

Adam: 00:00:01 Okay, we are live. Corey Hoffstein welcome.

Corey: 00:00:05 Thanks for having me, buddy. Good to see you.

Liquidity Cascades

Adam: 00:00:07 Well, I knew as soon as I read the new paper, I knew that we had to have this chat because there is just so much meat in there. You and I chat regularly so I know you've been exploring this rabbit hole for many months and you've been building options surface models and all kinds of quantitative analyses to help dig into many of the dark corners in your thesis and I also know it's a bit of a departure from your usual focus. This analysis culminated in the publication of this new paper, "Liquidity Cascades". But I think it's worthwhile having you walk us through the journey that motivated you to start investigating this new way of thinking about markets.

Corey: 00:00:55 Absolutely. I thank you again for the opportunity to come on the chat. I'm hoping you'll give me a lot of good pushback here. I do want to set the table a little bit with this paper. I have made it explicit, I hope that there are a lot of circumstantial narratives that I put forth in this paper and my personal conviction in any of these particular narratives varies from very strong conviction, to almost no conviction. So there's a couple of ideas in there that I put it in there that I think are fun, but I don't necessarily believe them personally, but they're out there as ideas that are being talked about. I think they're just worthy to introduce, given the whole sphere. At least for me, the big takeaway of this whole paper is, you don't have to believe in any of these ideas individually as the core idea that's moving markets currently, but they all work together and point to the same risk factor and we'll evolve into that as we chat.

But to get back to your original question, what was the instigator for this research versus prior research of ours which has been perhaps far less circumstantial and narrative in nature, and far more quantitative? A lot of it just goes back to questions that we started receiving from our advisor clients going back two or three years, where a lot of advisors started expressing this feeling that markets were different. My answer to them was, well, of course, markets are different, markets are constantly evolving not only technologically, but they're reflexive based on the players who are in them. But that doesn't necessarily mean the core ideas by which you have to invest are necessarily different. There's a lot of feedback that markets feel faster, and you're getting these more V shaped type recoveries and what does that mean for investors. Ultimately, from a quantitative perspective, it was really hard to dig out, is this

decade really meaningfully any different statistically from a return basis than prior decades, and there just wasn't enough evidence to say from a statistical basis, it was truly different. Queue March 2020. I think for me March 2020, in real time changed everything, where as we were looking at the pattern of factors as it evolved, a lot of people interpreted it as an exogenous economic event, and I do think to a certain extent it was the catalyst that kicked something off. But what I saw in real time was an endogenous liquidity issue within the markets, particularly fixed income, and you just saw all these markets fundamentally break down in the way you would expect pricing to work. It just seemed to cause this continued rapid sell off of almost every asset.

So, post that event, I said, something seems functionally wrong here. It took the Fed stepping into restore order, right or wrong depending on perhaps your economic and political views, the Fed had to step in and make markets at least operate correctly. Then from there, it really became a question of this does seem like an inflection point and how I understand the operation of markets and that's what really kicked off the research. For me, it was trying to get rid of all preconceived notions of how I think markets work, willingly allow myself to go down every narrative and conspiracy rabbit hole. I think I went through at least 10 rolls of tinfoil making tinfoil hats for myself, but ultimately what emerged was this paper.

Adam: 00:04:27 Well, I think what was really interesting to just having travelled some of this journey with you was that it prompted you to reach out to an ecosystem of, I guess, primarily financial Twitter based people who were more heavily immersed in this space on a daily basis, right? The Benn Eifert's of the world, and Himelsein's and Mike Green. So there's a lot of discussion around this type of thesis in certain pockets of the financial ecosystem. How did some of those relationships evolve and some of those conversations work out?

The Three Narratives

Corey: 00:05:08 Yeah, I think what's been really interesting for me is how people's view of how the market operates - it seems to be largely dependent on the type of assets they operate within. I think a lot of us come into the markets through the equity doorway, a lot of us read the Ben Graham and we have this idea of stocks equal discounted cash flows, and you start talking to people who operate in different markets and they go, well, that might not be the case, let me show you a different sort of idea. The three main narratives that I largely heard, or at least there were there were three main trunks of narratives, there's a lot of branches, but the three main trunks are: The Fed has totally distorted markets. The second narrative is passive investing or indexing, which are totally

different, we'll get into that, have distorted markets. The other one was this idea of liquidity mismatch that was existing between the liquidity being provided by high frequency traders and the liquidity taken by hedgers during stress market environments. Depending on who I spoke to, a lot of times they were very convinced that their narrative was the driving force, and the other narratives weren't applicable. It's actually been really interesting as I get feedback from the paper. A lot of people, for example, in the world of ETFs are saying you've massively overblown this idea of indexing's impact on the market, and you talk to someone else who perhaps is a little more skeptical about the impact that the Fed is having. Ironically, the derivative folks are all going no, you nailed it, derivatives are totally having an influence here. But I think you do have to be in the weeds of that particular topic. So someone like Benn Eifert who really truly has an expert knowledge of the way structured products are hedged by banks, and how the option surface and implied volatilities have changed due to the adoption of structured call over-writing and put under-writing programs by endowments and other institutions, is really invaluable knowledge that someone who's going out there and buying an individual small cap value stock because they think it's undervalued, they're just not getting the same view of the market. They're literally looking at it from a totally different angle, and potentially not understanding some of the external forces that are actually driving what's going on from a supply and demand perspective.

Adam: 00:07:31 Yeah, I think you're right. I think one of the real edges in your paper was that you didn't really get married or bogged down in any particular narrative. So you've got these three competing narratives and you're able to dig a little bit deep and ask some nuanced questions in each of the different domains. But by analyzing the three domains together, you're able to triangulate a little bit and maybe zero in on the true causal forces, or some of the things that actually might be going on fundamentally, and how those forces interact with one another. It actually is probably useful for...I found Figure 1 in your paper to be really instructive. It sort of ties together all the major themes in the paper. Do you have that handy, can you walk us through it?

Corey: 00:08:20 Absolutely, let me pull that up really quickly. Figure 1 sort of looks like, let me get this open for you. Let me know when you can see it.

Adam: 00:08:33 Yeah, I can see it.

Corey: 00:08:34 Figure one is what I called the current market incentive loop. I think when you first take a look at this, it's overwhelming. Maybe it looks a little bit like you see those old fashioned crime dramas where they're drawing red string between everything, and it starts to look a little bit tinfoil hat-ish. But the basic idea here that I've laid out with these different narratives is they're all operating almost

in a bit of a flywheel, a bit of a loop that all interacts with each other and they all have second, third order effects that occur. So where I picked up the thread was in 2008. That's how I looked at things as the experimental monetary policy that the Fed adopted and introduced over that time, served as an accelerant. I think you can certainly go back to the late 90s and say that there was the beginnings of the Fed's influence on the market started then, but I think the Fed had a much heavier hand introducing a lot more experimental policy into the market in 2008. That really had two effects. It showed that the Fed was willing to become an active player in the market, no longer just a referee but truly an active player in backstopping the market. And its suppressed interest rates in a way that forced investors, especially investors with real dollar liabilities to have to move up the risk curve. Then moving up the risk curve, investors go from, say US Treasuries that used to get them four or five or 6% and now all of a sudden have to buy equities or alternatives or move into strategies that they think can get them pseudo equity like returns but with some risk management characteristics. So volatility contingent like strategies. Investors abroad started looking at structured products to try to generate yield where bonds were no longer sufficient.

