

OVERVIEW OF CUSTOMISED HYBRID RISK MODELS

Efficient portfolio management is about balancing the various sources of risk in a portfolio against the corresponding expected returns. This can be done both for the individual holdings in the portfolio and for the various factor bets that the manager is making.

We believe that most professional investment managers have skill; unfortunately, this skill is often not reflected in the performance of their portfolios because the risks have not been managed properly, so that the contributions to portfolio risk are often not in proportion to the corresponding expected returns. Far worse, however, is the fact that the unintended bets in a portfolio can dominate the deliberate bets that are the sources of performance due to a manager's skill. It is for this reason that the performance of an actively-managed portfolio often shows no evidence of skill.

The ultimate goal of portfolio risk management is to improve the performance of the portfolio, either by improving the returns, or by reducing the risk, or both.

The whole point of using a customised risk model is to manage the risk of a portfolio more efficiently. This involves not just forecasting the overall risk of a portfolio, but, more importantly, analysing the contributions to portfolio risk either from the different holdings, or from the different factor exposures. At its most basic - and most useful - this analysis enables the manager to answer the question "How big are the various bets made in this portfolio (either by holding or by factor), and are they justified by the expected returns?"

A BRIEF HISTORY OF RISK MODELS

The first multi-factor risk model for the US market was built by Barra in 1975. Their approach uses stock fundamental data or dummy variables to define the stock betas, and then estimates the common factor returns for each month by cross-sectional regressions. These estimated factor returns are then used to derive the factor covariance matrix. Being the first, Barra set the industry standard, and there are now a number of other firms offering essentially the same kind of model.

QUANTEC built the first risk model for the UK market in 1980. They used the alternative methodology of first measuring the factor returns, and then estimating the stock betas by time series regressions. QUANTEC built risk models this way for all the developed, and most of the emerging markets during the 1980s, and in 1993, developed the first global risk model.

It can be demonstrated mathematically that, all other things being equal, the time series approach will always give better portfolio risk forecasts than the cross-sectional approach.

APT built the first purely statistical factor risk model in 1985, using weekly returns. These kinds of model, by construction, will tend to have the highest possible explanatory power of the in-sample data. However, they also have two well-known problems, namely, that it is hard to attach any intuitive economic meaning to the factors, and that the factors themselves tend to be unstable.

Since then, other firms, such as **Quantal**, have also built statistical factor risk models, mostly for the US market, using weekly or daily returns data. The use of higher frequency stock returns allows a much shorter look-back period than the usual five to seven years that is standard practice with monthly returns. This, in turn, enables them to capture changes in the market, particularly the emergence (and passing) of transient factors - such as the Internet bubble - much more quickly, although at the price of even greater instability in their other factors.

Northfield Information Services, based in Boston, began by building Barra-type risk models, and have subsequently gone on to build risk models in other areas, including both international and fixed-income models. **Northfield Information Services** were also the first to suggest the construction of hybrid risk models, using a combination of pre-specified and statistical factors.

CUSTOMISED HYBRID RISK MODELS

Hybrid risk models capture the best of both methodologies, in that they use pre-specified factors to capture most of the common factor covariance that is going on in the universe of securities, but then also use a small number of statistical factors to capture any other (possibly transient) common factor effects in the stock returns.

However, there is still a potential problem with this approach if one or more of the statistical factors turns out to be a significant contributor to a portfolio's risk. The manager is again left with an unsatisfactory explanation as to what this bet represents exactly, although they do at least have the comfort of knowing that they have captured all the bets in the portfolio.

R-Squared's solution is to create a **Customised Hybrid Risk Model (CHRM)** to reflect the portfolio manager's particular investment process. The pre-specified factors would include both the particular common factor bets that the manager intended to make, as well as any other common factors that the manager wished to monitor explicitly. For efficiency, managers should try to ensure that their portfolios are always neutral with respect to these other specified factors.

The key aspect of a CHRM is that all the factors that are relevant to the manager's investment process are included as defined factors. Any residual common factor effects are then captured by small number of statistical factors.

Although the economic meanings of the statistical factors are still unknown, they will now constitute only a small part of the portfolio's risk structure, while the manager will now be able to explicitly identify and quantify the factor bets that are intended to generate the portfolio's outperformance, in terms that correspond directly to their investment process.

Users of **Customised Hybrid XRD Risk Models** therefore have the comfort of knowing that all the common factor risk in the portfolio had been accounted for, in terms that reflect their own investment process, and that the stock specific risk really is uncorrelated and idiosyncratic.

This approach also avoids a problem common to most standard commercial risk models, namely, that they often include a number of factors than are not strictly necessary, for their own commercial purpose of appealing to as many managers as possible. In practice, this often serves only to confuse and obfuscate the portfolio's risk structure.

CROSS REFERENCE DAY RISK MODELS

The Reference Day effect refers to the phenomenon that relationships between stock returns and factor returns can appear to vary if a different reference day is used to define the time periods. Most risk model vendors use calendar monthly returns to build risk models for investors with medium to long horizons. If, instead, we were to use returns from the 15th of one month to the 15th of the next month, we could easily get somewhat different results. This can also be thought of as sample specific estimation error.

R-Squared's solution is to create **Cross-Reference Day (XRD) Risk Models**. These use 4-weekly returns instead of calendar month returns. This avoids exacerbating end-of-month, end-of-quarter and end-of-year effects in our samples of stock returns, and gives us 13 observations a year instead of 12. By using returns calculated from Wednesday closing prices, we also avoid most public holidays and end-of-week effects.

However, a set of stock returns over, say, eighty 4-week periods (about 6 years) will still have sample specific idiosyncrasies. We therefore create four 'raw' risk models using four sample sets of returns, staggered one week apart. Each of these risk models will have their own sample specific estimation errors, although they will all reflect the covariance structure of the universe of stocks over the last 6 years.

As a final step, the factor variances and covariances, and the stock betas and stock specific risks are all averaged over the four sets of estimates. This has the effect of diversifying some of the sample specific estimation errors, with the result that XRD risk models give more accurate and more stable results for portfolio risk analyses. For investors with shorter investment horizons, we build XRD risk models based on weekly returns, averaged over the five daily cycles.

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If you would like to learn more about how one of our Customised Risk Models can help you with your portfolio risk management, or with risk-adjusted performance attribution, please contact Jason MacQueen on +1 646 280 9598 (email: jason.macqueen@rsqrm.com).

R-Squared has been building Customised Hybrid Risk Models since May 2003, and we have been pioneers in the field of equity risk models and portfolio risk management for over three decades.