

Risk Considerations for International Investors

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Things We Want To Discuss

- What are appropriate measures of risk for international investors?
- What are the key analytical decisions in modeling risk across multiple countries?
- Do risk models really work globally?
- How can risk modeling methods be used for forecast future crises?
- International use of risk parity strategies to control risk

Are We Using the Right Risk Measures?

- We would assert that globally most institutional asset managers pay most of their attention to benchmark-relative risk (tracking error)
 - As investors don't pay their obligations with benchmark relative money, investors focused on absolute risk during the crisis for which many asset managers were unprepared.
- We assert that tracking error is an inappropriate measure of benchmark relative risk for all active managers
 - Every active manager and their investors must believe their future returns will be above average. To the extent that it is impossible for everyone to be above average, roughly half of managers must be wrong in this assumption and underperform. Tracking error simply ignores the risk of being wrong
- Short-horizon, capital based measures like VaR are really most appropriate for leveraged investors (i.e. hedge funds) that must be concerned with solvency, but such measures can distort rational policies for long term investors.

Is parametric VaR OK with “fat tailed” return distributions?

- There are a couple different theories on how the fat tailed nature of security return distributions comes about.
 - Depending on which theory you believe and the time horizon over which you wish to forecast, it is a relatively simple exercise to adjust tail probability values from the normal distribution to be more realistic for a particular context.
 - We do this by having risk models that are conditioned *on contemporaneous information* so as to rapidly capture changes in volatility levels.
 - In addition, we explicitly adjust for kurtosis by using rescaled range volatility estimators (see Parkinson, 1980) and Cornish and Fisher (1937).
- For additional information see diBartolomeo (2007) and diBartolomeo (2008).

The Unintuitive Nature of Beta

- For any given national market, the CAPM is derived so that the average beta across all securities is equal to one.
- Unless you fully hedge all currency risks, the correlation of a typical stock against a global benchmark will be lower than it would be if you currency hedged
 - The average beta will be less than one
 - Beta values will look very low if you expect volatile currency markets
 - Beta values are now functions of the investor's base currency

What other techniques are available to address volatile conditions?

- Any coherent risk measures (e.g. CVaR) is probably sufficient (i.e. NOT VaR)
 - The issue is not the nature of the measure as much as how the existence of higher moments should or should not be incorporated depending on the time horizon and utility function.
- Stress-testing and simulation are of limited value for unleveraged investors for whom risk management is an exercise in making intelligent risk reward tradeoffs over the future horizon.
 - These techniques are more suitable for financial intermediaries for whom day to day solvency is the key aspect of risk management:
<http://www.northinfo.com/documents/133.pdf> and
<http://www.northinfo.com/documents/213.pdf>.

The Oldest Question in Risk: Sector or Country

- Long debate in the finance literature on whether sector or country risk dominates for international investors
 - See Heston and Rouwenhorst (1994,1995,2004)
- A seminar at Wharton about 6 years ago
 - After a dozen presentations, the answer was pretty obvious
- If your framework is capitalization weighted, sector dominates country
 - Ford is worried about Toyota and Daimler Benz
- If your framework is equal weighted (e.g. emerging markets), country dominates sector
 - Local economic and political stability is the dominant risk

The Second Debate: Cross-sectional Versus Time-Series Models

- Most people forget that endogenous models were invented because exogenous models were hard to estimate at the security level, not because the risks to investor portfolios are actually endogenous
 - See Rosenberg and Guy (1976)
 - Statistical estimation techniques have come quite a long way since the 1970s
- Cross-sectional models have about the same degree of estimation error irrespective of portfolio diversification
- Times series models have more error on concentrated portfolios and less on diverse portfolios

Are Model Factors Stable Over Time?

- The short answer is NO.
 - But our modelling techniques do not require that the factors be completely stable
 - Since 2003, almost all of our models used a hybrid approach that involves both specified factors, and statistical factors (principal components) estimated only within the residual return observations
 - This allow almost all of the volatility of markets to be described by a parsimonious set of known factors, while still providing the flexibility for the model to adapt to new pervasive factors within the market as conditions evolve
 - With respect to the recent GFC, there has been no evidence that a permanent restructuring of our factors is called for, but the influence of the statistical factors was certainly increased on a transient basis.