So you have this mass adoption. Now, you can argue that that move up the risk curve, actually creates a perpetual bid for risk assets. Then by forcing investors up that actually balloons the demand side of the equation for these risk assets and actually has lifted all these risk markets over the last decade. Now you take that and you think, okay, these investors now all have to put their money to work in these risk assets, one of the big ways in which they've done it has been going into equities and largely migrating from active to passive strategies, or active to indexed ETFs over the last decade. That's had some interesting effects potentially from a cross sectional pricing perspective within equities, as well as the way in which markets operate on a micro structure perspective, that no longer are there active managers going out and buying individual securities, but when a dollar is now allocated to a strategy, it's largely allocated in a basket based manner, where that dollar is now being used to just buy a set of securities regardless of value, sort of the market makers who are facilitating that trade know the price of everything, but the value of nothing. You keep moving along the loop and if we do hit some market disconnect, say a catalyst like the Corona crisis that sends the market skidding off, we tend to see a situation where high frequency traders pull back the amount of liquidity that they provide largely due, it seems to the fact that they're operating with a tremendous amount of leverage contingent upon the collateral they can post which is often securities based. When markets get more stressed, they have to pull their liquidity but at the same time a lot of those strategies that investors have adopted are volatility contingent. So again, these structured products are ways in which investors are

searching for yield, like trying to sell options, buy puts, all of these things caused forced hedging by either options dealers or banks that ultimately is liquidity taking. So you get this pro cyclical effect that as liquidity is getting removed, more and more investors are trying to take liquidity which causes markets to draw down further, forcing further hedging and you get this liquidity cascade crisis that requires the Fed to come back in, backstop liquidity, and set the whole loop in motion again, and I think that's what just happened in March and where we are today. So I think the big question is, does the next decade actually echo the past because of this loop?

Adam:

00:13:20 Right, yeah. Extraordinary comprehensive and there's a lot of moving parts and a lot of feedback mechanisms. What struck me too is, you had a chart that you pulled from a Callan Associates report that showed that investors seeking, so a typical institution they've got either fixed liabilities or they've got fixed payment schedules, and so they've got a required return in order to not fall behind on their liabilities and or be able to meet these payments. So, the typical pension requires say 7.5% return, which on its face seems just absurd in the current environment. But if you make the assumption that you can indeed stretch to take on enough risk to generate that seven and a half percent return, it requires three times as much volatility to achieve that return today as it did in 2006. I believe that was the reference here, sorry, in 1995 rather. I think that was the reference here. What struck me as I went through that is that those are mean returns. So if you've got a mean return expectation of 7.5% at a 6% vol, your compound expected return is sort of 7.4%. But if you are generating a mean return of 7.5% with a 17% vol, your compound expected return is closer to 6%. And this volatility drag term scales exponentially as vol increases.

So there is a point at which just mathematically you will need to stretch so far into risk space that the vol drag will overwhelm whatever marginal benefit you get on the mean expected return. So, there's a cap to the total compound return that can be generated from this market and beyond that cap if that cap is lower than the required return for an institution's liabilities, or its cash flow promises, that represents a singularity event for these institutions. So, it is an interesting potential one directional end game for how this plays out, just one of many.

Corey:

00:15:41 I think, for me, when I started going down this question of okay, rates are suppressed so what? My question was, why do people have to move up the risk curve? Why can't we just accept less return? And the answer, at least as I found it, became...because there are certain people who have far dated liabilities, that just because rates went down doesn't mean they don't owe \$100, 20 years from now to their pensioners, they still have to hit that return that they've promised regardless of what's happened to base rates or premia. They've made

a promise and either they're going to default on that promise which has all sorts of economic consequences for us as Americans, or they're just going to have to keep moving up the risk curve until they can try to find a return and try to stomach the volatility. And ironically, by moving up the risk curve and adopting riskier and riskier strategies, they might have both simultaneously from a supply demand perspective, pushed returns up in the short term by everyone moving up and demanding more equities, but also compressed those premia going forward. I think we've seen that in the volatility space. To your point, if they keep adopting more and more and more volatility, that compound growth rate as compared to that arithmetic expected return starts to take a nosedive.

Adam: 00:17:06 Yeah, absolutely. That has profound impacts on even sustainable withdrawal rates for retirees, not just institutions. It's anybody who is needing to lean on their savings to generate income to support financial objectives. I think it affects everybody.

Corey: 00:17:25 I think for me anecdotally, this was very obvious over the last decade with a lot of the advisor clients I worked with, where they started to look at things like private REITs, they started to look at things like MLPs and covered calls and introducing all that stuff to their clients to try to supplement yield for retirees and stretch in every which way they can. I actually just put out a question on Twitter saying to folks, look, 10 year rates in the US are very very low. It's a great predictor for returns over the next 10 to 15 years. If you're an advisor charging 1% and the 10 year rate is 70 bips, what are you doing with the 40 of your 60-40? And I'm not here to say there's a death of the 60-40 by no means. But I think it's an interesting question to ask. Almost all of the answers I received involved people moving up the risk curve in some capacity.

Adam: 00:18:18 Yeah. Certainly either they're moving up the risk spectrum in a traditional sense, like they're moving into deeper credits or they're moving into higher beta equities, or et cetera. They're selling more volatility, or they're moving out the complexity spectrum into products that probably, advisors have less intimate understanding of the internal mechanics of, and certainly by proxy the end investor has much less understanding of. So, you're either taking risk in complexity or risk in terms of volatility or probability of losses, but you're taking risk either way. I read down through that thread and I have to say I don't know what your reaction was, but I didn't find any of the answers particularly satisfying.

Corey: 00:19:08 Well, I'll tell you personally, I don't think I've come up with a super satisfying answer myself. I'm not here to judge because I'm living in a glass house. This is a really tough problem. What struck me is interesting. is I tried to dig through the answers was, it seemed like they were people who were trying to solve

what I would call the yield problem of bonds, and people trying to solve the capital preservation problem of bonds. I think we have been so fortunate over the last 30 years that bonds gave you both. You could sort of see was, there are people saying, okay, I need to think about how I can generate 5% yield for my client, because there's still this idea that, hey, the best way in retirement to make it through retirement is clip 4 or 5% coupons. I'm not going to get into a debate as to whether that's better than just generating total return or not. I'll leave that up to someone else. But there is that mentality that people like to know the coupon is there. So people are searching for that yield, and then there's a whole other base of people saying, this is supposed to be the stable anchor of my money. Maybe I can look at things like equity long-short, maybe I can look at things like some structured product with a defined outcome. I think regardless which path you go, it all plays into the narrative that I played out that you're either selling optionality somehow or moving up the risk curve in a way that I think continues to put more and more conditional stress on the market.

Adam: 00:20:33 Yeah, I agree. So let's move on from the role of the Fed and start talking about the next major force at play. This accelerating adoption of passive investing. You said a Vanguard study showing that passive funds have grown from about 10% of equity fund assets to 45% of assets today, or I don't know, maybe-

The Adoption of Passive Investing

Corey: 00:20:55 I just clipped over 50 from my last Morningstar report that I saw.

Adam: 00:20:59 Oh, perfect. So we've got more recent information. The effects of this mass migration can be seen in cross sectional security pricing as well as an impact on market microstructure. But I know you did a lot of work especially on your own, investigating the impact on cross sectional security pricing and factor investing. Why don't we start there? What are you seeing?

Corey: 00:21:21 Yeah. Before we go into this, I'm going to be try to be as precise as I can with my language, because I think it's really important here. So when I say passive, I am going to mean something that is market cap weighted, or within a stone's throw of market cap weighted. So Russell 1000, S&P 500, ideally a total market exposure but sort of market cap weighted or significantly close to that. When I say indexed, I am going to mean strategies that follow an index passively. So this is going to include all smart beta products, we'll get to that when we start to talk about the market microstructure but that's going to be a really important distinction that even though those smart beta products have an

active tilt to them in terms of the active bets they embed, they are indexed in a way that I think is important and potentially influential in the market.

