

## R-Squared interview on risk modelling methodology

### Company Representative

Welcome to Financial Research Perspectives with FactSet. Today, we'll be listening in on a discussion with Sean Carr, Vice President of Portfolio Analytics in FactSet's London office, and Jason MacQueen, one of the founders of R-Squared. R-Squared is a custom risk model provider, which recently added a global short-term model on FactSet. Sean and Jason will be discussing the details of the model as well as R-Squared's methodology for model creation and application. As always, we welcome your feedback on our podcast, and hope that you will write us at [podcasts@factset.com](mailto:podcasts@factset.com), or review our podcast in iTunes.

Let's get started with the interview.

**<Q – Sean Carr>**: My name is Sean Carr. I work for FactSet as VP of the Portfolio Analytics team based in London. Joining me today is Jason MacQueen, Founder of R-Squared. R-Squared is a custom risk model company that recently put the model onto FactSet: the global short-term risk model. I'll be exploring with Jason several areas regarding the models and the specifics, and then ask him to expand upon them in detail.

Jason, your model on FactSet, it is a short-term model. Can you expand on what that means?

**<A – Jason MacQueen>**: Yes, it's intended for investors who have relatively short investment horizon. The thinking here is hedge funds obviously, but also any other investor with a relatively short-term horizon. As you know, there are a number of other risk models available, some of them on FactSet, but almost all of those without exception are oriented towards investors—institutional investors who typically have reasonably long horizons. What I mean by that long horizon would be anything from six months up to 18 months or even two years. What we're looking at today is a model that's designed for investors who are concerned about looking at risk over a period of anything from one day up to about two months.

**<Q – Sean Carr>**: So a long-term model literally – in terms of horizon, we're talking about turnover?

**<A – Jason MacQueen>**: Well, it's one way of measuring it. As a matter of fact, I was just having this discussion with a hedge fund manager this morning and asking him what his average turnover was. And from that we were trying to back out what his typical investment horizon was. But yes, whenever you build a risk model, it should be geared towards the investment horizon of the portfolio manager. And as I say, there are number of models that deal with medium- to long-term horizons; very few that I know of that are geared towards short-term horizons.

**<Q – Sean Carr>**: Could you use the model for long-term funds? Are those numbers going to be inaccurate or just less prompt?

**<A – Jason MacQueen>**: Clearly, you can...risk models have a long history of being abused, I'm afraid; but it wouldn't really be appropriate. We're trying to catch the characteristics of the global equity and bond markets over the past year with a view to being able to make useful forecasts about the risk of the portfolio, and more importantly perhaps, the risk structure of the portfolio over the next few weeks or up to a couple of months. Clearly, you could take the numbers that come out of that analysis and assume that they were going to hold a year or more, but there is a good, good chance that they wouldn't, and it wouldn't be a very sensible thing to do. Contrarianwise of course, you could take a model that's intended for a long-term horizon, 12 months or more, and scale the numbers down and try and get predictions for what's going to happen over the short term. That would probably also not be terribly useful.

**<Q – Sean Carr>**: So expanding on that topic, let's get into the construction of the model itself. As you said, because of the shorter term, things are changed annually that fit to the company on really useful factors. Can you expand a bit more on the construction methodology and the factors that you would use in this model?

**<A – Jason MacQueen>**: Yes. Perhaps in terms of the construction methodology, it would be most helpful if I do a compare and contrast exercise against models that investors might be more used to. Typical long-term models will use something like a five-year look back of monthly returns to build a risk model, to construct the factors, and to determine the individual stock sensitivities to

those factors. And then that history would be used to forecast 6, 12, 18 months out. In our case, we're using basically a one-year look back of daily returns and using that to forecast anywhere from one day out to about two months or 40 trading days would be another way of saying it.

The first question of the model, it's in a US dollar based currency so that's obviously suitable for US investors and anybody else using the US dollar as their base currency. But we're also going to be coming out with euro-based currency versions and sterling-based currency versions. There are various types of factors in the model, clearly because this is a global universe. We therefore have securities priced in many different currencies. One of the obvious things you want to be able to separate out is how much of the risk is currency risk, so currency factors come first in the model.

