UNIVERSITY OF OXFORD

Saïd Business School

MODULE 4 UNIT 1
Video set Video 2 Transcript

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NIR VULKAN: This is quite a complicated spreadsheet now ahead of us, but all it is really is, if you like, an extension of the things we've seen before. We've now added a model or an indicator. So we are looking for a trend model, and a trend model uses what we call a detector. A detector looks at the past few days and decides whether it thinks that the market is going to go up or down. Now, the most simple detectors that you've seen that appears in most textbooks is what we call "moving averages", where you compare, for example, the average of the last 10 days of the close value, for example, with the previous 10 days or something like that, and if it's greater than you think it's going to buy, if it's smaller than you think, it's going to go down and therefore you sell, and so on.

We, here, are using quite a different indicator and it's one of the most sophisticated ones because we wanted to have something fun for you, and it's called "Polarised Fractal Efficiency". And the Polarised Fractal Efficiency has a lookback window and a threshold, and it looks over the last n days, and if the Polarised Fractal Efficiency is beyond a certain threshold – for example, if it's beyond the threshold of zero – then the indication is that the market is going to go up. And if it's [below] a threshold – for example, threshold of zero – then it indicates that the market is going to go down.

Now this comes from physics. And if you want to find out more about the Polarised Fractal Efficiency, the PFE, please click on the following link here.

Click the icon to learn more about the PFE (Polarised Fractal Efficiency).

NIR VULKAN: This, I know, this looks complicated but believe me, this is a very very simple model. It's a simple model because there's only one rule and because we are going to restrict the positions to 1, i.e. it's only going to— if we think the market is going to go up, we're going to buy a lot of 1, and if we think the market is going to go down, we're going to sell a lot of 1. That's already a simplification because you could think the value of the Polarised Fractal Efficiency can be used to decide how much to buy. For example, if it's a little bit more than 0 – buy 1, if it's a lot more than 0 – buy 5. Yes? You can think of a model rich like that. We're not going to do it here. So this is number one.

The second thing is we're going to restrict the threshold value to 0 as well. That's kind of a standard way to look but you can make it more complicated in a number of ways. First of all, it doesn't have to be 0. And also it doesn't have to be the same threshold for buy and sell. For example, you could say only buy if the PFE is above 0.2, but then sell if it's below 0. Then you have a model that can be long or short or out of the market, because if the value of the PFE is between 0 and .2, then you do nothing. So, you stay flat. In the model that you look here, because it's the same threshold, basically you're always in the market – you're either long or short in every given day.

Okay. The spreadsheet that you have then have a bunch of assumptions about what we call "being filled" and the costs associated with that. And the costs here are quite realistic costs that we picked, and they reflect the cost of the transaction cost, how much it costs to buy and sell one contract of DAX index, but also the costs associated with the what we call the "slippage" or how quickly, how easy it is to get in and out of position. We have made quite a general assumption here that you always get filled, so, you trade on the open and you can always get filled, so the model at the end of the day issues, so when the market is closed overnight, it looks at the PFE and it makes a decision, and then if the decision is to buy and if you're not already long – because if the decision is to buy and you're already long, then you do nothing, you just stay in the position – but if you have to make a change, we're going to make an assumption here that with the appropriate transaction costs and slippage, you get filled, okay? That is slightly simplifying assumptions, but actually, in this case, this is a quite liquid market. It's also not very restrictive.

Just to remind you so far we have simplified by only looking at minus 1. We have simplified by having the same threshold, which is 0, which means you're always either long or short. And so, there's only one parameter for us to play with which is the lookback period – this is highlighted here in yellow. So, what you see in front of you is a rule with lookback window of 20 days. This is 20 trading days.

Now, the other thing we're going to do is we're going to hide the out-of-sample year from ourselves, so whilst the model computes all on the right here, the Sharpe ratio for all the years, we have looked at this yellow square here and it gives us the in-sample Sharpe, meaning it's eight out of the 12 years. What we have done is we have picked four alternating years to be out-of-sample. So, the year 2006, 2008, 2010, and 2012 are out-of-samples and all the rest are in-sample. Okay, this is a standard alternating years towards the end, it's a standard procedure to use for out-of-sample. The alternative would be just to take the last four years and make them out-of-sample, but then you may have a little bit of a bias because you're missing out, basically, on, sort of, trends in the last few years. And so what we're doing here is fairly standard.

So, what this complicated spreadsheet does is it allows you to then play around with the lookback window, and the spreadsheet will then compute what the model would look like day by day. Then the model will work out what the Sharpe ratio is year by year, and then the model will give you what the in-sample Sharpe is for all those eight years. So, for an n of 20, the in-sample Sharpe is 0.55. What if we pick 30, here, then everything gets updated and we actually have a model that loses money over the eight years of the in-sample, and the in-sample Sharpe is minus 0.22.

Now, if you do that for all possible ns, you get some kind of relationship. This can be quite cumbersome and most firms would use some kind of automation and scripts. We have done some of it for you already and I'll talk you through it in the next tab, but you can play around with this spreadsheet, put in different values, give it a second or so, and then the model will update. And so we're going to move now to Tab 4.

So, what we see here in Tab 4 is I have graphed, I've logged for you all the in-sample Sharpes from the values of 30 to 130. Okay? So, you can do it manually one by one. I've done it all for you here and I've graphed them in this nice graph, here. So as you can see, for very small values of n, relatively small values of n, the model is very unstable and tend to lose money. And then the model have kind of a stable region here around the 80, 80 plus value, and then there's very good Sharpe numbers towards the end with very large lookback windows.