Adam: 00:22:17 So passive is cap weighted, indexed is systematic but not necessarily cap weighted.

Corey: 00:22:23 Yes. So let's go to the passive, the influence of passive. The idea here ultimately, is that inactive investors, and by the way, I should full stop. What I am going to say here is a mere subset of the expertise that someone like Mike Green has on this topic who you've had on extensively. So, I would highly recommend that everyone hits pause on this podcast and goes and listens to Adam's chat with Mike Green, and then comes back. Because Mike Green has done far more work on this and it's actually been an incredible resource for me and sort of talking through some of these ideas. But ultimately, the idea here is that a flight from active to passive requires an unwind of active bets. The simplest way I can think about this is looking at something like a value exposure. So let me see if I can pull up a chart from the paper really quickly. So when I think of a deep value portfolio here in paper I use the S&P 500 pure value ETF, there are what we would call active bets embedded in that portfolio. And active bets can really just simply be summarized as, which securities are you overweight? And which securities are you underweight relative to your passive benchmark? So, in this case, looking at the S&P Pure Value ETF, all you do is take the weights and subtract the weights in the S&P 500 which is that passive benchmark. What you see in Figure 6 here is that it is predominantly underweight all the names on the left here, which are the mega cap growth names, things like your Microsoft, your Google, your Amazon, it is underweight to the tune of 5-6% and overweight your smaller cap and of course value names.

So the idea here is that if you are a value investor and you capitulate and you move to a passive benchmark, you need to trade in such a way that unwinds this active bet, you are going to have to sell down all these securities you are overweight, and buy up all these securities you are underweight. And in doing so, if you have a large enough portion of people that do this, and you assume the people who are instigating this trade are the ones crossing the bid-ask spread, you would expect from a supply demand theory basis on the market, that this would drive down the prices of your smaller cap value securities that they're selling to cover, and drive up the prices of the mega cap growth names that they now need to buy up to get back to their passive weighting. So the idea is that if you have a huge proportion of people doing this, regardless of reason, whether it's because they're doing it from a performance chasing perspective, or whether they're doing it from a fee based perspective, or I've heard plenty of anecdotes about a regulatory pressure perspective, the DOL rule that was proposed in the 2015 era, I know caused a lot of advisors I work with to start

adopting passive strategies more aggressively, and in sharing this paper, I had a large number of advisors tell me that in recent SEC reviews of their practice, that the SEC would come in and point to certain funds that they had, more expensive funds in their portfolios and ask them why they own that versus a lower cost alternative. Again, to me it doesn't matter what the answer is, why people are making this change? It could be a combination of reasons. But if the people at large are making this tilt away from active, which typically depending almost every style of active value, quality, size, low vol, all of those embed a tilt that is largely away from these mega cap growth names that a move back towards passive would ultimately bid up those mega cap growth names.

- Adam:** **00:26:50** Yeah. I think you got some really good feedback and pushback on your paper and one reader suggested that if there was a switch from active in general to passive that you'd expect an equal amount of active redemptions from for example, small value, as you would from large growth - sorry, small value as you would from large growth, and that those different types of redemptions should offset one another and in aggregate, they would be representative of the cap weighted portfolio, and so that might undermine some of that dynamic. But I think there's a different way of interpreting that because of the current distribution of cap weighting, relative to that large growth, versus small value dynamic that I think is maybe worth highlighting.
- Corey:** **00:27:45** Yeah. I think the pushback is basically around the idea of Sharpe's arithmetic which is that active players as a whole, their net bets have to sum out to the weights of the passive market, that on average dollar weighted average, they have to net out. So, you can't just have every value investor capitulate and move to passive, it's not possible without also having all the growth investors capitulate, you need offsetting dollars.
- Adam:** **00:28:13** Assuming that growth and value are just opposite signs of the same characteristics.
- Corey:** **00:28:18** If we totally simplify the market and just say we're going to divide the market in half, half his growth, half his value, we're going to ignore cap spectrum for a moment, that math doesn't work out. What I would argue is that let's say we really only had three players in the market, someone who's passive, someone who's growth and someone who's value. Again, we're just going to assume we're splitting the market in half, the value person is overweight all the value names growth person is equally opposite. Those names in terms of their under and overweights. If the value person wanted to capitulate, and the growth person said, well, I'm not selling, the only way they can capitulate to a passive position is if they're able to drive the passive weights up to match those of the growth weights. And in doing so, then all of a sudden, everyone becomes

passive. Because you can't just have one active player because there's no one offsetting them, but you can also see that in doing so they actually drove up the security prices in such a way that in trying to chase that trade. Now again, we're all saying well, no trade was done. How does that actually materialise. It has to do again with the prices at which they're willing to execute, because the growth person isn't going to trade unless those prices come up to meet them, and then at which point they might be willing to trade for all non-economic reasons. Now, I think when we get out of that simplified framework and go to the market at large, it becomes a lot stickier trying to disentangle it.

Ultimately, it comes back to this idea that a lot of this is being based upon supply and demand and there is a lot more supply of small value, a lot more demand for large cap growth, it is ultimately going to change the way in which they are priced within the market, and if those large growth names keep going up and small value keeps going down, there might be folks on the growth side who are necessarily capitulating, they're just taking profit. Because those prices keep going up. There might be people on the passive side who are trading for non-economic reasons. And there's all sorts of reasons that flow in individual names might occur. But the ultimate idea here is, we're not operating in a market that has an individual saying, I think this security is worth x, we're now operating in a market predicated upon supply and demand.

Adam: 00:30:31 Yeah, which I think we are increasingly becoming hyper aware of the fact that it has always been thus. And that the whole idea of markets being efficient on stock, versus being efficient on flows is maybe one of the great misapprehensions in academic finance. I look forward to a lot more literature on that topic.

Corey: 00:30:56 That was a very eye opening part of this for me. Going back to this idea of active versus indexed. If we think and again, index being like a smart beta ETF, if we think all the money in value, is in the Russell 1000 Value ETF to simplify the world, that ETF rebalances once a year. So when we think about the influential force in which it is trying to apply impact on the market, all the money that is in the ETF already, is just riding, it's not doing anything, it's only at that point of rebalance that it's actually executing an impact on the market. So marginal dollars coming in continue to create an impact, but all the money that's already in that strategy, unless it's being used to rebalance in some capacity, it's not doing anything, it has zero influence at that point on the market from a supply and demand framework.

Adam: 00:31:59 Mm-hmm, absolutely. I don't think you've touched on this in your paper but we have chatted about it offline. One of the ideas that Mike Green proposed, which I find especially intriguing is the idea that the price of a security is set by the

marginal buyer or seller. So it's a flows, not a stock dynamic. If there's a mismatch between a stock's float adjusted market cap, and the average dollar depth of the order book, this could cause a really large sustained and reflexive distortion in pricing. So just to take an example, if you got stock A and stock B. Stock A has 10 times the float adjusted market cap of stock B. But stock A only has five times more dollar weighted liquidity. Well, as passive flows come in, you're trying to stuff 10 times the flows through a pipe, that's only five times as large. Obviously, this is going to create excess buying or selling pressure. And there's this feedback loop...

Corey: 00:33:04 And it only works in a pro cyclical reflexive way that in theory, you would drive that price up further, and now it's not 10 times, it's 12 times.

Adam: 00:33:11 Exactly. Then if the size of the order book doesn't grow in proportion, then this mismatch gets larger and larger over time which causes an accelerating phenomenon in the same direction.