Data Frequency and Illiquidity

- If you treat country or currency risks as separate factors you're going to need lots of observations to estimate a stable correlation matrix
- One obvious way to get lots of data is to use daily return observations
 - Fundamental data is updated at most quarterly so most of what you see daily at the stock level are just price momentum effects
 - Daily return data is asynchronous across global markets
 - Daily returns have high degrees of kurtosis
- Many smaller markets are highly illiquid
 - Odds of guessing on the Bahrain stock exchange
 - Lo, Getmansky and Makarov (2004)

International Accounting Standards

- Endogenous risk models often use accounting variables (e.g. B/P) as factors
- Accounting standards still vary widely across countries although a few hundred global firms are trying to report on purportedly international standards
- These are not small differences! How about a discrepancy of 10% US annual GDP for one firm?
- Country standardization is generally not the solution
 - Is buying the largest stock in Poland a large cap bet in the context of a global portfolio
- In many emerging and frontier countries most local investors don't believe financial statements are credible

Developed Country Risks

- If there was one lesson that should be learned in the financial crisis it was that “too big to fail is real”
- The financial stability of national governments and the stability of the banking system is inextricably linked
 - We’ve modeled government securities are part of the “financial sector” since 1999
- The US is low on the scale of vulnerability
 - The “systemic risk banks” in the US have assets of 65% of GDP
 - France 249%, UK 337%, Switzerland 550%, DB alone is 84% i
 - The stunning day in 2008
- We now model government bond credit in contingent claims framework assuming bank bailouts will be normal

The Problem of Volatile Currencies

- Just calculating the time series volatility of the exchange rate of any two currencies is problematic
- Consider an exchange rate of 80 JPY to 1 US\$
 - A Japanese investor puts 80 JPY in the US
 - An American investor \$1 in Japan
 - Lets assume the exchange rate changes to 100 JPY to the US\$
 - The Japanese investor's US position can be converted back to 100 JPY, a gain of 25%
 - The US investor's 80 JPY can now be converted back to 80 cents, a loss of 20%
- Repeated over many periods, the difference in return will generate differences in volatility
- See de Jong (2010, 2011)
 - <http://www.northinfo.com/documents/381.pdf>

Cross-listings, ADRs and GDRs

- To understand country exposure requires proper handling of cross-listings, GDRs and ADRs
- Most equity risk models treat ADRs as simply having the same characteristics as the underlying local share
- This makes perfect sense for a company like Nippon Telephone
 - NTT is a very Japan centric company. Almost all the trading is in Japan and the vast preponderance of company revenue arises from Japan
- Would the same logic apply for Royal Dutch or BP?
 - Is the Netherlands the key country exposure for RD?
 - Not much trading, not much revenue and no oil
 - How about Minorco, a mining company formerly legally based in Luxembourg, and previously Bermuda?

Do Risk Models Really Work?

- Generally, they work very well
 - Especially given the financial crisis in the sample period but security level models for some emerging markets are still problematic
- Here are some results for MV portfolios (200 names maximum) 1/1/2000 through 12/31/2010

Monthly SD	Ex-Ante	Realized
Brazil MV	8.83	9.29
Brazil MC	11.26	12.21
Asia MV	2.95	2.56
Global LC MV	.44	1.82
Global SC MV	2.18	2.29

What made models robust during the global financial crisis?

- Our models tightly link information across asset classes
 - Our internal model of corporate bond credit risk can be used to adjust the volatility of the equity of a firm to reflect the probability of bankruptcy
 - Information from equity option markets has been very valuable in risk assessment of the European sovereign debt crisis.
- Make a very explicit distinction between risk horizons
 - Understand the difference between the annual volatility of a portfolio (from today to one year from today) and the annualized value of the expected volatility over the next week
 - Since 2008, for shorter horizons the parameters of our models are *conditioned on contemporaneously observable information* regarding financial markets (e.g. VIX, TED spread). In essence the model is based on an information set that includes the present as opposed to merely looking at the past

Will models help to detect the next crisis or regime shift?

- Our models incorporate a hybrid structure involving both permanent specified factors and transient statistical factors (within residual).
 - Under typical conditions the in-sample explanatory power of the statistical factors should be close to zero for the market portfolio. To the extent that the explanatory power of statistical factors increases to meaningful levels this is an indication of changes in the market factor structure.
- Our process of conditioning each key aspect of the risk estimates on contemporaneously observable information set allows for rapid changes in the model estimates of factor and security correlation as well as volatility
 - In particular, observations of the cross-sectional dispersion of security returns and implied option volatilities are useful inputs to this adjustment process.
 - See diBartolomeo and Warrick (2005), diBartolomeo (2006), and diBartolomeo (1998).

Does the model time horizon contribute to the ability to detect regime shifts?

- Our models are available in three distinct forecasting horizons, one trading day (US equities only), ten trading days and one year.
 - The limitation on availability of the one day horizon models is based on the lack of liquid options trading on most individual stocks outside the US.
- Since 2004 our systems have incorporated CUSUM, a sequential probability ratio test as a formal test of change in long-term changes in regime.
 - The test can be applied to time series of factor returns or other aspects of market structure.
 - For background, see diBartolomeo and Warrick (2005b).

How can linear models deal with non-linear derivative instruments?

