thought that there was just a tremendous opportunity to bring what Silicon Valley really pioneered, which is I think making software that is easy to use and you can integrate in your daily life into this kind of old industry fundraising and capital allocation.

[00:05:33] JM: The kinds of capital allocation that exist, there's equity and debt financing and different flavors of these things. Say more about the different classes of fundraising and how they are typically appropriated to different kinds of businesses.

[00:05:51] BS: So you have the main groups, absolutely correct. There's equity and there's debt. Equity means you sell part of your business forever to a group of people. And as the business grows and succeeds, they'll get a share in that success, and ultimately income forever.

Debt means you temporarily borrow money from somebody. You pay them to that money and then at some point in time that money is paid back and you get all the future income for your business. Equity is permanent. Debt is not permanent. If you think about how normal companies are financed. Let's take the S&P 500. About 30% of the capital that S&P 500 companies use to run their businesses comes from debt. In the venture world, that's remarkably just 2%. And the thing that's crazy is this is 2% with early stage seed companies. Also 2% with public venture-backed companies in places like the Bessemer Cloud Index, which is like a $1 trillion index that

publicly traded technology companies started their life with venture backing, many of them SaaS companies. These companies also are just 2% finance with debt.

But nonetheless, within these classes, the reason, it's obviously economically much better for a business and pretty much every case to finance itself with debt because it's not permanent and it can be paid back. It's much, much cheaper to use debt. That's why you buy a house with a mortgage. You don't sell 20% of your future income forever to your bank to help you buy a house. But the reason that people use equity comes back to the risk profile. So just like if you lose your job and you can't pay off your mortgage, the bank owns your home. Same exact thing happens with debt.

Historically, if there's very low certainty around the outcome typically in an early stage investment, you're doing a lot of brand new R&D. You have no idea if it's going to work. You hope overtime that you'll be successful. But there's really quite a bit of uncertainty. Equity is a great tool, because you're not going to lose a business. Everybody can basically react to a failed R&D project, decide what to do next. Everybody had the same incentives. Equity is kind of like the consonant tool for high technical risk, high uncertainty investments. And then debt is basically the tool for everything else, and it can be used, as most companies do, for call it 90% of the places that businesses are investing. If you're spending money on sales and marketing and you know what you're doing and you've been running campaigns before that were successful, very little reason you should use equity for that if you're buying inventory, if you are a big business that's reached the level of success. That means you have a bunch of diversified cash flows coming in. Businesses might take out debt on the business kind of overall. So it's less important what specifically you're using the money for. But it's important to recognize that most companies are financed roughly 50-50 equity versus debt. It's just venture-backed companies that are kind of uniquely equity financed.

[00:09:07] JM: The capital that is being steered towards a recipient, it's often originating in a large source, like a sovereign wealth fund or a family office and it's being routed through something like a capital allocator, like a venture capital firm, for example, or a bank. How does this capital get allocated to these smaller sources? What is the supply chain of capital in a traditional sense?

[00:09:39] BS: It's kind of funny to think about capital and things like the stock market in a form of a supply chain, but this is exactly how we think about it. At the end of the day, capital originates in somebody's savings, basically society savings, right? You have a retirement account or you're a population like in Singapore, in Norway, where there's a lot of capital that's sort of accumulated from the population and the sovereign wealth funds, or you're an endowment that's managing donations that have accumulated over many, many years. Ultimately, you're trying to invest this capital to own and return and pay for something, pay for your retirement, pay for the university's operation, so on and so forth. That's where capital starts.

And then it basically flows through the economy in theory to all of the economic projects that are most profitable and efficient for society. And so if you step back and you think about like how is it that the American dream or the Chinese miracle happen in both of those cases? Kind of at different points over the last hundred years. Why is it that society basically stagnated?

The world was a pretty scary place to live in up until about 1750 when the industrial revolution started. Why is it that basically for all of human history, people fought each other for food and died at the age of 30 or 40? And over the last 250 years, that has totally changed? It's because we have an economic system that converts capital from its original owners. Diverts it to the most productive projects, which if they're successful, replace some old, more expensive way of doing something with a newer, better way.