Corey: 00:33:25 This is where I have changed my tune on certain things. In the past, I would have died on a hill, where I said smart beta products are active, they have an active bet, how could you call these passive? I still think that is true to a certain extent. But again, to my point that all that stock, all the money that's already in the ETF, once it's in there isn't doing anything, it's just along for the ride. When you think of new flows, new flows coming into the ETF, they express a bet that is the prior active bet, but those active bets are now being allowed to drift based upon relative performance of the securities.

So again, you go back to the Russell 1000 Value ETF that rebalances once a year and every new dollar that comes in after that is expressing to a certain degree a momentum trade. If you put \$1 in yesterday and I put \$1 in today, my dollar is going to overweight those securities that outperformed yesterday, and underweight those securities that underperformed compared to what you bought. Now we're both going to still have broadly the same active bet, but if you imagine this occurring in all the smart beta products, there is this influential potential of a momentum driven market flow from a supply and demand perspective. So as the market migrates from, when I give an active manager \$1, that manager looks at their portfolio and says, well, this stock is overvalued, that stocks undervalued, I'm going to try to net things out to, I try to buy \$1 worth of an ETF, and assuming it's large enough, the market maker's just going out and scooping up a basket as efficiently as possible and making a trade with the AP to give me a share. That is a totally different dynamic occurring over time. Again, when you think a lot of these ETFs are rebalancing once, or maybe two times at the extreme maybe quarterly, but that seems to be far rarer.

There's a lot more just passive operation going on passive drift that's occurring throughout the year.

Adam: 00:35:35 Yeah, I agree. You actually did some analysis of how these flows may be impacting different factor strategies, any major takeaways from that?

The Impact of Flows

Corey: 00:35:46 Yeah. Again, I think what I really want to stress here is my conviction in these ideas varies. I'm trying to do my best to not tell people where my conviction lies. But I think it's fun to think about how these things play through. When you think about this narrative of moving from active to passive, again, a lot of these active strategies that are underperforming are underweight these mega cap growth names, and so that capitulation is going to move flow pressure towards buying up those mega cap growth names. So it's not a surprise that based on that narrative, size, and value, and even things like quality and low vol have underperformed to a certain degree because most of them are net underweight, those mega cap names, it's just been growth and to a certain extent momentum that's been able to keep up. So, what you would expect is as this flow continues, those factors would continue to underperform and momentum would outperform. That is to a large degree at least for naive factors, what you have seen over the last decade as you start to work with more, I don't want to call them sophisticated or complex but just more perhaps thoughtful craftsmanship factor implementations, where value isn't just a naive price to book sword, it's a composite of signals and your industry neutral and factor neutral. Some of those have continued to hang on. But you've certainly seen a capitulation in recent years as it seems like that that passive adoption has accelerated.

Adam: 00:37:10 Yeah. You can certainly look back on factor performance over the last decade or so and there's definitely a difference in character in terms of many factor strategies relative to what we observed in prior decades. Certainly, you and I've talked about this, and it could just be that many of these so called factor approaches were data mined to begin with. And I have no doubt that some of them are, but I don't think you need to make the assertion that all of them are if you also are open minded to the view that just the market structure has changed in the last decade in a way that is counterproductive for many of these factor strategy constructions.

Corey: 00:37:55 Right. Both from a microstructure perspective, but also reflexively as more and more people adopt them. I really like your framework that you sent me the

other day, and I don't know whether you're comfortable sharing it, sort of this adoption framework idea of smart beta and pre-publication versus post-publication. I'd love for you to share that because I think it plays into this and these ideas of reflexivity in the market. I think is largely under appreciated.

Adam: 00:38:18 Yeah. Well, let's reserve that for another chat. But I definitely think there's a lot of meat there too. But yeah, I just think it is neat and I know that in chatting with a lot of smart beta and factor investors, there's just general, there's a lot of frustration. Any attempt to diversify away from cap weighting, with the possible exception of low vol, which has really lagged certainly in this recent thrust, which is to be expected at any given three or six month period, or any active strategy would be expected to deviate. But if you look across the spectrum of smart beta strategies, it has been a very difficult decade.

Corey: 00:39:04 I think what's really hard is it's tough to determine, well, is this sort of just random noise? We'd see in all of old factor data, it certainly went through cycles where things didn't work. Is this an issue of too much adoption? No strategy can work with an unlimited amount of dollars, there is ultimately an issue there. Is this a change in market microstructure? Is this just poor implementation? You have published a tremendous amount on, if you have a specific model that you use, there's huge idiosyncratic model risk. Is it the stuff that I published budget timing risk unfolding. There's just all sorts of stuff that makes it so hard to disentangle which narrative is reality. Which I think is probably a feature of markets, not a bug. It's what keeps people operating in them. But I think to a certain degree, when you start to think of this world as a supply and demand versus, the value premium just exists and it a thing. If you start thinking the world of what's happening from a supply and demand perspective, you start to go, it sort of makes sense why value would stop working if everyone moved from active value to index value and in between rebalance periods, everything's a momentum based flow.

Adam: 00:40:16 Yeah, absolutely right. Look, what is the source of these premia? The source of the premia is that there are our investor cohorts that have preferences to not own securities with certain characteristics, either because for values reasons, or for just different dimensions of risk, not wanting to deviate too far from a benchmark, not wanting to take on leverage. There's a variety of different dimensions of risk that investors can perceive and which would cause them to misprice securities relative to investors that are purely profit seeking in a mean variance framework. So, if you've got a certain amount of dollars based on investors that are mispricing securities for these reasons, then if you deploy an equal amount of dollars to arbitrage those mis-pricings, that is going to neutralise that effect. That edge or premia is going to go away. And if you get twice as many dollars that are chasing into stocks with certain characteristics,

then that mispricing, the sign of that mispricing is now going to flip. So, a premium which previously had positive expectancy, now may actually have negative expectancy. So, there's absolutely a very interesting rabbit hole to drive into there for another conversation. But let's try and get back on track with the arc of your paper. I think that the next major theme was on the effect of dealer hedging, I guess it's this paired dynamic of investors, this huge global carry trade and then what that means to the dealer network that needs to offload the risk from investors that are constantly seeking positive carry, so why don't you dive into that.

Dealer Hedging

Corey: 00:42:22 So when I started this section, a lot of it started actually going down a rabbit hole of high frequency trading and what I found was A, it's an incredibly opaque world, it's really hard to get good detail what's going on on high frequency trading. But a lot of the ideas of high frequency traders is just pulling liquidity. You talk to high frequency traders over beer, they say, yeah, look, we're not a charity, we're not required to necessarily participate X% like they have in other markets, we can come and go as we want. But that's only part of the story. The other part of the story is this idea that they're actually liquidity constrained, and they are operating as a high Sharpe strategy, operating with a tremendous amount of leverage to be able to facilitate all these trades and a lot of that leverage is achieved by posting collateral that's security based. So when markets get stressed, obviously, the amount of leverage that they can use goes down and so they're just literally prohibited from providing liquidity. It's a constrained problem. I think evidence of this is when Virtu Financial, is like around March 22nd this year went out and did a presser saying, hey, we're trying to raise \$400 million, so we can keep providing liquidity. You're not doing that if you don't want to provide liquidity, you're doing that because you're constrained. I think that is a huge part of this and I think we've seen, I don't want to say it's...well we've seen an aggregation of market makers. It's getting more and more power concentrated in fewer and fewer players. So if all of a sudden Virtu Financial is constrained from providing liquidity, the market is truly sapped of liquidity. And so that's a problem.

Adam: 00:43:59 Hold on, I just want to dig into the mechanics of that because this is what's going through my head. I'm thinking about Virtu, or I'm thinking about any kind of market maker and they've got a certain amount of delta that they're willing to take on and that they're trying to hedge but as volatility increases, the dollars that you need to maintain your target delta goes up. So I guess what's happening is, vol increases just think back to March, you've got a massive expansion and daily range, vol is increasing, in order to maintain your target

delta you need a lot more collateral on the books to collateralize that delta. Am I working on those mechanics properly?

