Quantitative Credit Research

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In fixed income, the basic portfolio optimization problem is to maximize expected return (ER) subject to risk being less than some prescribed limit. A large number of linear constraints can be added and they serve to regularize the solution, that is to say, reduce over-concentration and make stop the target portfolio moving too much as the market moves. We can also deal with the risk and constraints side including transaction costs. Broadly, in a fixed income setting this reduces to constraints on interest rates and credit duration, countries, sectors and issuers. But what about expected return? Expected return is not a simple thing to quantify, but at least in fixed income it can be broken down into several components, some of which are easier than others:

[1] Yield (or carry), which is most easily understood as the PL we derive from sitting on the position while *the market remains still*. In more detail that does not mean the bond price remaining fixed, because there is a pull-to-par effect. For a premium bond, the coupon exceeds the yield, but we lose money as time progresses and the price moves towards par. Similarly for a discount bond. So, it really means the yield curve remaining as it is.

[2] The whole market moves. In 2022, for example, maximizing yield led to the lowest return, not the highest. Interest rates and credit spreads both rose, causing mark-to-market losses. Those who stayed in cash did best, with the exception of those who eked out a small profit by sitting on very short-dated bonds that have since matured or are about to.

[3] Individual issuers move. We can buy a three-year bond at 75, with a yield of 25%, but that isn't much use if it defaults. Back in May, we were looking at particular issuers, and its 2025s were trading at pretty much that level. We thought they were not a great investment since its debt to capital ratio were above the optimal level[1] by a factor of $2x$. Now they are in the low 50s and the yield is ~40% or so. But yield does not equate to expected return.

From what I have seen, [2] and [3] ingredients are much more difficult than [1], and still old-school investment houses, which purport to provide fixed income portfolio advisory to clients, go no further than maximization of yield. I would not recommend anyone to do that, whether it is to build clients' portfolios, or to try and beat ETFs. The liquidity of the selected fixed income portfolio is likely to be far worse than an ETF, and they are likely to be in wrong credits.

The problem with maximizing yield in a risk-off environment is that we are likely to be in the worse credits, or longer duration, and both are going to hurt. One useful early warning sign is the risk premium[2], which is the reward we get for investing, and when it is high we should be paid a higher spread.

But how to translate all of these into a portfolio? There are a couple of approaches.

[1] Capital allocation via optimal financing mix and excess returns: https://www.linkedin.com/pulse/capital-allocation-via-optimal-financing-mix-excess-fermin-cota/

[2] The risk premiums that we observe - https://rpubs.com/rafael_nicolas/crp - are a function of how much risk capital there is in play, with risk premiums going up when risk capital becomes scarcer and down, when risk capital is more plentiful. In the bond and loan market access to risk capital will determine default spreads on bonds, with lower rated bonds feeling the pain more intensely when risk capital is withdrawn or moves to the side lines. Not only will default spreads widen more for lower-rated bonds, but there will be less bond issuances by riskier companies. In the equity market, the equity risk premium is the price of risk, and its movements will track shifts in risk capital, increasing as risk capital becomes scarcer. A pull back in risk capital is often the catalyst for market corrections, where price not only converges back on value, but often overshoots in the other direction (creating under valuations). It behooves both investors and traders to therefore track movements in risk capital, since it will determine when long term bets on value will pay off for the former, and the timing of entry into and exit from markets for the latter.

The first allows us to carry on maximizing yield if we must but with a risk constraint. So we need some measure of how geared to the market we are, and the obvious criterion is the $CSW10$ measure, which is sensitivity to spread increasing by 10%. The higher the duration, or the wider the spread, the more risk we will be running. We can decide how much risk we run by comparing with a benchmark, e.g. 100% makes us market weight, 50% is severely underweight, and so on.

The second allows us to reprice the intended portfolio not off today's yield curve, but off a wider one that anticipates higher yields in the future. This solution for navigating widening markets, in which yields are on the rise, is a bit more formal but allows us to put in a view of where we think credit markets are likely to go. We simply calculate total return, taking an anticipated yield movement into account. So the ER is not just the yield, from that must be subtracted the mark-to-market loss associated with the yield curve widening. It can also be done sector by sector, so for example we can push all industrial names wider if we want. Finally, it can be done at single-name level, which is where we will be spending most of our time.

When we maximize ER we will naturally screen out long-duration bonds, though we won't necessarily avoid bad credits. If we just maximize yield, then we have a fundamental problem avoiding them, because by definition they are the highest-yielding instruments around. Maximizing expected return is likely to be better. But even so, keeping them out is hard, simply because even with the possibility of default factored in, they can still look quite attractive, unless we downgrade them severely. The lines of defense against bad credits are:

- Lower issuer concentration on worse credits. Like the $1-2-3$ rule which says no more than 3% for IG, 2% for BB, 1% for B (and possibly 0.5% for CCC). Larger institutional mandates will require tighter constraints in grounds of practicality, i.e. liquidity will be a problem.
- Credit analysts indicate whether they are confident about an issuer, by specifying lower concentration where necessary—and total avoidance of names that are fundamentally non-analyzable.
- Where available, using the implied equity risk premium[3] to tell us what it thinks. It can point to situations where the equity market is overpriced, in which case the credit market is telling us to short the stock, but sometimes it is the bond market that is being overoptimistic.
- Knowing where the models are have nothing useful to say about a credit[4], particularly in idiosyncratic binary situations that are make-or-break for a firm.
- Cutting names that we no longer understand.

We should consider not buying credits that we do not understand, and while there are always uncertainties—if not there would be no credit spread in the first place—a detailed knowledge of the company and its workings is essential. Any credit research team that works properly must be able to address the following 3 key questions:

- Why does it trade where it does?
- Where do we think it should trade?
- What is the catalyst that takes it from one to the other?

Quantitative strategists are great at coming with answers to where do we think it should trade, though such answers might be wrong, particularly if the model does not explore a wide enough range of scenarios. They are far worse at answering why does it trade where it does. And without answering the *why* there can be

[3]The forward market equity risk premia can be derived by solving for the discount rate that equates future cash flows to the current market price: https://www.linkedin.com/posts/rnfc_covid-19-implied-equity-risk-premium-activity-6663866086435487744-dPJW/

[4]Optimal financing mix for a total of 41,489 companies globally https://www.linkedin.com/pulse/optimal-financing-mix-total-41489-companies-globally-fermin-cota/

no answer to what is the catalyst that takes it from one to the other. For that they need to know where each issuer is in the capital structure. And second, what do they think about the company's excess return on invested capital. Let us start with the second question first. Scaling profits to invested capital yields accounting returns, and comparing those returns to costs of funding, we get excess returns, shorthand for the value created or destroyed by growth. Now suppose a company is about to increase its leverage to fund growth, and the credit market is pricing most of that event in. By using the current leverage without regard to that likely increase we will get an implied asset vol that is too high (to match the credit spread), making the credit look overly attractive. But it won't be, and if the market has not priced in the full leverage increase, the spread will likely widen further, and the investor will likely lose money.