So I think when I describe that, like I think most people can step back and say, "Yeah. Okay. I kind of see how capital flows through the system. It goes ultimately to someone making an investment decision, like a venture capital firm. Ultimately gets into the hand of the company. A company decides to invest and creating some product that people love. Let's say like Amazon. And then everybody switches from buying goods at some store that may or may not be in stock to the world's best selection of anything you could ever want at the most efficient price. Society gets wealthier, basically, through these kinds of steps and these transformations.

But it's fascinating if you step back and think about it. Nobody actually thinks those processes as efficient as it could be. Like we'd ask people all the time, people that we're interviewing, journalists, the companies we work with, so on and so forth. How efficient do you think the

world's capital allocation is? I've never met a person that says, "It's pretty good. We're like 90% of the way there." In fact, most people think it's pretty inefficient. They think of companies like WeWork, and some of them were famous cases lately of Silicon Valley backed businesses that totally underwhelmed that disappointed their initial expectations. I think most people admit that the sufficiency of capital allocation is either broken or nowhere close to achieving its potential.

So we basically – We'll talk more about our technology and how we do what we do. But we basically think of this problem as our problem to solve. There's an incredible amount of opacity and inefficiency and how the data that goes from a project or a company ultimately funneling up to an investor flows. And so it's hard to place blame, because there are so many people in the supply chain. But I think it's super clear that it's as difficult to measure whether or not a project or a business is good at converting capital into value and wealth and products that people want. It's nearly impossible for society to become really good and efficient at allocating its capital.

So we're here basically to make the data gathering, data transformation, visualization, communication of what's actually going on at a business as efficient as possible. From that, we think some great things are going to happen to the economy.

[00:13:43] JM: Go a little bit deeper on the role that a bank typically plays in capital allocation.

[00:13:51] BS: Well, so if you think about how a bank works, like let's take a consumer bank that most people kind of think about. You've got a checking account right now. You've got some money in that checking account. That account actually takes your money. Most people know this. Your dollars aren't sitting in that account waiting around for you to withdraw them. Your dollars are actually rolling up into the bank's treasury. There's somebody at the bank working with the regulators to say, "Hey, how much of this money can we actually put into things like mortgages, commercial loans?" All of the uses of capital that society has and some effort to move the world forward and make the economy efficient.

So those deposits basically roll up into a big investment fund and there's ratios that regulators set globally that say, "How many of those dollars need to be kept in reserve, versus how many are actually able to be invested?" But with the portion that's able to be invested, it's there to fund

somebody building a house, to fund a business building a factory, to fund sales and marketing, or inventory procurement for some other business.

A bank was basically the original investment fund. And a bank has – Unlike venture funds and other sources of – As we typically think, private capital. The bank has its tricky problem here at any moment, all of the depositors holding those checking accounts could show up and say, "Hey, I want my money back." That's why banks have to deal with reserve and capital predicting the amount of withdraw, and classically everybody wants their money at once at the worst possible time. So banks have to deal with quite a bit of volatility. Now if you take an investment fund on the other hand, totally, totally different structure. Your typical venture fund will have money available to it for a period of 10 years from typically these larger pools of capital we talked about. Very rarely individuals are investing their retirement savings in venture funds. Typically it's sovereign wealth funds, endowments. Basically pools of individual's capital.

When one of these funds makes a commitment to a venture fund, it will say you've got the capital for 10 years. You've got to pay me back as investments exit. But other than that, we'll just check in 10 years from now and we hope that we have more than we gave you to start with. There, there's no liquidity problem, because the fund has effectively carte blanche to keep the money invested until some set of businesses grow and succeed and go public and make distributions.

One thing that's sort of fascinating that's happened in the last 25 years is private capital, capital in the format of these kinds of funds have just grown tremendously. So today, there's a little over $5 trillion dollars of private capital being allocated in this way. So think like buyout funds, venture funds, so on and so forth. These funds don't have the liquidity problems of banks. They can make much longer term for looking investments. This has created a tremendous potential to make the economy more efficient by taking out the time spectrum. This is why venture investors can do things like finance SpaceX or Tesla and really build fundamental technologies in a way that a bank never could. This is an amazing thing. However, leads to a very long feedback cycle. So the incentive goes way down when you take out the timeline over which an investment needs to payback to carefully monitor and understand what's going on in the business day to day.