Corey:

00:44:43 I wouldn't even get into the world of delta yet. Just think of it purely from, I need \$500 million to operate and I need to borrow to use that \$500 million. I'm going to post a bunch of collateral. The same way, I know you work in the futures world, when you start to see market stress goes up, what happens? Well, the margin you need to post goes up. You probably know better than me what happened with margin requirements. I know for us in US Treasury futures, they went up significantly in March. And so all of a sudden, the amount of leverage you can apply goes down. So even before we start talking about the issues of what's going on with options market makers, just market makers in general and equities, for example, are going to be constrained as markets become stressed because the amount of leverage they can use goes down, and therefore the amount of liquidity they can provide goes down. Not even introducing this idea of delta and other options greeks.

So that's part of the equation. I think then the question becomes, well, who cares if liquidity goes down? Well, you care if again, going back to supply and demand if the supply has gone down, and demand has gone way up? So then the question became, well, who is demanding liquidity? And as it turned out, there are a lot of people demanding liquidity in these market environments. What seems to have unfolded after 2008 is a huge amount of people who were forced up the risk curve, have taken volatility contingent strategies. I'm going to use a big framework here, volatility contingent to me is going to mean, you're either explicitly dealing in options, you have some, and that includes structured products, you have some sort of trade, where your portfolio is linked to volatility. This is going to include CTAs, this is going to include risk parity, this is going to include things like variable annuities that use target vol indices, or you're somehow vol correlated. Trend following for example, you tend to see markets go down when volatility goes up and therefore trend following strategies tend to sell at the same time volatility is climbing. It's also going to include some of the levered products like the levered ETPs that have that have come to market. All of them are intrinsically tied to the volatility in the market. And as it turns out, all of these people need liquidity at the exact same time. And so you get this huge mismatch.

I think what we've seen, certainly there's a lot of players but I think what's come forefront this year is the huge influence of options and option dealer hedging, both in the chaos we saw in March, and the recent tech ramp up we saw in August, and happy to go into both of those if you want.

Adam: 00:47:31 Yeah. So before we do though, I think it's also worth noting that there are at least two dynamics at play here. One is of course the rise of volatility targeted type products, the CTAs, the risk parity, the structured notes. The other is, there used to be a huge bid by fundamental price seekers in the market, the traditional active value oriented funds or players or institutions in the market that if the markets got too expensive, they were sellers, if the markets got too cheap, they were buyers. So they were lurking in the background, they were ready to provide liquidity when markets went too far in one direction or the other and one interesting externality of this migration to passive is that it has sucked the air out of these liquidity providers, the traditional value oriented or fundamentals based liquidity providers. So, yes, we do have an increase in these procyclical types strategies and that's exacerbating divergent moves in both directions. But we've also had a major contraction in the market participants that would normally be relied upon to push against those divergent forces and to force markets back into equilibrium. And so it's this combined dynamic I think that is causing this Jekyll and Hyde type personality in markets and one or the other wouldn't be sufficient, but the combination is highly destructive.

Corey: 00:49:28 Yeah, and again, I'm always hesitant and reluctant to try to point to causality. But I think you point out something important, which is, again, you don't need to believe that either of these narratives is inherently the driving force because you recognise that both of them together, it is a one plus one equals three scenario, that if people are moving to indexed products, all the securities are now being traded on a basket basis, all happening at the top of the order book because it's all price takers. It's no longer active managers who are trying to price individual securities. You can imagine that the friction in the order book has dramatically reduced. Now all of a sudden, these market makers become liquidity constrained and people try to take liquidity and all of a sudden there's no depth to the order book anymore. No one's willing to step in because everything's being done in a basket trade. I think Chris ... who came on my podcast a little couple weeks ago said, look, the millennial way is to buy everything in a basket, you go to Betterment to buy a preset portfolio of preset ETFs, that buy a preset selection of stocks, you just it's baskets all the way down and who is left to actually buy individual securities? And it's a little alarmist to say all that I get it and it's very difficult to prove but again, it's not about, you have to be wholesale in on one story or another, these things certainly influence each other and they have again, a procyclical reflexive impact on one another.

Adam: 00:50:53 Again, you got to constantly remind yourself and others that the price of every security is set at the margin. So it's the marginal buyer or seller. We don't know

whether 50% passive is the point at which the marginal supply begins to dwindle at some nonlinear rate, in which case, you've got to chase the order book in order to be able to buy that marginal share using these marginal passive dollars that are flowing into the market day in day out, and are price takers and are completely price insensitive. You can't model this, you don't know what it looks like, you just got to observe it and be able to adapt to the conditions. So how was the huge increase in options strategies changed this dynamic?

Corey:

00:51:55

Let me play that out a bit real quickly. What we have seen and again, full pause. The real expert in this area is Benn Eifert. He's had a couple podcasts on Odd Lots. He's been on my podcast. He's talking on Twitter all the time about this Benn Eifert, at QVR Advisors, highly recommend you look him up for some amazing details in this space. But what we have seen in this regime where institutions and individuals are stretching to find yield is a huge adoption of volatility selling strategies. And what I mean by that is things like covered calls, and put underwriting. So you're selling puts or selling calls. What this chart shows is the average dollar volume on S&P 500 index options and you can see that compared to 2005 how much the dollar volume has exploded, and how much it's exploded in particular in what we would call short tenor zero to two, two to six month type options, which I'll get to have a larger influence on the type of hedging that dealers are going to have to do. Interestingly, the adoption has been so high that we've almost reflexively seen that this volatility risk premium that a lot of these institutions bought into, not only as a way to generate excess yield, but as a potential diversifier has almost disappeared from the market, you compare the performance, pre 2008, pre 2009 of put right type indices or the buy right indices compared to their sort of post 2008, 2009 experience, and it is very, very, very different. It seems to largely coincide with the mass adoption that occurred around 2011 to 2013 of institutions and individuals operating in this market and trying to harvest the volatility risk premium through selling calls and selling puts.

Now, the question is, what influence does that actually have on the market? Why should that matter? I think what's really important to consider here is what's actually happening when you buy or sell an option. As a very simple example, Adam, let's assume you want to do covered calls, and so you've decided you're going to sell some short dated out of the money calls to the market to try to harvest that premium, and I am going to be on the opposite side of the trade. Now, I am not an individual investor, I'm basically a market maker, an option dealer. And when I buy that call from you, I am now long the call. But as a market maker, I don't want to have a directional bet. I want to be completely neutral as to what happens the underlying stock, I'm just trying to profit from that bid-ask spread. So what I'm going to do is I'm actually going to

hedge the underlying exposure. What it means when I find a long a call, I have positive delta, we can think of this as the beta of an option to the underlying security, that when the stock price goes up, the value of my option goes up. And when stock price goes down, the value of my option goes down. Again, I want to be completely neutral to that. It means, I need to short some exposure, but as the market starts to go up, that delta actually goes up, and so I need to sell more. And as the market goes down, my delta goes down, and I need to buy back some of my short. So we can think of this if dealers are an aggregate all of a sudden taking the opposite side of this trade of institutions who are selling calls at an unprecedented notional level, that all of a sudden, every options dealer in the world, every time the market ticks up, these dealers are selling, every time the market goes down, these dealers are buying, and you have this massive volatility reducing impact on the market.