Then, because we expect models using stock selection methodologies that include half a dozen active factors, and those are constructed on a regional basis. So they'll have things like book-to-price, earnings-to-price as value indicators momentum, look at the short and long-term momentum variables in there. There is a liquidity variable in there and a growth variable in there, and each of those are calculated, as I said, on a regional basis. So there will be North American versions of the variables, European versions of the variables, Asian versions, Japanese versions, and so on. The model universe is very large. It's about 40,000 securities, 40,000 equities that is, worldwide. Clearly that covers all the developed markets and most of the emerging markets, and we have things like Saudi Arabian securities in there as well as all of the more of obvious ones.

In addition to the currency factors and what I call the active factors, meaning the things that managers typically use to help them to pick stocks on the basis of their value or growth characteristics or momentum and so on, we also have a series of country and regional factors and a series of industry factors.

One of the shortcomings of traditional risk models has been that they select a set of factors which they hope would explain most of the common factor risk present in the universe of securities, and then they tend to assume that everything else is uncorrelated. That of course isn't necessarily the case. There is a more recent development which we pioneered with the development of hybrid risk models. So what you do there is you, as I say, explain as much as you can with the currency factors, the active factors, the industry and country factors. And then instead of assuming that everything else is uncorrelated, you run some statistical tests and indeed you create some statistical factors to try, and if you like, soak up any residual common factor risk that turns out to be left over. I think in the FactSet model, we have five statistical factors. They tend not to be very important. But on the other hand, they also are not totally unimportant. And so what I'm telling you is there is a small amount of common factor risk that is present in the universe that isn't captured by all of the specified factors.

Lastly of course, for each stock we have stock specific risk, and it simply tells you how much risk is idiosyncratic to that particular stock and uncorrelated with everything else.

A number of interesting things have come out of this model. One particularly interesting thing given the huge turbulence we've had in the markets over the last few months and given the hugely dramatic difference in market conditions now from what we had a couple of years ago is that we ran the model back to June 2007. So in other words, we were looking at the characteristics of the model as it was then and we plotted how those have evolved over the 18 months since then. And one thing that was very striking was that although the risk of the country and industry factors in particular had increased quite dramatically over that period as you would expect, particularly during the last half of 2008, it was quite striking that the statistical factors had not changed. The volatilities were fairly stable throughout the whole period. What this told us is that what's going on in the markets is essentially more of the same rather than the emergence of something different. And this is quite important for risk modelers.

When the Internet bubble came along, the Internet of course was a new common factor that affected not just Internet stocks but began to affect quite a lot of other stocks as well, but it wasn't in anybody's risk model. And so we entered a period of maybe two or three years during which most of the standard risk models seriously understated the risk of portfolios. And this was because the Internet itself wasn't captured by any of the defined factors, and they didn't in those days have statistical factors to soak up anything different or new. One of the good things about having statistical factors is that if something new starts to happen in the market, they will pick it up reasonably quickly.

So I would just stress the point that despite all of the turbulence that we've seen in the last year and the very, very different market conditions that we find ourselves in, what the evolution of this model is telling us quite clearly is that it is simply more of the same. So we've got more industry volatility, more country volatility, to some extent more currency volatility. But what is not going on is that something new has started to happen. I think that's quite important and quite interesting.

**<Q – Sean Carr>**: Jason, I know that as well as the hybrid side, something that makes your model perhaps not unique, but different from a lot of the others is your attitude to betas. You don't use single industry or single country betas. Could you expand on that, please.

**<A – Jason MacQueen>**: Yes, I'd be delighted. Again, a number of the standard models use dummy variables for things like industry membership or country membership. So just to be clear what that means, we have a stock like Société Générale, for example. We're building a risk model from a US dollar-based currency perspective. And we essentially start off by saying okay, there are three things that we know for sure about this stock. One is that it's priced in euros. The second is that it's a French stock, and the third is that it's a bank. Now, you would therefore expect your risk model to, in some sense at least, reflect those three things that you know about the stock. The way that most of risk modelers traditionally approach this is to simply say effectively okay, we'll set the stock to have a beta of one on the euro, one on the French market or the European market depending on exactly what the factor is, and one on banking or finance, whatever the industry or sector factor is, and this is known as dummy variables.

Not only do you set the things that you know about to one, but you also set everything else to zero. So you're actually making a very, very strong statement there. You're saying Société Générale goes up and down with the euro, up and down with the French market, and up and down with banking. And it doesn't go up and down at all because of any other country or industry or currency. Now that's an extremely strong assumption and I will illustrate very clearly that it can't possibly be true.