So it's pretty interesting to think about the different pools of capital. There's – Not to make it sound too confusing, but I think everybody will admit that the financial markets are incredibly diverse and complicated. We track basically about 15 different kinds of capital and there are sorts of pros and cons with each one. But a bank is one, a private fund is one, and an insurance company's balance sheet is another. You've got things like ETFs and public vehicles that hold capital. So there's quite a bit of complexity in the structure of the financial markets.

[00:18:01] JM: All right. That's maybe the supply side of capital on – And then there're all kinds of middlemen and all kinds of different arrangements. But ultimately, there's also the demand side of capital, at least from the point of view of companies getting started, which is startups or companies that are in later stage, whether maybe they're not exactly considered startup anymore, but they're mature. These companies have models for how they are predicting they're going to grow. But oftentimes these companies are very lumpy in terms of how their revenues come in, how closely their predictions can track reality.

How do technology companies even model their finances? Is there a way to model their finances that actually has some meaningful trajectory?

[00:18:55] CO: Sure. First, companies need to basically think about all the places that they're spending their money. And we do I think a pretty good job of organizing this and making it simple. When we look at companies, and we can talk more about how the capital machine operates. But when we look at companies, we basically think that there are only a handful of places that money gets spent. You spend money on short term projects that you hope are efficient, things like sales and marketing. You spend money on paying for your sources of financing, like paying interest on debt, making distributions to your investors. And then you spend money on everything else, and everything else can be designing software, or building a product, so on and so forth.

So if you break the demand for capital down into just those three buckets and look at them that way, some pretty interesting things happen. The first is, for those short term investments that you hope are productive, you can track pretty granularly weather or not they are, and we'll come back to that. For paying back your investors, you sort of know exactly how much you're paying your investors. So that's a pretty easy thing to track.

Then for the operating cost, most people will call this OPEX, that you're paying to keep the lights on, things like rent and your accountants, the CEO's salary, so on and so forth. These are table stakes expenditures that you need to stay in business. So amongst each of those three things, there are different things that you want to do to optimize, and I'm happy to go in a more detail and sort of go through each one if you think that'd be useful.

[00:20:28] JM: Yeah. Well, let's talk a little bit more about how these companies should be modeling their revenues or a way that is meaningful to model their revenue so that you can potentially think of them as targets for capital allocation. If we think about understanding what company might be a viable recipient of capital, how can you accurately predict the trajectory of that company or would they present a model? Would they develop a model? Go through in a little more detail how a company would sort of justify its need for capital.

[00:21:05] CO: So typically what most companies do, and this is not terribly useful or accurate, but I'll tell you what most people do. I mean, by the way, like how essentially the entire economy predicts demand for capital works like this. Companies take their income statement and their balance sheet historically and basically they have this Excel file and they've got a bunch of rows that have different things like my revenue, my revenue that's linked, or my expenses that are linked to revenue, [inaudible 00:21:35]. So on and so forth. They grow each of those rows by some number that they hope to hit.

So if you want your revenue to double next year, you'll say, "Hey, my revenue is $100 today. I want it to be $200 12 months from now. I'm just going to draw a line between those two points." Every month, there'll be some number that's on that line, and that's my monthly revenue. I want my expenses – Everyone knows my expenses are going to have to go up if my revenue goes up, but I don't want them to go up as much as my revenue. So I'm going to draw a line that's somewhere less than the doubling.

And you put all these lines together in one big Excel file and they are your corporate projects in general. This is true for big companies, small companies. But that's not actually how company revenue works. Because if you go back to the three categories we talked about before and you just focus on the one that talks about these short term investments, the way company revenue

actually works is a company this month, let's say they spend $100 on sales and marketing. Well, they're hoping to get a return on sales and marketing. So they're hoping that in the next six months that's paid back or 12 months that's paid back, you can actually track every time they spend money on sales and marketing. How quickly it gets paid back.

So it's that level of precision that can accurately predict revenue. So what we do is we basically just get a list of every time money was spent on one of these short-term investments, so we use sales and marketing for an example, and then we get a list of all of the revenue that was ever earned. And we attribute between both of those lists' cause and effect. And we do that using a bunch of techniques that are pretty common place in your typical data company or a machine learning company. We use some math, things like factor graphs. We use simple kind of correlations. We have whole kind of financial framework to guess what attribution should be, because you learn a lot as you see different businesses and you see a bunch of different patterns, which you can basically cluster on.

But it is this linkage between spending on something like sales and marketing and then seeing revenue go up or down, but makes or breaks a business. And you want to look at it in isolation, not in a bundled entirety, which is now financial projections are typically built.

