Rodrigo:	**00:06**	Hello everyone and welcome to ReSolve's 12 Days of Investment Wisdom mini-series, where Michael Philbrick, Adam Butler, Jason Russell, and myself, Rodrigo Gordillo, will explore timeless evergreen principles that will help you and your clients achieve long-term investment success. From the importance of asset allocation, thoughtful portfolio construction, and maximum diversification, our aim is to offer you a comprehensive framework for a more thoughtful investment approach that may change the way you view the complex arena of investing altogether. We hope that you enjoy the series as much as we enjoyed putting it together.
Disclaimer:	**00:42**	Mike Philbrick, Adam Butler, Rodrigo Gordillo, and Jason Russell are principals at ReSolve Asset Management. Due to industry regulations they will not discuss any of ReSolve's funds while on this podcast. All opinions expressed by the principals are solely their own opinion and do not express the opinion of ReSolve Asset Management. This podcast is for information purposes only and should not be relied upon as a basis for investment decisions. For more information visit investresolve.com
Mike:	**01:11**	Welcome back to what will be the final day. It was nice to, uh-
Rodrigo:	**01:14**	What a sad day
Mike:	**01:15**	Yeah, it is a bit of a sad day, I agree. Today it's a very popular research paper, Adaptive Asset Allocation, Dynamic Portfolios to Profit in Just About Any Economic Environment. And we're gonna drill into that case study and, uh, share a little bit more than is in the case study there with you today. And, um, have a little bit of fun on our last day.
Rodrigo:	**01:39**	Absolutely, and what we're really going to cover today is a practical application of a lot of the topics we went through. And we specifically want to give an example of how ensemble methods may work. And the case study is going to involve using momentum, uh, specifically multi-asset momentum. What we're going to do is kinda walk you through the- the reasons and the things that you can, um, deploy in terms of strategy construction that may benefit and and improve your outcomes for your strategies and your clients. So, let's think about the idea of trying to capture a positive rate of return and a consistent basis that's above what you can get from a market cap weighted portfolio, or in this case with multi-asset momentum, if you can do better than a global market portfolio. So what we wanna try to do with multi-asset momentum is to capture the momentum signal. We're gonna use momentum as a case study, but what we want is, uh, people to take away the fact that this framework we're gonna lay out could apply to a value strategy, it could apply to a, um, low volatility strategy, it could apply to anything, right?

Mike: **02:45** Right.

Rodrigo: **02:46** It might involve a VIX strategy, you can ... you can use it for anything.

Mike: **02:47** Adaptive Asset Allocation is a ... is a general concept, it's applicable across whatever edge you might want to apply to the machine.

Rodrigo: **02:55** That's right. Okay, so- so let's- let's think about this term momentum, right? What is it that momentum really is from the basics? Momentum is just herding behavior. And if we believe that humans will continue to herd, then that is the only signal we care about. We wanna do the best possible job of extracting that signal. If we're talking about value, what you care about is that there are undervalued assets that people aren't taking into account. If you believe that that is something the humans are gonna continue to do over time, then you wanna be able to capture that in the best efficient, least destructive way.

So, if we think about the momentum signal as a signal going out into space, what we really wanna do is capture ... you know, create antennas around that signal that are gonna do a good job at harnessing that signal. And from the academic perspective, we talked about this in the past, is it's ... momentum is just, um, ranking asset classes, ranking stocks, from best to worst performing based on price differentials, so return, based on percentage differentials, and, uh, based on the last 12 months look back.

Mike: **03:58** Well yeah, in academics yeah.

Rodrigo: **03:59** Academics, that's what they use.

Mike: **04:00** 12 months-

Rodrigo: **04:01** 12 months look back minus one an- and then you- you rinse and repeat.

Mike: **04:05** And it might be just, uh, instructive, in the paper we just used six month momentum. So just as a ... as a point of comparison so that you can flesh this out is that- that's not what we do in real life.

Rodrigo: **04:15** The truth is that there's nothing special about that 12 months, right? And if we look at the many ways of ranking asset classes, you can rank them based on, you know, the last 20 days, or rank them based on six and a half months, or 12 months. If you go through the spectrum of lookback between 20 days and 300 days, what we find is that the long-term back tests show a very similar Sharpe ratio. It doesn't really matter what the lookback is. Now they- they might be slightly different from each other in short periods of time, but over the long term they're both ... all of those lookbacks do a pretty good job at capturing the momentum factor. They're highly correlated to each other.