- We routinely provide factor representations of more than a hundred types of derivative instruments.
 - Users can input the terms and conditions on more than 100 types of derivative positions and the system replies with data
 - For instruments with asymmetric payoffs we use Cornish-Fisher and can also take into account whether the position is a long position or a short position so as to get the tail probabilities correct at a user selected confidence interval (e.g. 95%) even though the linear model computes a symmetric measure. For downside risk, you only care about getting the downside tail right.
 - For selected instruments with highly non-linear properties (e.g. barrier options), we have an additional system called “Collection of Positions” that uses Monte-Carlo simulation of the factor model components to estimate the price distribution of an entire set of derivative positions simultaneously, and create a factor representation of the spectrum of portfolio value changes.

Introduction to Risk Parity

- Risk parity is one of several allocation strategies that do not require explicit forecasts of asset class (or country) returns
 - There are still return forecasts involved, they are just implicit in the portfolio formation procedure
- Qian (2011) describes risk parity allocation as “capturing risk premiums from a risk diversified portfolio”
- Other allocation approaches without return forecasts
 - Equal Weighted
 - Global Minimum Variance
 - Most Diversified
- Risk parity formally (subject to leverage constraint)

$$W_i\beta_i = W_j\beta_j = 1/N$$

Literature on Risk Parity Allocation and Related Strategies

- Two basic industry pieces from consultants
 - Allen (Callan, February 2010)
 - Foresti and Rush (Wilshire, February 2010)
- A good overview of risk based allocation strategies
 - Lee (*Journal of Portfolio Management*, Summer 2011)
- Empirical analysis of risk based strategies
 - Bhansali (*Journal of Investing*, Spring 2011)
- The most practical Powerpoint
 - Qian (2011)
 - <http://www.northinfo.com/documents/458.pdf>

The Big Ideas in this Literature

- Most of the risk in investor portfolios comes from high risk assets (e.g. equities in volatile countries)
 - Depending on calculation method, 90% or more of the risk of a typical 60/40 portfolio comes from equities
- Empirically observed Sharpe ratios are higher for low risk assets than high risk assets
 - In many countries, low risk equities have performed better than high risk equities
 - Bonds are usually better than equities on Sharpe ratio
 - Illiquid asset classes *falsely look really good*
- Restructure asset allocations so that an equal (or more) amount of the risk comes from low risk assets
 - Normally requires the *use of leverage with some asset classes*

Ambiguities Around Risk

- Risk parity uses beta as the relevant risk measure
 - The use of beta as a risk measure arises from the CAPM which introduces certain conceptual complications
 - As discussed beta has ambiguities in international contexts
 - The use of beta provides for a unique solution to the problem
- Other risk-based strategies such as “maximum diversification” or “minimum variance” are based on the full expected covariance matrix
 - Decomposing portfolio volatility (standard deviation) or portfolio variance into additive components is common but controversial
 - Non unique solutions that are dependent on your assumptions of how covariance should be allocated and the “contra asset”
 - Standard deviations are not naturally additive, variances are
 - *Consider a portfolio of equities and short Treasuries: Should we credit half of the covariance to the bonds?*
 - Qian (*Investment Management*, Q4 2006)
 - Menchero and Hu (*Journal of Performance Measurement*, 2006)

Possible Rationales for Using Risk Based Allocation Methods

- Explicit asset class or country return forecasting is counterproductive. When we do it, we get it wrong!
 - Under MPT if we can't forecast return but we can forecast risk we should hold the minimum variance portfolio of risk assets
- If we can't forecast returns, and our beliefs about risk are vague
 - Under MPT we should use risk parity to spread the risk out as much as possible. We avoid holding large amounts of what we incorrectly thought was the low risk asset
- Low risk asset classes empirically have higher Sharpe ratios than higher risk asset classes so we should lever them up.
- There is a subtlety in the difference between geometric rates of return and arithmetic rates of return that may explain why risk parity works

An Algebraic Rationale for Risk Parity

- The CAPM is a single period model.
 - There are only two concepts of time, now and “until the input parameters change”
 - This means that we are talking about arithmetic returns since compounding is impossible
- In CAPM expected returns are a linearly increasing function of beta
- In the real world, parameters do change so we have to consider multiple periods with compounding
 - The geometric return is equal to the arithmetic return minus half the variance
- This means that the relationship between the geometric rate of return is non-linear and convex
 - The peak value depends on the Sharpe ratio of the market portfolio
 - If you go past the peak in beta the more the geometric returns go down

Conclusions

- Basic decisions about what risk measures to use are often controversial
- There are a lot of subtleties in estimating models that have to cover lots of countries in the same model
 - For developed markets country risks revolve around stability of banking systems and “too big to fail”
 - Many of the challenges peculiar to emerging and frontier markets remain outstanding
- Existing models of equity risk across international markets are reasonably effective and can be reasonably extended to handle derivatives
- New risk based strategies such as parity and MV are consistent with MPT under particular sets of assumptions

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