[00:24:09] JM: Okay. Well, let's talk a little bit more about what you actually do. If you're talking about early stage technology companies, describe how you are modeling those companies and how you are making decisions as to whether they should receive capital.

[00:24:26] CO: When a company comes to Capital, they come to our website. They sign up for this system that we've built, which we've called the Capital Machine. And the first thing that they do is they connect their accounting system, their payment processor typically. So think like a Stripe. And then sometimes they'll provide other things, like a pitch deck or a data room or whatever other information they have prepared.

The system pulls down all of the day in the accounting system and the payment processor. We look at other systems too, but these are the two key ones that I'll dive into in detail. So what ends up happening is from the accounting system we get a list of all of the times the business has spent money on these things, like sales and marketing that we're talking about before. From

the payment processor, we get a list of all the revenue transactions, and crucially we did at the level of each customer payment.

So we scrub PII. All we really care about is having a customer ID. But once we have data at that level, we can start to do this linkage and say, "All right. Look. This business spent a million dollars on sales and marketing in March of 2018. In April of 2018, we saw revenue grow by 20%. That was a pretty substantial change. What actually happened here?" You can typically identify the sub-categories of sales and marketing and start to do this linkage between these two. And this is really the magic behind our data science and our quant team pairing with our data engineering team to figure out this problem and solve it in a way that's robust.

But once we have these two data feeds and the system goes through and does all these attribution calculations, we're able to present back to a company a pretty clear picture of what's going on. And so we'll say things like, "Hey, your business is pretty seasonal. And in the summer is when you're typically more efficient at converting your sales and marketing dollars into growth. So first, you want to finance growth in the summer. The second thing is only about 80% of your business if financeable. There's 20% where you might not know it, because you're not looking at this level of detail. You're busy building your business, which is exactly what you should be doing." But 20% of your business is not efficient. You're spending money on sales and marketing categories, product lines, etc., that just shouldn't exist. So if you get rid of those, if you doubled down on the part of your business that is efficient, then we predict your revenue will be X 50% higher and we'll tell you exactly how much money you need to invest to raise the revenue by 50%. We give you a bunch of charts that allow you to see how history and projections merge together and dig down and inspect how we do that linkage to make sure that you agree."

But this is what the Capital Machine does at its core. It converts company data into a fully audited, completely transparent picture of how a business works, where it's efficient, where it's not efficient. And then that's where our technology stops and where our balance sheets come in. So we then take this information and we make balance sheet investments directly in companies. So primarily at this point, we lend money to technology companies that we see from their data are eligible for non-dilutive funding. We make that capital available to them directly. We basically allow them to access it through the Capital Machine. We use this one system to communicate

changes to the business, keep both sides informed, so on and so forth. But this is the kind of analytics layer that's essential to making these capital allocation decisions more efficient.

So I think you could imagine a day, at least for us, in the not too distant future, when it's not just us using our balance sheet and this tool to make investments. But in fact, just like Excel, every investor can benefit from a similar level of analytics and transparency as can companies by getting more accurately priced faster access to capital, less friction and so on and so forth.

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[00:29:00] JM: GitLab Commit is GitLab's inaugural community event. GitLab is changing how people think about tools and engineering best practices, and GitLab commit in Brooklyn is a place for people to learn about the newest practices in dev ops and how tools and processes come together to improve the software development lifecycle.

GitLab Commit is the official conference for GitLab. It's coming to Brooklyn, New York, September 17th, 2019. If you can make it to Brooklyn on September 17th, mark your calendar for GitLab Commit and go to softwareengineeringdaily.com/commit. You can sign up with code COMMITSED that's, C-O-M-M-I-T-S-E-D and save 30% on conference passes.

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Thank you to GitLab for being a sponsor.

[INTERVIEW CONTINUED]

[00:30:28] JM: The inputs specifically, if you think about a model for determining whether or not a company should be eligible to receive capital, I'd like to know how the models are built, the

data science models that you're building are constructed from the point of the view of the inputs. How are you determining or how do you – Like a company comes to you. How do you turn that company into some structured form of data that you could put into your models and determine whether it's worthy of capital?