So if we know that, if we understand that, then the reality is that there is no optimal momentum lookback. In fact, there is a series of optimal efficient frontiers. And that momentum ranking is not a point but it's actually a range. And so what we're really trying to ... there's really two aspects to momentum. One aspect is what's the lookback that we're gonna use? And what we're saying here is that you don't need to choose, you need to just kinda be broadly correct about what the lookback's gonna be. Sometimes it's gonna be optimal over nine months, sometimes it's gonna optimal over three months. And it's gonna ebb and flow over time, so we wanna- ... we wanna, kinda, hug that signal as much as possible with the lookbacks.

However, there's another dimension to this. And we've just defined momentum as the percentage rank, percentage return rank. Well, what's so special about that? What if we were to rank asset classes based on their Sharpe ratio and the risk adjusted return? Does that seem to, kinda, jive with that momentum factor? Is it highly correlated to that? Is it ... Is it, from a theoretical perspective, kinda doing what we want it to do? Yeah, that's another antenna that we could put in place to capture that momentum signal.

Another way to look at it is days that an asset class has been above a certain trend, or the distance between a short term and long-term moving average. And we wrote a piece called “The Many Faces of Momentum” that people can go to our website and a- we'll- we'll provide a link to it on the, um, show notes. But really, these are different ways of looking, uh, uh, trying to answer the same problem in different ways. It's no different than looking at value and saying that, uh, price-to-book is- is one way of looking at value, price-to-sales, uh, EBITDA-to-enterprise-value and so on. So there's many ways of capturing that signal.

Mike: **06:27** So what I'm hearing, just so I can summarize, in the paper we looked at six months, in the other literature they look at 12 months to measure momentum. And that's just, like, putting one antenna in the ground and hoping that you capture the signal and you get lucky with the ... with getting a good signal.

Rodrigo: **06:42** Yeah. And that signal might have a slight, very tiny, edge, right? That lookback. And another, uh, lookback might have another tiny edge. And ranking them based on Sharpe ratio might also have a tiny edge, and you wanna do it across many lookbacks. So all of a sudden you're- you're creating thousands and thousands of different strategies.

Mike: **06:58** An antenna array.

Rodrigo: **07:15** An antenna array, you're- you're just encapsulating that signal.

So just to simplify things, let's a- ... let's assume that we have a ... five different, or eight different momentum signals that we've identified. And each one of those signals we're gonna re sample between 20 days and 300 days to capture the broad

lookback space, but we have eight different ways of measuring momentum. Well the- that's fantastic, you now have ... are- are ... minimizes your chances of being specifically wrong. Right? And you're trying to almost find eight ... you- you've a- identified eight different managers, almost like a fund of funds. So that's one side of the equation, identifying many ways of capturing your edge, in this case it's momentum.

The other side of the equation now is how do you weight these? We've talked about this throughout the series, but do we weight these asset classes, does the average of all systems give you a weighting ... not a weighting scheme, give you the winners that you should be investing in and excludes the asset classes you shouldn't be investing in? How do we then weight them?

Mike: **07:58** Think about it in the research paper, just to sort of ground this in- in some writing that we've done, right? Well, what we did was we did the top half, as an example, on a six month lookback.

Rodrigo: **08:07** Yeah.

Mike: **08:08** So now you have one antenna and one equal weighted portfolio, which we discussed a podcast or two ago about, you know, how you might think about constructing the portfolio, and in the portfolio optimization machine series, and how equal weight is maybe not the best way to do it based on your beliefs. And then in the paper we walked through inverse vol. And so, as you say, there are lo- ... you can go a lot deeper, you've got ... you've got ... What have we got now? Eight different measures of momentum, you mentioned…

Rodrigo: **08:36** Eight different measures of momentum and now we gotta figure out whether there's ways of, uh, weighting differently.

Mike: **08:41** Right.

Rodrigo: **08:42** Is it equal weight, is it inverse vol, is it, um, maximum diversification? And so what we care about, as everybody now should know, we care about equating the risks across the board. And as anybody who heard episode 10, there are many ways of creating risk parity portfolios. Now this isn't truly risk parity in this case, because we are ... at any given time we're excluding a ton of asset classes because it's a momentum thing, but within the asset classes that are left, now we can be more thoughtful about weighting. And do we wanna just use one weighting mechanism? No. Let's ... In- In the case of our strategy I think we use five different weighting methodologies.

So you got five different optimizations that are trying to find the risk parity portfolio and you have eight momentum strategies, but now you can cross them, right? It's- It's really five times eight, you end up getting out 40 different, what I call ... I like to call it virtual managers. These are all managers that think ... these

virtual managers think that their way is the best way. But because they're disagreeing with each other, what you end up having in this disagreement is you end up kind of eliminating the error terms. Disagreement is good, there's- there's a level of humility that- this- that you're infusing into the system by being humble about not- not knowing which one of these managers is likely to do best. Right?