Now, this volatility reducing impact is procyclical in a way, and I'm going to tie it into some of these other volatility contingent strategies in a second, but so these institutions start to sell options and as this space gets more and more crowded, that premium gets thinner and thinner, the implied volatility goes down and what that does is it means that the next institution that steps in if they want to generate the same yield, they actually need to now sell more options, if the space becomes even more crowded, and more open interest occurs that dealers have to hedge. Now what happens is the dealers are hedging these options, more and more and more and more of them and it's reducing realised volatility, their trading is explicitly reducing realised volatility that's occurring in the market. I would argue this is largely what happened in 2017, why we saw such unprecedented low volatility levels. Now pause here and again, now think of all these volatility contingent strategies, things like your target or cap volatility variable annuities, your CTAs or risk parity strategies, who are all tied to volatility levels in the market. Well, what happens is realized volatility goes down, all of a sudden your target volatility strategy starts increasing its leverage. And so we can actually model this. On the X-axis what I have modelled is sort of an estimate of dealer hedging pressures, where the negative dollars mean that every time the market goes up, the dealer is selling, every time the market goes down, the dealer is buying. On the Y-axis, what we have is an estimate of leverage and an S&P target 10% volatility strategy. And we can clearly see that the more negative hedging pressure that the dealer has, the higher the notional leverage exists in this strategy.

Adam: 00:57:48 This is really edgy, this chart is a proxy for showing that the size of the negative dollar amount of dealer hedging pressure, explains market realized vol. Right?

Corey: 00:58:06 Exactly.

- Adam:** 00:58:07 And by virtue of that increased leverage for vol contingent players.
- Corey:** 00:58:12 Yep. Or at the very least highly correlated, I would argue, there's a stronger causal link here in the influence. But you can see, dealer hedging pressure as it gets more and more negative, potentially suppressing where every time the S&P goes up they sell, every time the S&P goes down they buy, that driving down realized volatility drives up the leverage needed by these volatility contingent strategies and so what you get is as the market becomes more and more compressed and it's realised volatility, you're creating much more risk in the left tail, because of a sudden fragility for sure, as soon as that market selloff occurs from that exogenous event, all of a sudden, all these strategies have to de-lever simultaneously. So that becomes a huge influence on market environments like March, where you have running into March very low vol, huge levered positions that all of a sudden have to dramatically unwind all at the same time.
- Adam:** 00:59:16 Right. So, the volatility compression regime is one side of the coin. And that is an equilibrium seeking dynamic. But there's a different dynamic when dollar dealer gamma hedging pressure flips to a positive sign to become a positive feedback mechanism.
- Corey:** 00:59:45 Absolutely. So the other side that occurs very frequently is, I mentioned there's call overriding and put underwriting. Well, you also have a lot of people who are buying puts as protection and this is evidenced by the skew that we see in the volatility curve, and so a lot of people are out there buying puts. So what that means is the dealer is actually short a put, that as the market goes down, that dealer is going to ultimately potentially owe money on that put. So what it means is that they have to hedge that exposure by shorting stock. Conversely, as the market starts to go up, they end up needing to cover that and so they buy more stock. Now what seems to happen is that these puts that are bought tend to be further out of the money and further dated in such a way that as markets gyrate normally, there doesn't have to be a lot of hedging that unfolds, that dealers can more or less ignore them and they're focused almost entirely on these calls, the calls that are very short dated, one or two months out, and much closer to at the money than these puts are. As the market starts to sell off, let's say this exogenous event hits and everyone re-prices is the market downward 10%, all of a sudden, the calls are so far away, they don't really matter anymore. And all of a sudden the puts become the influence.

Again, they have the exact opposite impact, that is the market goes down all of a sudden, dealers have to sell more, and as market goes up, the dealers have to buy more. All this is occurring simultaneously to all these volatility contingent strategies de-levering and so you have market makers who are now

constrained in the liquidity they can provide. You have option dealers who are all now trying to chase stocks up and chase stocks down and you have all these volatility contingent strategies that are trying to de-lever at the same time, everyone's suddenly rushed to the side of the boat trying to demand liquidity from the market when liquidity no longer exists.

Adam: 01:01:53 Right. So, or as the puts become closer and closer to being at the money, the delta of those puts gets larger and larger at an accelerating rate. So, the dealers have to sell stocks into a declining market at an accelerating rate in order to maintain their delta neutrality on their hedge book. This is the thesis for what we saw during some of these cascading episodes in March, for example.

Corey: 01:02:28 Precisely. Right around early March, estimates of dealer hedging pressures, dealer gamma is what it's called, flipped sign, and then all of a sudden, volatility explodes, you saw intraday, it just towards the end of the day, everyone's chasing at whatever direction the market moved, and then right around March 23, everything starts to die down, volatility starts to die down. Well, what happened? Well, there was options expiration, a huge amount of those options expired and the dealers no longer had to hedge as much. All of a sudden, a couple days later the sign of dealer gamma flipped, volatility kept going down. Then what happens? Volatility keeps going down. Now all of a sudden, a lot of these volatility contingent strategies are going to start buying again, and potentially creating now a reverse upward pressure to reapply the leverage that they had taken off.

Adam: 01:03:24 And what's been astonishing in this market is just how quickly volatility expands and contracts. The character of volatility over the last three or four years is completely different through a variety of prisms than any environment that you saw previously. It certainly makes sense to try and dig into some of the causal mechanisms of that and then what I also thought was interesting, and I want to get into your framework for how an investor might think about investing in the current environment, given some of the potential dynamics that are at play, and that we've discussed, and I really like your framework of Icarus and Daedalus. So, let's go through that and then I want to spend a couple minutes on some of the indicators that you proposed and that we started to see in the Twittersphere on the dealer gamma and some of the basis of ETFs versus index mutual funds. That kind of stuff. But let's talk about the Icarus trades first.

The Icarus Trades

Corey: 01:04:38 Yeah. And just really quickly to close out the influence of dealer hedging, if people have...because the opposite is occurring in single name stocks. So

what's interesting is you generally assume that at the index level, there's a lot of call over writing. In single name stocks, there can actually be a lot of people buying calls, and you've seen that, I hate to say it's the Robinhood trade or Wall Street bets effect. But you've seen a lot of individual investors starting to buy calls in speculative tech names, and there's been a huge influence of dealer hedging there. Again, we probably don't have time to get into that. But for folks who want to learn more, again, I would I would stress go follow Benn Eifert. He just did a podcast with Odd Lots that goes through that in detail and I think it's very illuminating for folks who are perhaps wondering why these tech names keep accelerating upward in a way that seems totally disconnected from fundamentals, I would argue against these supply and demand effects that are occurring within the market with forced hedging that have nothing to do with fundamentals, that are driving this.

So to your question, going through this idea of the Icarus and the Daedalus Portfolio, when I sort of thought of this again, this end of your conclusion will ultimately be tied to your belief system, where you have conviction in these ideas. If you believe that this cycle is the virtuous market cycle we're in and the Fed is always going to step in, and in the Fed we believe and there's never going to be an issue with that. Then I think the conclusion is, pinch your nose, close your eyes, buy some levered equities, come back in 20 years. Because they're just going to keep melting up and there's going to be some horrible drawdowns along the way. But if you can ignore it, you're probably okay. I don't know how much faith people want to put in the Fed necessarily, maybe you go out and you do that and then you buy some volatility on currencies as sort of a hedge of the US dollar collapsing, maybe you buy some Bitcoin, I don't know. That's all beyond me, but I thought of that is like a trade like Icarus.