[00:31:03] CO: Yeah. I mean, it kind of comes down to what the data is that you're pulling down. So when we connect to a system like Stripe or a transaction record system, we know that that's the revenue of the company. Now, where things get interesting is when we connect to balance sheets and P&L [inaudible 00:31:19] of a company, it really comes down to understanding at a more granular level what exactly these numbers mean. And that's sort of where we've made our data pipeline, is sort of built from the ground-up to give us that granular view of a company's cash flow. Not only revenue streams, but where is the money going and where are they allocating it. And it's that level of granularity, once you understand that data through that lens, that lets you build pretty sophisticated financial models on top of it. As soon as you have the picture of the company, you can really do a lot of flexible analysis on the back like distributed computation and some stuff that you would never be able to do in excel. Quite frankly, like a lot of these companies don't have the staffing internally or really the tools to understanding [inaudible 00:32:09] for themselves. So you'd be surprised that when we surface this analysis back to the company by virtue of just being transparent on how it is we're making decisions, how it is we see their business, the signals that we're uncovering, the operators, the CEOs, the CFOs that are really focused on building their company are really surprised and they're really – They think these insights are really transformative to how they think they should access capital in the future and what they think they should invest in growing the business.

[00:32:39] JM: Are there any sources of third-party data that you can gather to improve the decision making?

[00:32:47] BS: There are at a macroeconomic sense. And so it's actually quite useful to look at public company performance and say, "Hey, SaaS businesses in general –" and most people know this about SaaS businesses. But SaaS businesses in general are seasonal in the 4th quarter budgets basically expire and people come in and they buy a bunch of SaaS software. So to take concepts like that, basically shapes of curve signals and apply them to private company financials is useful.

Crucially though, there is no private company data repository of any kind. It just doesn't exist. Notoriously, even with small businesses, it's actually quite, quite difficult to get access to any sort of meaningful credit data. And so what ends up happening is these businesses give you a picture of their business directly as an investor and you have to interpret it directly. And that's basically how this works. Totally unlike consumer credit, there's no credit bureau that people are paying. So most investors are analyzing this data in Excel. Excel notoriously breaks when there's about a million cells worth of data.

And so we've got this great visualization showing our data pipeline and it's basically a bunch of boxes and there's a little tiny box in the bottom left corner that's Excel, and there's a bunch of other boxes across the entire rest of the page that are nodes in our distributed computations. But Excel is very, very limited. And so it makes it impossible to actually understand what's going on in the business from the source data. And it's at the source that you see this variability and this linkage between profitable capital allocation decisions and unprofitable capital allocation decisions.

[00:34:41] JM: Describe in more detail the workflow. So a company comes to you and they're going to put their inputs into the – What you call the Capital Machine. What does that workflow look like in a little bit more depth?

[00:34:56] CO: Yeah. So when they come to the website, they create an account, much like you would on if you're creating Twitter or a Facebook account. You enter your details and your email. You verify your email and then you land on what we're calling like the Capital portal. And on there, you have a set of tools to connect your systems of record. And these are typical OAuth flows. Flows that people are very familiar with. You say, "Hey, let's connect my Quickbooks." You [inaudible 00:35:27] credentials in sort of a secure way, and you click okay, and the system – You get a checkmark by your Quickbooks. And the system starts pulling down that data at a regular cadence. And depending on what system you're connecting and kind of the characteristics of that particular systems of record and how much data you have, the data is available anywhere from 10 minutes to a couple of hours later.

Once we have that data in our system, we run that through our data analysis pipeline and the user, as a company, you get charts back in a tab and we kind of call it the insights tab. And these are views that we think would be helpful for you as an operator in your company to understand about your business. And then separately, we also get views of that data that are useful to our internal investment team whoever is looking to make capital allocation decisions.

[00:36:22] JM: Are there certain business categories that are a better fit for modeling and better fit for the kind of predictable capital returns that you can expect with the investments that you're making? So like ridesharing, or gig economy businesses, or SaaS businesses? What are the categories that are the best fit?

[00:36:45] BS: I'll just going to say very few categories don't fit from the perspective of linkages. But there are certainly models that I think are easier to think through and easier to understand, but our system can underwrite today a lease on a commercial aircraft, a fleet of ships, an insurance agency, a SaaS company. I mean, the most important thing about our system is that the financial theory that underlies it is very general, just like a PE ratios is very general. So that kind of sounds crazy. A lot of [inaudible 00:37:20] people, a lot of people say, "What business is a best fit for your system?" And it's kind of like asking what business is a best fit for Warren Buffet? Warren Buffet is a generalist. He can invest in any business and he has a framework in his own head to figure out how to make a ship comparable to American Express.