So if you think about the job of a fund of funds manager, the job of a fund of funds manager is to find the one strategy that is likely to outperform all the other strategies you could have invested in. And Adam, why don't you walk through this part of things, right? When you have a bunch of options to invest in and you can ... you know, each one of them has a specific Sharpe ratio and when you put them together, what is the- the type of result that we can expect in a portfolio versus having to make that one choice? I mean, what is it that we're trying to get away, uh, away with if we are explicitly trying to predict the future of any of these back tests, any one of these strategies?

Adam: **10:35** The challenge in strategy design is that a lot of the edges that we've identified as being persistent, pervasive, sustainable, grounded in intuition, implementable, all those things, are approximately equally as robust. They produce about the same long-term risk adjusted performance. And if you look at the empirical Sharpe ratios they're statistically indistinguishable. And that's true also for the variety of ways that you just described that we can think about measuring trend, or the horizons that we quantify trend, or the ways that we form portfolios of high trending assets or of high momentum assets.

And so all of these are equally legitimate. So how do you choose between them? Well, I think when many Quants start out they go through a large number of different permutations of these different methods and then they end up choosing the one that has performed the best in sample, but they neglect to explicitly account for the fact that the Sharpe ratio has a distribution, like any other statistical variable, and that most of the time the, um, the distribution of Sharpe ratios encompasses all of the potential strategies that they've evaluated.

So in other words, they're all kind of equally good. And then they ... But they proceed to just choose the best one. And what we say is, instead of having to make that choice and running the risk, the very substantial risk, of being specifically wrong out of sample, instead of doing that, use them all. And what's so incredible and magical about using them all is that when, for example, you put together the 40 different sub strategies that we use for our production, Adaptive Asset Allocation strategies, that the combination of all of these different sub strategies produces a Sharpe ratio above the 80th percentile of what we observe from any of the single strategies. So you get this incredible Gestalt Effect where the whole is considerably greater than the sum of any of the individual parts.

Rodrigo: **13:00** Right. So if- if we take it back to ... if your job is to be a fund of funds manager and pick the best performing one of these strategies, what are the chances that you're

gonna be better than the 50th percentile? I mean, it's generally quite low, it's a difficult task. The fact that we don't have to choose is the magic here. The fact that, by using them all and because ... yes, they're highly correlated to each other. If you're doing a bunch of value, uh, strategies they're gonna be highly correlated to each other, but they're not perfectly correlated to each other. And that slight difference allows for a higher- higher diversification, higher Sharpe ratio, you land in the 80th percentile. So you don't have to choose to do well.

And we see this now in- in- as you see the evolution of machine learning and these machine learning competitions, you- you could see what type of strategies these Quants were putting into these competitions. There were single strategies, highly optimized, highly, uh, data mined strategies that, you know, really didn't work out of sample that much. And what's most common in these competitions today are ensemble methods.

Adam: **14:02** Absolutely, they completely dominate. The AdaBoost methods, the XGBoost methods all completely dominate the, um, the more precise or specific applications that were favored previously.

Rodrigo: **14:15** Exactly. So really that's ... we just wanted to give, like, a step by step good case study of how to think about the portfolio construction process, what the outcome is of creating multiple virtual mangers, and how this really, uh, makes it difficult for any manager to say, "I found the best value metric," or "I found the best, uh, momentum method or the best trend method"

Mike: **14:38** Yeah. I think what you guys are expressing here is, this is an exercise in anti-fragility. You take one optimization with one estimate looking back as your, you know, your indication for what the mean will be in the optimization and- and use only one estimate for- for volatility and correlation. You are highly susceptible to being over optimized and quite fragile. And it comes back to being generally correct rather than specifically wrong. We don't want luck. I don't want good luck and I don't want bad luck.

Adam: **15:10** Exactly! Exactly. What's so ... What's so powerful here is all of these different methods that we're describing are equally legitimate from an intuitive standpoint, from a mechanical standpoint, from an empirical standpoint, if you properly account for the error term in what we observe in simulation. But you know, if you use any single one you're vulnerable to the fact that that single implementation may just have a run of bad luck over the finite horizon that you're investing in it.

So it's kinda like going back to the single player at the blackjack or do you wanna have 20 or 40 different players all playing blackjack at the same time where everybody pools their resources. There's a reason why the casinos don't allow that.

Mike: **16:00** Yeah.

Adam: **16:01** It's because it gives such a massive advantage-

Mike: **16:01** We- Well let's-

Adam: **16:03** ... to the players.

Mike: **16:04** Let's even flip that and say why don't we be the casino where we have multiple games, uh, in multiple locations.

Adam: **16:14** Love it. Yeah.

Mike: **16:15** And- And so it's- it's not just ... we're not just on the Roulette wheel or- or subject to a- a bad, uh, string of cards on blackjack, we have many different, uh, card games, many different dice games, many different Roulette type games across very many different betting sizes and horizons and thus you get this very consistent return that stems from that because you're exploiting the edge.