It isn't true that all French stocks go up and down the same as the French market. It may well be true that they all go up and down to some extent with the French market. That's the market effect that Bill Sharpe identified 40 years ago. And clearly it's the case that all French stocks will go up and down with the French market, but it's certainly not the case that they all go up and down in lockstep. What you will have in fact is that some will go up, some will tend to exaggerate the market movements, and some will tend to dampen the market movements.

And the same of course is true for the industry that the stock happens to be in. You have highly geared banks, and believe it or not these days, you have banks that are not quite so highly geared and only tend to reflect the movements of the banking industry to a dampened extent. And similarly for currency effect, it simply isn't true that because the stock is price in euros, that's the only currency exposure it has. Otherwise it's true that if it's priced in euros, it necessarily goes up and down exactly the same as the euro does relative to your base currency.

I'm afraid we like to say that dummy variables are for dummies. It's really quite a silly thing to do. And we prefer to take a much more general view and to say fair enough, we know that Société Générale is priced in euros. It should therefore have some sensitivity to the euro. Equally, it should have some sensitivity to the French market and some sensitivity to banking. But those sensitivities need not necessarily be one, and almost certainly they won't be. Not only that, but we also allow for the possibility that Société Générale, which is indeed a French bank by nationality and is headquartered in France, nonetheless has branches over most of Europe. And it's entirely likely that it may have some sensitivity to other European market movements even if not to America for instance.

It's also possible that a bank could have sensitivity to some other industries, real estate for example, if it has heavy real estate involvement, or other industries. And it's also possible that it could have sensitivity to other currencies. It's quite easy to think of examples. HSBC Bank almost certainly has sensitivity to Hong Kong as well as having a sensitivity to the UK. Many large stocks these days count as multinationals. And because they happen to be based in London or happen to be based in New York clearly doesn't mean they're not exposed to multiple currency effects and multiple country effects and even possibly multiple industry effects.

So in our procedure, we use a combination of benchmark price and statistical significance checking to try to determine for each stock what the sensitivities are that are actually significant. Trying to strip that of the jargon, what that means is that in case of Société Générale, it will have betas on the euro and on the French market and on banking. And we will determine what those betas are, those sensitivities are, by regressing the returns of Société Générale on the returns of those three factors, and it may well turn out that they are either higher or lower than one. Off the top of my head, I don't remember the numbers for Société Générale. But for example, I know very well that the sensitivity of Sony to the yen is only about 0.5, and indeed the sensitivities to two or three other currencies as well, as you would expect given that it sells its products in Europe and in America as well.

Having established the obvious betas for a stock like Société Générale, we then take the returns that are left over and regress them on other currency factors, other country factors, and other industry factors to see what the sensitivity to any of those might be. Now clearly the regression will give you answers for every country and every industry and every currency. Equally clearly, most of those are not statistically significantly different from zero. And we apply a quite stringent statistical test, which is roughly speaking 95% certainty. And anything that fails the test gets set to zero, but anything that passes the test we keep in the model.

So typically for example, the average stock in the universe I think has 1.5 industry betas. Another way of saying that is that every stock has a beta on its own industry as you would expect, and approximately half of them turn out to be significantly sensitive to some other industry as well. Likewise, the average number of country betas per stock is also higher than one. I think it's about 1.7. And likewise the currency betas again, the average number of betas per foreign stock, because US stocks wouldn't have the sensitivity to the dollar as such because it's riskless; again the average number of currency betas for a foreign stock is also higher than one. We believe that this gives you a much more accurate picture of the true sensitivities of stocks, particularly of multinationals.

**<Q – Sean Carr>**: Can I follow up on that point there, your comment about multinationals? You have a global model. If someone is investing globally, obviously that fits. But when you have some markets such as the UK where multinationals both in industry and in finance are so global in nature, can you comment on should I be using a global model or a single country model?

**<A – Jason MacQueen>**: I can; let me just tell you little anecdote first. In my old firm QUANTEC, we built the first ever global risk mode. I think this was back in 1993. And in the process of doing this, we invented a measure that we called the Globalization Quotient. And the idea of the Globalization Quotient was that it was simply the ratio of how much risk of a stock was explained by its exposure to global factors versus how much risk you've had overall, so effectively what percentage of any particular stock's risk was affected by global factors.