Our system has a very similar framework. It just operates at the level of transactions instead of at the level of financial statements. But certainly within that framework, there are some examples that are just easier to describe. I think like thinking through the efficiency of sales and marketing, something that's a lot more obvious than thinking through like the stability in refurbishment of commercial aircraft parts, which is a key question pricing. Pricing of refurbished parts, which is a key question of your financing a commercial aircraft. Our team, the investors that use the Capital Machine internally, which we primarily do internally. We do a little bit of partnering with outside groups to use us as well. These people are all specialists in some particular area, but it's crucial to understand. They're looking at the exact same charts as all of the other specialists in all of the other areas. It's like literally the SaaS company and a commercial aircraft will have the same series of charts and investors are there to draw their own conclusions.

[00:38:38] JM: This is a question for Chris. Can you describe the stack of technologies that you've built in more detail?

[00:38:45] CO: Yeah. Yeah, of course. On the frontend, we are React, Typescript, kind of on NextJS. Everything is on AWS. And in the backend, we're all Python, and really the reason for that is if you're doing any serious machine learning or data science today, you can't really get away from Python Stack. We're all Python on the backend. We have Flask as our API layer. And yeah, that's the high level.

[00:39:14] JM: And can you talk at a little bit more detail about how the data science layer works?

[00:39:20] CO: Yeah. Yeah, of course. So we pull down the data into basically a data lake. Then that goes down into our data pipeline, and that's all orchestrated on top of a technology called Airflow. And we use technology called Dask for our distributed computation. And I think that this is a good choice for us. At this moment, I see us doing a lot of work on using Spark and other distributed technologies in the future and we grow out the team. And it turns out that we pull this data down and organize the data lake, what's sort of really important to us is we build a lot of abstractions to make accessing that data really easy for quantitative analysts. Because what's really important and essential to our whole technology is that we're able to do a lot of different financial analysis and experiment very quickly on top of this data. So the implications of that really cascade down all the way into what technologies we're using. How we structure our data lake? Even how we structure our teams. So it really had broad applications across the whole product.

[00:40:24] JM: How is it that when you're analyzing a company that you have enough data that it weren't a Spark cluster? Because I can imagine, the financial data around a company, how can there really be that much data to analyze?

[00:40:39] CO: Oh! You'd be surprised. And a lot of these transaction systems, particularly if the company had been around a couple years and they're direct to consumers. These datasets can be pretty large. We're talking about in the millions and millions and millions of transactions that

we're pulling down and storing. That's just on a per company basis. That's not even talking about if we want to do benchmarks cross-companies and also if we want to do scenario analysis.

So one of the things we do as part of our data pipeline is take this data and run it through like 90, 100,000 simulations to understand the sensitivity of different variables on the performance of your business. And you can imagine, if you're starting out with a – Starting data that's already large, there's sort of a multiplying effect on how much data this system needs to be able to process as we go through those different stages.

[00:41:28] JM: And can you tell me in a little more detail like what would a typical Spark job look like for a company that you're assessing?

[00:41:36] CO: Yeah. So first step is sort of our financial data ingestion part. So we download something on the order of 40, 50 gigabytes of transaction data for a company. Then we have to do all of the work to interpret and understand what that means and reorganize that data in a way that our downstream analysis and primitives can make sense of and to use for useful analysis. Really, the first step of the Spark job is transform the data in something that's useful. Then there's all the work on what are the clusters and what are the machines in the analysis, in the computational resources you did to run all these simulations. Not just on your local compute. Your local compute will kind of fall over. You only have about 32 at best, 64 gigabytes of RAM locally.

So that's when the workflow comes in and creating easily these interfaces into Dask clusters and making sure that when you run a job, you know when it fails, you know when it's done. You know when the quant team can, "Okay. This part of our analysis is done. I have this intermediate data asset ready to do more analysis on. Now it's time to get back to work," is a lot of the time we spent developing internal tools to make it easy.

[00:42:43] BS: One other thing that I'll mention that I think is important is a lot of the underlying technology in our data pipeline, it's no different than like what a Tableau or any traditional BI business would have access to. But what's fascinating is when you have a vertically specific

domain, financial data in our case. You can make a lot of interpretations about the data that let you do much more intelligent things.