Rodrigo: **16:39** The rules of those games are for the house to have a 50.5% edge and for the player to have a 49.5% loss, where they think it's a coin toss but the house knows that it's a persistent edge. Now, if you play one game over and over again you may have a losing streak that's gonna kill you from the house perspective. What you're doing is creating not only multiple Blackjack tables, multiple Roulette tables, but diversifying across different slight edges that you may have to minimize the- the chance that over your one lifetime you're gonna be in truly bad luck.

Adam: **17:13** And it's not just a lifetime either, it's about how long you can stick with a strategy that's not performing as expected. So, I mean, we know from ... Listen, the Dalbar study's has got lots of flaws, but I think one thing that we can count on is the observation that the typical holding period for an investor in an equity fund, a bond fund, or a multi-asset fund ... and the typical investor holds a multi-asset fund for about four years. Four years. They- so they give it, kinda, four years to either out or under perform whatever the alternative multi-asset funds might have ... they might perceive that they can invest in.

So, you know, it might be that a true financial investment horizon's 30 or 40 or 50 years. That's rubbish. The true investment horizon is however long the investor can stick with whatever the strategy is given the actual amount of potential for true loss or the amount of time that the investor might spend below or underperforming whatever his emotional benchmark is. Period, full stop.

Mike: **18:10** And the idea of diversifying the bets is that you're just gonna be susceptible to less bad luck. There's a string of bad luck going on in one of your areas of the casino, let's call that the trend factor. Right now it's having a horribly difficult period. The value factor, also having a horribly different difficult period. If you've got an ensemble of different ways to look at that portfolio and different ways to optimize

that portfolio, well, what's carrying the day? Some defensive? Some low vol? Some U.S. stocks?

So again, those are just …

Rodrigo: **18:45** But, and it's also important, like you said, to minimize the chance that you ha- ... you're susceptible to being hoodwinked by somebody who's had really good luck. Right? So if you think about the line items, like, "I need to find a momentum manager, I need to find a value manager," and your way of searching for that is a recent track record, that's a wrong way to go. Because, yes, if we're saying that this ensemble method is in the 80th percentile, what that means is that 20% of those strategies did better than the ensemble. And so there's 20% of momentum independent managers that you might wanna go and say, "Well, these guys are momentum guys too," and they're crushing you.

Mike: **19:21** Mm-hmm (affirmative).

Rodrigo: **19:22** They are crushing you. Why would I give you money? Well, this is where you need to x-ray. Not- Not the ... read the label but rather look at the process. And so you want to look for managers that have a process that is diversified, you wanna create strategies that are diversified, and you don't just wanna say, "I want momentum, I want value, I want defensive, and so I'll just look for the best performing track record."

Mike: **19:44** Oh yeah. I mean, DFA is a great example. The price-to-book-value metric has run across some- some tough times, they do an amazing job at educating the advisors and clients, which is a wonderful thing that they do, but that ... had they just taking in ... taken a more diversified approach in the way in which they looked at value, they would have sup- ... they wouldn't be in the lowest percentile of potential measures of value. I think every other value factor, every other way that you could ... you could suss out value, has done better than price-to-book. And this is a very relevant, timely and specific example of why you don't wanna just have one measure of any particular factor that you might be trying to harness.

Rodrigo: **20:32** I love it.

Mike: **20:33** Alright. Well, gentlemen, that has been ... high-fives to all of you guys, that has been-

Rodrigo: **20:36** Good job, what a marathon.

Mike: **20:38** ... a wonderful opportunity to share with each other, introduce a new team member, and launch this mini series with you, our listeners. And so, obviously, if you've ... if you've enjoyed this series, like and share with your- your friends. I would also add that, if you have other ideas that you think ReSolve has a particular skill in and you'd like to see another mini-series on another topic that, you know,

you think we might be able to share some information with, let us know. Some of our best ideas actually come from our constituent clients and- and whatnot and- and potential clients. So we do love that, when you share that with us.

Rodrigo G: **21:16** Thank you for listening to our 12 days of Investment Wisdom mini-series. You will find all the information we highlighted in this episode in the show notes @investresolve.com/12 days. You can also learn more about ReSolve's approach to investing by going to our website and research blog at investresolve.com, where you will find over 200 articles that cover a wide array of important topics in the area of investing. We also encourage you to engage with the whole team on Twitter by searching the handle @investresolve and following Adam, Mike and myself. If you're really enjoying this series, please take the time to share us with your friends through email, social media, and if you really learned something new and believe that our series would be helpful to others, we would be incredibly grateful if you could leave us a review on iTunes. Thanks again and see you next time.