We all know that a lot of people know the story of Icarus, I remember it from having to take Latin in high school, and having to translate it but the story of Icarus is that his father made him wax wings. Daedalus is his father, a great inventor, they're trapped, and to escape, they make these wax wings and Icarus ends up climbing and climbing and climbing too close to the sun and ends up having his wax wings melt, and he falls into the ocean below. A lot of people remember that part of the story and they tell it as a story of hubris, almost that. That Icarus climbed too high, took too much risk and ended up ultimately perishing for it. And so to me some of these ideas that I was coming up with saying, well, if you believe this cycle and you're just going to go all into it, felt to me like they were ideas that had a little bit too much hubris to them. It assumed that this cycle was correct and rather instead of taking sort of a do no harm view of, well, this narrative might be wrong and this might still be a portfolio we can live with. It was a portfolio fully predicated on this idea of

being right. I think the part of the story most people don't know, is the warning that Daedalus gave to Icarus prior to them leaving, which was don't go too higher, your wings will melt, don't go too low to the ocean or your wings will get bogged down, take the middle course.

So what I really wanted to stress here was this idea that you could try to lean in to some of these ideas. If you think the market is ultimately experiencing a flight from active to passive, well then your equity exposure might be just predicated on momentum factors. That's totally fine. But you might want to couple that with something that is going to protect you, if you expect there to be a great unwind, that if you think this is like a game of musical chairs, that's the game we have to play. But you know the music's going to stop, and there's going to be a chair missing at some point, you're going to want to think about the hedges you can put on and ideally convex hedges that you can pair with some of these alpha trades or positive carry trades that can work in conjunction with one another and create a more balanced approach.

Adam: 01:09:00 Right. You've got a few great charts to try and illustrate this concept. One of them looks like a normal density curve but the idea I think is when you're in a positive phase of this environment, so passive flows are driving momentum names higher at an accelerating rate. You've got this convex positive payoff function. You want to own momentum names, you want to own some call options and far out of the money call options, for example, and then there's flip the sign. There's either some failure of the monetary backstop, or you flip the sign on a deal or hedger hedging pressure, and you go into a negative feedback loop and you want to introduce things like more conservative equities, and maybe a trend following overlay to sort of sidestep some of that market risk and then some tail hedging. Is that generally the implementation framework?

Corey: 01:10:04 Yeah. I should stress here, when I was considering this framework it was around the idea of trying to build a resilient equity portfolio. It's not going to include things, for example, that are going to necessarily be tremendously tied to an inflation bet, or other asset classes. By no means is this meant to be your total portfolio solution. But around this idea that equity for most investors is a huge driver of risk in their portfolio, how can we try to think about building a more resilient portfolio that leans into some of the ideas with a little bit of conviction of this market cycle that's going on, but if it's wrong isn't necessarily a portfolio that we regret holding. So to your point, the idea here is that if we think markets are going to continue to express this super low vol melt up, and then proceeded by some sort of crash, a sharp recovery and a melt up, again if you don't just want to buy and hold and close your nose and maybe have a little bit of leverage to that, then what you try to hopefully do is create some convexity in the tails. So, on the far right to your point, out of the money calls, which we

might argue are going to be depressed in price, at least at the index level. Because another way that these dealers are trying to hedge some of all this option selling is not just by shorting underlying stock, but actually selling other options to try to offset their exposure. Well, that can actually have the price of further out options are going to be potentially depressed. So you might buy some of these out of the money calls, and get convexity exposure far cheaper than you would have a decade ago. As you move in and say, okay, my regime is no longer that three standard deviation melt up 2017, I'd argue anything we've experienced this year after March falling into the same camp, but it's now just a positive market exposure. Well, again, if you believe in this move from active to passive and the flow based influence that can have on cross sectional security pricing, that would argue for a momentum trade.

As we start to think of the other side of the equation, market losses, both occurring slowly as well as those that are re-pricing very quickly. On the far tail, we want to think about some of these exposures that can create convexity in a sell off. This is going to be things like out of the money puts on equity, or call options on the VIX. And you can get creative here, you can say, look there puts on bubbles and calls on anti-bubbles and you can do calls on treasuries and all sort of basis trades. I'll leave that up to the reader and you can get far more complex and how you implement these things. But again, I think what you're looking for ultimately is convexity in the left tail that is going to be underpriced because these dynamics that we're talking about here, I don't think have been fully appreciated by the market. As we move up to perhaps not rapid cascades down, but just quicker sell offs, I'm going to talk a little bit about the quality equity here with the idea that we do want some instantaneous repricing that there's going to be this continued flight to safety within equities, people moving to stronger balance sheets, people moving to lower vol securities. And these are things that potentially you might have to actively harvest. So you're going to get this pop in a market crisis, the idea isn't necessarily to buy and hold that but you might want to harvest that pop that you see, buy some passive exposure and then as things calm down, roll back into those quality names after you get that pop.

Then finally, I included some trend equity here with the idea that I don't wholly believe that these market dynamics can keep the market completely disconnected from the economy at large, forever. I do think that there is economic gravity ultimately at the end of the day, and that once you get a rapid sell off, you do tend to see a lot of these puts re-priced to a point that they're no longer really going to be effective going forward as a hedge. So things like trend and other such strategies may be applicable in that more prolonged drawdown environment, where puts are no longer as price effective.

So, when we started thinking about putting that into a portfolio, the simple idea was, well, I don't know what regime we're going to be in, in the future. If I sort think of the three potential regimes of being, we hit this melt up dynamic, a meltdown dynamic or some prolonged decline, what I should really think about doing is breaking my portfolio into those three regimes from a risk weighted basis. In this case, it's pretty close to dollar-weighted weighted basis and putting each of those strategies to work for that regime. So, for prolonged declines, it's trend equity and things like equity replacement with options. For melt down, it's a combination of quality equity and out of the money puts, and for melt up, it's a combination of momentum equity and out of the money call options. The idea here again is pairing these positive carry anti carry trades together to create a one plus one equals three scenario ideally.

- Adam:** 01:15:17 You couldn't have had the melt up scenario in green?
- Corey:** 01:15:22 I get a lot of pushback on my colors. That is the number one thing, the feedback I got from this paper.
- Adam:** 01:15:31 I'm sure you did. I guess the proportion of the allocation there broadly reflect the probability weighting that you place on each of these different scenarios and the relative volatility or impact that these different sleeves will have on the portfolio and the different environments.
- Corey:** 01:15:50 Yeah. Going back to this idea of do no harm, unless you have a model to forecast either which environment we are in, or which is most likely going forward. I would argue that you do want to take that risk weighted basis. Since most of this is being implemented with pure equity exposure on a risk weighted basis is almost equal to a dollar-weighted basis. So just from a strategic perspective, thinking about giving equal exposure to these regimes gets you about there, then the question becomes, okay, well, I just went through a meltdown, if I don't think that sleeve is going to be as effective going forward, should I actually increase my exposure both to melt up and prolonged declines? Because that's when we think about maybe a state graph as to what states we can move into? Well, a meltdown doesn't lead into another meltdown typically. Once a meltdown is over, you're either prolonged decline or a melt up. So why would you continue to hold a lot of meltdown? And I think that's the next step, next evolution of thinking of how you would work with this portfolio. But again, just going back to a pure strategic basis with no view as to what's coming next, you would want to think about equally, providing equal exposure to each of the regimes.
- Adam:** 01:17:06 Right. I was interested in the indicators that you talked a little bit about toward the end of the paper, the dealer gamma and the basis between an index ETF

and an index mutual fund. First of all, what are these about? Or what are you trying to track here fundamentally and how are you contemplating or how should investors maybe contemplate using these to inform tactical tilts between the sleeves?