For example, you don't have to make your own charts as the user of the Capital Machine. We make all the charts. You can of course as a business we work with give us ideas for charts. You can mock up your own. We basically have an interface for business BI teams to write some code if they want to. But when you have quants who are thinking about financial risk, financial attribution across all of the companies that we see, distilling that down into a series of indicators that are detailed but generalizable and then publishing that back to all of the companies that use the Capital Machine to run their own capital allocation decisions and access external fundraising and capital.

Some pretty amazing things happen. So it's only with a vertical view actually having these – We call our data scientists quants, but actually having these people who typically are graduate level economists thinking for the first time about using transaction level data in their analysis, which is notoriously not available to normal economists. That you get the kinds of insights and analysis that are actionable for businesses. And then in term of the data pipeline, that then means we actually store a bunch of intermediate data that's opinionated in that way. And that makes it much faster to access, much easier to benchmark, much more useful across a network of companies versus just that isolated Excel model that explains only one business.

[00:44:48] JM: One thing I'd like to ask you about, capital intensity. So there are kinds of businesses that are capital-intensive. For example, we have to pay upfront for a lot of ridesharing rides, and as Uber or Lyft has down in much detail, you allocate all these capital to things to subsidize rides, because you try to win a market. There are all kinds of other capital-intensive business. How does capital intensity change what makes sense with regard to the equity financing or the debt financing that you are shepherding for these companies?

[00:45:26] BS: That is a great question, and because of where you focus, and I think your audience, you totally get this way than most financiers don't. SO the first point, exactly like you said, capital intensity means a business consumes a lot of capital. It doesn't mean a business has a physical factory or plant or rail cars. So it is absolutely true, exactly like you said, that there are a lot of tech businesses that are incredibly capital-intensive.

If you are a capital-intensive business, that means you need – Especially if you're growing, you need to raise a lot of external capital. So it is even more important that your capital or a big portion of your capital base is not dilutive. That's just essential kind of table stakes, because what you see with these businesses, the ridesharing companies are a great example, is by the time one of these things actually goes public, the early owners in the business own a very, very, very miniscule piece of that business still. If you contrast that to company like Veeva Systems, which I think is one of the most capitally or capital efficient businesses in venture history, I think that this has raised something like $12 or $15 million total before it went public at a multibillion dollar market cap.

Capital intensity is a synonym for dilution. You're going to own way less of your business than you think when you exit and then it's even more important that you figure out a way to raise capital non-dilutively upfront.

[00:46:58] JM: Some broader questions, just zooming out and getting your perspective. Do you have a thesis for what is going on in the economy right now where you look at the fact that we have obvious pressures to reducing the size of the economy through the lack of tourism, the lack of social gatherings while the stock market climbs higher and higher? And it appears that the technology side of things is almost unaffected by coronavirus. Is there a thesis that you've arrived at or is there a set of theses that through conversations with other people you've found most compelling?

[00:47:49] BS: Sure. The most important thing to realize about the stock market is that it discounts all cash flows from all businesses in the stock market to infinity. And so the value of the stock market, about 80% of the value of the stock market is pretty far into the future. Like more than three years from now.

So if you believe that the current economic crisis, and this is why there is always a recovery, at least in the western world over the last 250 years after an economic crisis. If you believe the crisis will eventually revert and there will be a recovery, then it only makes sense discount stock market assets by anywhere between 10% and 25%. If you believe the business is fundamentally going to go out of business because of this crisis, that's a different story. But that

explains why something as terrible as COVID-19 and a pandemic only discount of the stock market by roughly 30%, 35% in March. But that's not what's actually going on today as you mentioned. So stock market prices now have completely recovered. That is something that we think is a little bit of out of sync with reality.

But I should mention, we don't spend too much time thinking about the stock market beyond that. We just look at private company fundamentals. We try to understand what's actually going on in individual businesses. Then we look across all the businesses in our network to see what we can understand and what kind of conclusions we can draw.