And having done this, we then ranked our universe, which was quite a small universe at the time. It was about 8,000 securities I think, mostly in the developed markets. We ranked all the securities by this Globalization Quotient. And I looked at the top of the list with great interest to see what the most global stock was. And to my surprise and amazement, it turned out to be the SPDR, which is the S&P 500 Exchange Credit Fund, the S&P Depository Receipt. This tells you something quite interesting; that American investors, for example, used to think certainly that if they were only investing in their own market, then they weren't exposed to foreign currency risk or international risks of any sort. They would sort of say, "I'm a domestic manager." But what that result tells you is that there's almost no such thing as a purely domestic manager these days. If you're investing in large cap stocks in almost any market in the world, you can be sure that it has some exposure to foreign influences of one sort or another, be they foreign currencies, foreign countries, or even possibly industries that don't have a very big presence in that particular domestic market itself. Commodities would be the obvious example.

So to get back to your question, it is a global model. As I said, the universe is about 40,000 equities worldwide. A lot of those are quite small. A lot of those are in emerging markets. And it is intended primarily for global, or at least multinational, portfolios. Now, you could obviously use it to look at the risk of a single country portfolio. It would probably give you a fairly good forecast of the risk of the portfolio. The only thing is that the decomposition of risk might look a little bit counterintuitive in the sense that let's suppose you were looking at a UK equity portfolio with this model. Not only are we going to see obviously large bets on the UK and on the major industries in the UK, we're also going to see small but not negligible exposures to some European factors, possibly to some American factors, and the industry exposures might also reflect things that the UK doesn't necessarily have a lock on itself.

So you can certainly use it for a single country portfolio. It will be better if it's a single country portfolio dominated by large cap stocks that themselves tend to be multinationals. If you were using it to analyze a portfolio of, shall we say, Japanese fishing stocks or German breweries perhaps, very, very domestically oriented small-cap stocks, then it might not do such a good job. But if you're just looking at some of the large and mid-cap stocks, particularly ones that have any kind of multinational-ness about them, then it should do a reasonably good job.

**<Q – Sean Carr>**: Just carrying on that theme just a little bit further regarding intuition, what is your general feel? You mentioned market turbulence earlier. Do you think people need to monitor risk more closely, more often, or just continue to spend more time examining exactly where things are coming from?

**<A – Jason MacQueen>**: One of the good things we discovered about this model, and we were looking at the way which it had changed over the last 18 months, was that it does seem to respond very quickly to changes in the market. So it will pick up much quicker than a model based on monthly returns, say, the fact that we've had a very high burst of turbulence in the markets, which will cause it likely to persist for a little while before it settles down. You don't often get – in fact; I don't think you ever get – a period of high turbulence one week and then the market settle down to normal behavior the next week. When turbulence starts, it tends to persist for a while. So if the model picks that up, it will help to give you more accurate forecasts of the risks you're likely to experience over the coming weeks. Since this is a short-term model and oriented towards shortterm investment horizons, I would expect people who use it to monitor risk at least weekly or whenever they make significant adjustments to their portfolio holdings.

One other thing I would say about this model, particularly in the context of the markets that we're in at the moment, is that the model was released some months ago. We're actually about to release a second version, where we've made some adjustments in the light of recent market conditions. One of the good things about it being a short-term model is, as I said, it does respond very quickly to changes in the market, and that in turn means that we can adapt the model to more accurately reflect those changes, if need be. So I should stress that no model, be it a forecasting model, a stock selection model, or a risk model for portfolio risk analysis is going to be good forever. It's always a creature of its time and it's always going to evolve as time passes and the market changes; so you would expect to see a change from time to time as we adapt it.

**<Q – Sean Carr>**: Thank you for your time, Jason. You've expanded upon the model and some of the detail on it. Jason MacQueen of R-Squared with your new model; thank you very much for speaking with us today and answering my questions.

### **Company Representative**

Thank you for listening. You can join us again in three weeks for the beginning of our two-part episode in which we will interview Emanuel Derman, author of *My Life as a Quant*. Derman will be discussing his newest work as he deals in the industry with Goldman Sachs. For more information on any of our products and services that are discussed in our podcast, you can reach us at [podcasts@factset.com](mailto:podcasts@factset.com) or listen us on the web at [www.factset.com](http://www.factset.com).

Thank you.