Now, one thing to notice is to remind you that these are only in-sample Sharpes, and therefore, the fact that they're particularly high here doesn't mean that it'll necessarily hold out-of-sample. So what we're looking for is decent areas that are stable, and, therefore, I will restrict attention to here and here. And with a model like that, I would do, at most, two out-of-samples. Just one or two, that's it. That's all you get because otherwise we would what we call “burn the out-of-sample”, i.e. if we look at 50 different values of out-of-sample, one or two of them may hold but they’d not be real, it would be just, you know, it is a positive chance of that happening.

Let me comment on the value. The values here are between 0.5 and 1. It may look a little bit small – I remind you that the Sharpe ratio of 1 means that you, kind of, are compensated correctly for the risks you take, but given that this is one market, one rule, very simple rule, and I’m only allowing buy 1 or sell 1, this is actually not bad performance at all. I will then show you at Tab 6, when we get to that, what the model would look like when we allow multiple markets and when we allow more than positions of varying sizes and you’ll see how that expands. But for now, this is actually not a bad performance for… given the restrictions that we’re putting on ourselves.

So, what we can do now is we can say well, “Okay what would it look like? What values should we pick for out-of-sample?” So as I said, I would pick one from here and one from here. So, for example – and you can do it yourself, but just to demonstrate – this is Point 84 that has a decent Sharpe. You can go back to Tab 3, select 84 – which I’ve already done here – you get the in-sample Sharpe of 0.6, and if you click on that plus sign here, it will reveal what the out-of-sample Sharpe is as well. Okay? So the out-of-sample Sharpe is the average of the four out-of-sample years. And what we see here is that there isn’t a huge gap between the in- and out-of-sample, so I would say that this model largely holds out-of-sample.

So, you can play around with this. Looking at these values, as long as you don’t do more than two because otherwise that’ll be cheating. Or you can just stay with me and I have picked two models, one from here and one from here, and I’ve put them on Tab of one.

So, one of them is 84, which we looked at just now, and you can see that the model has an in-sample Sharpe of .6 and an out-of-sample Sharpe of 0.52. This says that largely, even though there’s a small degradation here, the model is kind of the same in- and out-of-sample, and therefore this model seems to be valid. What happened with the model that have a larger lookback window is looking at 116 trading days, and this model had a strong in-sample Sharpe of 0.92, and a negative out-of-sample Sharpe. So, this model has collapsed out-of-sample and this is clearly invalid.

The question is, of course, why? And we can only speculate but I would say two things about this. I would say about here, the large model that it’s a model that doesn’t trade very much. If you look back at 116 days, you will find a number of decisions that the model makes is very small. And so the risk of overfitting is very large with the model like that, because, you know, you’ve only looking at models that make so many decisions and, therefore, if it was lucky with those decisions the days it made them, then it looks like it’s a very good model, but it’s just because it was lucky. So if you flip a coin once a year, then it might, you know, you might do well in three or four years, but that doesn’t mean much – in eight years, sorry – but it doesn’t mean much that it will continue in the last three years and I think that’s what’s reflected here.

The 84 is, for those of you who’ve been trading and have seen this kind of models before, that’s kind of the range that normally holds. This is what we call the middle trend’s three months period. If you look back over the last three months, three to four months, there’s a good indication of what’s happening there of a trend that’s likely to last. So, if you look at shorter things then they tend to be a bit random, if you look at longer things, as I said, it’s overfitting, but around that region things tend to be indicative of what's going to happen next.

So that's, as I said, a very very simple illustration of what the life and work of algo trading optimisation looks like.

Now, I know a Sharpe of 0.6 doesn't look very impressive, so I've included, in Tab number 6, a model that's very similar to that. It also trades the PFE but it trades 40 different markets, including the DAX, over the same period of time. This is actually a model that I've been working with. It's kind of similar in the sense that it has two pairs of rules, of two PFE rules – one buy and one sell – and they are not restricted to only holding a position of 1. So if the signal is very strong, it trends more, and if the signal is less, is negative, and it's particularly strong, it can take a large short position and so on. And, you can see, this is a model that over 12 years has a Sharpe of 1.43, then you and I would have done very well to invest in models like that. This is a very good model. And it's not much more complicated than what you've seen.

But this perhaps illustrates what Anthony Ledford, the Chief Scientist for Man AHL, talked to us about in the end of Module 1. If you remember his lecture where he explained that even if a trend exist and it's a real phenomenon, the signal is quite weak if you look in an individual market, but if – and this is where you really use the power of algos and computers – you can use this to do 40 markets at the same time. And therefore, each market contributes, sort of, a Sharpe ratio of 0.6, 0.7, but together when you put them because they are not all correlated, of course, you can get a Sharpe ratio of 1.42 over a very long period of time, and if you can see this model have very small drawdowns. This is a very very strong model. So this is as good as any, sort of, performance that you would see, and it's really very, not much different than the kind of stuff that you have seen perform on the DAX.

This is the spreadsheet. Hopefully you were able to follow and to see. You can play around with it. What we've done is composed a number of questions for you, and when you answer the questions, please go between the tabs, feel free to play around with the model and enter whatever you like and you can see how the model responds – and, enjoy.

NIR VULKAN: Well, I hope that you find this exercise useful. It's quite involved. I hope you were able to follow all of the steps. Please feel free to go through it again, if you need to. I hope it gave you a little bit of a taste of what it's like to optimise a model and then to see whether that model is valid by verifying it in the out-of-sample as we did.

NIR VULKAN: Did you understand all of the concepts in this video? If you would like to review any of the questions, click on the corresponding button.

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