So if you take that lens and you actually look at what's happening to businesses due to COVID-19, it's fascinating. Some businesses, like think the food delivery space, have gotten a lot more efficient. So those businesses looked a lot like ridesharing businesses back 12 months ago. There was sort of a bloodbath between a bunch of companies competing in local markets to acquire customers, all fighting, Google and Facebook and so on and so forth, subsidies for drivers, etc. That's essentially stopped. These businesses are incredibly profitable. The cost to acquire customers has fallen by even more than half in a lot of cases. The channels were just a lot less competitive.

So if you're running one of those businesses, now is a great time to be aggressively expanding. Weird things like commercial construction businesses. There are actually a handful of businesses that we've seen that do things like install windows and doors in commercial buildings whose businesses have accelerated. Because all of these buildings are closed down. Construction project timelines have gotten pulled up. All of these orders are coming due and they're sort of rapidly doing installations.

There are obviously a bunch of other businesses that have been hurt by the pandemic. But our general thesis, our general view, we've studied a pretty detailed way the Spanish Flu in 1918. These things eventually go away. There will be a vaccine. The economy will get back to normal. And as long as we can stay focused on working through this as a society and sort of maintain our fabric of kind of economic progress, then the stock market values today will eventually make sense. It's just sort of a question of when for the stock market. And then if you're actually running a business and thinking about your own performance and isolation, really being clear

about is now the time to invest and grow my business, or is now the time to be very careful with my expenses and just get through this for the next year or however long it takes for there to be a vaccine?

[00:51:19] JM: So the way to think about your company if I understand correctly, if I was to put it in a nutshell, is that I think of you as a data science middleman between large capital allocators and startups deserving of capital. So the sovereign wealth funds, the banks, the I guess funds of funds. These kinds of sources are essentially looking to you for guidance on where to direct the capital. And you're on the other side absorbing data and creating opportunities from these startups to source the good directions of that capital. Just to wrap up, would you put any more color around that description of refine it in any way?

[00:52:13] CO: Yeah. I mean, I think that at the core of what Capital is, is we're the core technology enabler of sort of the private market. If you think about public markets today, you have clearing houses like the New York Stock Exchange, and you have companies that provide analysis on top of that like Bloomberg. We see a tremendous opportunity to ship the paradigm where the place where all the financial transactions happen. It's also the place that collects the data and provides information for those making those decisions. Yeah, I think Capital is really at the center of making a transparent technologically enabled financial marketplace.

[00:52:57] JM: Well, guys, thank you so much for coming on the show and discussing Capital. I guess one last question is do you have any predications for how capital allocation for startups will look differently in 5, 10 years?

[00:53:12] BS: Sure. The first prediction, and this is happening now. I mean, the infrastructure is absolutely in place both with us and others. Most startups fairly earlier in their life think is equity the only way to do this? So that's a cultural shift that's already happened. People are starting to ask that question.

The second prediction is seed and series A funding will be entirely unchanged. After series A, there will be a bifurcation between businesses that are really capital-intensive gigantic R&D projects. Think like SpaceX. Where the series B, C, D, E and F are really about building and

launching a rocket. Those businesses will by and large not turn outside of equity to finance themselves, but there are very few of those businesses.

Pretty much every other business, businesses that you see raising a series B, a series C will, like any normal business in the entire rest of the economy, raise maybe half of that capital non-dilutively either in the form of debt, royalty, financing, factoring, all of the other instruments that normal companies use to finance themselves and avoid dilution. That will happen roughly three years from now. That will kind of – We'll see obvious signs of that from a very early base. Then the final thing is Steve Kays talk a lot about this with the rise of the rest, and he's got this great venture fund that invest explicitly outside of the coast. So kind of the rest of America. And we've seen that there's a pretty dramatic distinction between being a coastal business and non-coastal business from a capital access perspective, but there's no distinction from an actual performance perspective. So we'll start to see some of the regional differences and biases around where capital flows go away.

So I would maybe put that on a 5-year timeline, like raising capital is actually much more predictable, much less biases. And that's great back to the beginning of our conversation. That's great for the economy. I mean, every project or business that can convert capital to products and services that people love should get financed. No questions asked. It doesn't matter what the color or your skin is, what background you have, whether you went to college, didn't go to college. It just doesn't matter. You have a business with data that can prove whether people love it or whether people don't love it. So I think we'll start to see that over the next 5 years.

[00:55:53] JM: All right. [inaudible 00:55:54] to close off. Blaire and Chris, thank you for coming on the show.

[00:55:58] BS: Yeah, thanks for having us.

[END]