Dealer Gamma

- Corey:** **01:17:39** Yeah. This is a question of how can we try to identify market stress? Or how can we try to forecast market stress? So, as we started thinking about it obviously, as I said, I'm trying not to give ideas where my high conviction ideas are, I definitely have more conviction in the influence of options for sure, at least at this current market environment. So, going through and trying to estimate how dealers are at large positioned, I think is going to be very important for understanding, is the low volatility we're seeing today a function of general market malaise? Is it a function of positive economic expectancy? Or is this purely a reflexive function of dealer positioning? I think that puts you on a different setting of, okay, if we're seeing huge negative influence or repressive influence by dealers, and we know that's going to be driving up vol in all these volatility contingent strategies, making that left tail more and more and more fragile, you have to think about, I can't sit out for the melt up, but man, I really want to make sure I probably have some of that protection on, that convex protection, as cheaply and as explosively as I can find it. Because I do know that the longer this goes on, the more violent the unwind is going to be. So all that dealer gamma, or that hedging pressure that we're looking at there, is really looking at is looking at the open interest at any time and S&P 500 Index Options, and making the broad assumption that all calls are sold by individuals and bought by dealers and all puts are bought by individuals and sold by dealers and netting out where they are at any given time, what the implied hedging pressure is and aggregating that all up together. Now, is that a perfectly accurate picture? Absolutely not. There's a lot of people who will go through the very painstaking work of going trade by trade with the options and trying to figure out who crossed the bid, who crossed the ask, who is likely on the other side, and that can paint you a more accurate picture but I do think in broad strokes this does give you a good ideas to the hedging influence that these dealers are going to have at any given time.
- Adam:** **01:20:08** Any idea? Have you tried to use this time series as a feature for forecasting purposes?

- Corey:** 01:20:16 Yes. We've definitely started to try to introduce it for some tactical views. I think what you find interestingly enough, is, you don't know how long some of these regimes are going to last for. So you can start to think about as I as I mentioned in March, there were the early indications of it really looks like things are about to get volatile. But volatile doesn't always necessarily mean things are going to sell off. September 2011, I think is a great example where markets sold off rapidly, if we go back and look at dealer hedging pressure, the sign flips. But as I said, all that means is now dealers go from suppressive behaviour to expanding behaviour, as markets go down, they're going to sell more as markets go up, they're going to buy more. That doesn't necessarily mean it's going to drive markets down unless you have all these other players at the same time making for the exits, you have to have market makers being limited in the type of liquidity they can provide, you have to have all these players being limited in the type of liquidity they can provide. So I think a lot of the conversations you and I have had, it's not just a one variable, one input type tactical signal, there's a lot of conditionality to it.
- Adam:** 01:21:28 Yes. Makes sense. I really liked this idea of measuring the basis between the ETF price and the mutual fund price. How did you get this data and what is this chart saying?
- Corey:** 01:21:44 Yeah, all this is really showing is the return differential between an ETF and a mutual fund that theoretically track the exact same investment. If they're both tracking the S&P 500, you would expect very little dispersion because any dispersion there can be pretty easily arbed away by buying the mutual fund and selling the ETF. Interestingly enough, in doing so, you probably create a larger dispersion here because very often what you see is that the ETF price then ends up going below the mutual fund. So you actually end up blowing that out further. But I think what it's showing is the stressed environment in which the market is going under that. When you have two securities that are theoretically linked to the exact same basket, trading in a materially different price, it means the underlying basket and the arbitrage mechanisms that keep them in line have fallen apart to a certain degree. It doesn't necessarily mean that they've fallen apart and that there's no one there, it just means that the people who are usually taking part in this arbitrage, are either liquidity constrained, or they're operating with a degree of hesitancy in the sense they're going, we don't understand what's going on. There isn't enough juice here to justify us taking this risk. So you see this, certainly, in equities in fixed income, this exploded tremendously during March. I think I have a graph here where I show the difference between the Vanguard Total Bond Fund and the ETF share class of that fund. We're looking at different vehicles, we're talking about truly different share classes of the same fund having huge dispersion in their returns

and I think that's just an example of some of the arbitrage bounds that normally keep the whole market in line breaking down.

Adam: 01:23:49 Yeah, this is a function of Virtu not being able to raise the \$400 million that they would love to deploy in order to arbitrage this spread. I mean these are perfectly fungible...

Corey: 01:23:56 And as the bond market, in particular the bond markets and March in particular just breaking down and, look, I think there's interesting trades here to think about, there's huge embedded optionality, as it turns out in owning fixed income mutual funds, by the way pricing occurs, that you can buy the mutual fund and wait for a crisis, and then just jump to the equivalent ETF. And either the ETF will converge back up to the fund, or the fund will converge down to the ETF, but either way, you've missed that price jump and it's really at the cost of all the investors who have stayed in the fund. So when we think about, I don't want to say we're taking advantage of well-trained Vanguard investors, but you see that during a market crisis, Vanguard investors tend to just keep staying in their fund, they don't tend to withdraw money. Well, if you can buy the Vanguard Total Market Bond Fund, and then just wait for a crisis, jump to the equivalent ETF. In this case, if you've done the right timing, you're talking about a pretty healthy spread of total return there.

Adam: 01:24:55 Especially as a percentage of total expected bond returns.

Corey: 01:24:59 Exactly. Now again, this trade is not riskless, per se, but again, the optionality is being sold to you by all the people who are just staying in the fund. I don't think they're being compensated for it.

Adam: 01:25:11 Yeah. 100% percent. So, are you building any...Like, how's Newfound positioning for this from a business standpoint?

Corey: 01:25:21 Yeah. So this obviously has pretty big implications. Again, depending upon your conviction on how you think this is unfolding. Newfound, has for a very long time been a trend following focused firm and if you believe that there's going to be more of these liquidity cascades, then the efficacy of trend following has to be called into question. You can argue, well, all you need to do is speed things up but that's not without its own costs. And it's also just sort of becomes an arms race. If everyone speeds things up, it just makes this all unfold quicker. The other option is well, you slow things way down and then the answer is it's March 2020, the markets fallen off 35% and you're sitting there saying to clients don't worry, it's going to come back, it's a liquidity cascade. It becomes just an impossible ask from a client servicing perspective. So, for us where we have conviction, high conviction in some of these ideas, we are starting to adopt and

implement some of them. We are in some of our mandates reducing the exposure to explicit trend following and introducing both some types of convex hedges both on the right tail and the left tail as well as trying to introduce some liquidity based tactical signals that can inform some of the convexity we're introducing, as well as try to inform which regime we're leaning into at any given time.

Adam: **01:26:42** Nice, well, hopefully you're going to publish some articles that describe some of the ways that you're using these indicators tactically in a systematic way.

Corey: **01:26:50** Well, I will tell you that this article almost killed me getting this out the door. So I'm going to take a healthy rest and then maybe we'll get back to it.

Adam: **01:26:57** I hear. You should go travel the Caribbean, I think that'd be-

Corey: **01:27:00** I hear that's pretty nice.

Adam: **01:27:03** We'd love to obviously see you down here. You're welcome any time. But it's been fantastic. This paper, I think we covered a lot of the concepts, but there's still lots in there that we didn't get a chance to cover. You should absolutely go and read it top to the bottom. I agree, some of Benn Eifert's recent tweet storms have been incredibly informative in terms of the types of leverage that even small retail players can get from their option positioning and individual names and the impact that that can have on the trading pressure and some of the giant moves that we're seeing in some of the big tech stocks for example, at the moment. Other conversations with Mike Green, and others in this ecosystem have been enormously informative. Definitely go and check those out. But I think this paper is a really good summary. Like I said, it's sort of, you triangulate the views from at least three specialist areas to try to narrow down the trajectory of what to expect from, or what one might expect from what's happening and how the markets have adapted. It was awesome and a lot of fun, the conversation. So thanks for your time.

Corey: **01:28:18** Thank you, sir. I appreciate the opportunity.

Adam: **01:28:20** All right. Well, let's do this again soon. Thanks for listening and have a great day.