A Statistical Perspective on Hedge Fund Manager Selection

Dr. Jim Conklin

January 16, 2012

The materials contained in this presentation do not constitute an offer to sell or the solicitation of an offer to purchase any securities of any entities or any program described herein. Any such offer will be made solely to qualified investors by means of a private placement memorandum and related subscription materials.

QFS Asset Management, LP
10 Glenville Street
Greenwich, CT 06831
203 983.5600
www.qfsfunds.com

The Statistics of Manager Selection

- When choosing or eliminating managers:
  - What historical performance thresholds should you set?
  - Over how long a sample?
  - How long should you accept low returns?
  - What magnitude draw-downs should you tolerate?
- Conclusion: a narrow statistical focus on performance yields disappointing accuracy on manager selection within relevant time frames.
- Managers of HFs need to make judgment calls on the true ability of hedge funds to generate alpha (qualitative "*priors*")

Outline

I. Hedge fund performance measurement

II. An illustration on Bayesian inference from gambling

III. Bayesian inference applied to hedge fund investing

IV. Some criterion for judging return attributes of hedge funds *a priori*

V. A little macro: trading opportunities in a zero-rate world

I. Hedge Fund Performance Measures

Jensen's Alpha:

$$\alpha: \quad \left(R_{i,t} - R_{0,t}\right) = \alpha + \beta\left(R_{port,t} - R_{0,t}\right) + \varepsilon_t$$

Normalized Alpha:

$$\hat{\alpha}_i = SR_i - \rho_{i,port} \cdot SR_{port}$$

"Absolute return space" suggests LIBOR as benchmark:

$$SR_{port} = 0$$

though this perspective's relevance has limits

I. Hedge Fund Performance: nAlpha

DJCS Indices:

		50% S&P500, 50% SB-BIG	Hedge Fund Index	Convertible Arbitrage	Emerging Markets	Event Driven Multi-Strat
SR:	**1993-2012**	0.576	0.746	0.647	0.349	0.820
	2003-2012	0.662	0.874	0.430	0.800	0.894
	2008-2012	0.453	0.409	0.365	0.028	0.189
beta:	**1993-2012**	1.000	0.573	0.386	0.524	0.542
	2003-2012	1.000	0.707	0.561	0.729	0.642
	2008-2012	1.000	0.743	0.613	0.796	0.703
nAlpha:	**1993-2012**	N/A	0.416	0.424	0.047	0.507
	2003-2012	N/A	0.406	0.059	0.317	0.469
	2008-2012	N/A	0.072	0.087	-0.332	-0.129

		Event Driven Risk Arbitrage	Fixed Income Arbitrage	Global Macro	L/S Equity	Managed Futures
SR:	**1993-2012**	0.825	0.430	0.897	0.630	0.275
	2003-2012	0.856	0.415	1.437	0.662	0.356
	2008-2012	0.606	0.346	0.876	0.075	0.357
beta:	**1993-2012**	0.498	0.354	0.285	0.652	-0.059
	2003-2012	0.663	0.566	0.341	0.778	0.086
	2008-2012	0.702	0.620	0.343	0.816	-0.094
nAlpha:	**1993-2012**	**0.538**	0.225	**0.733**	0.254	**0.309**
	2003-2012	**0.417**	0.040	**1.211**	0.146	**0.299**
	2008-2012	**0.288**	0.065	**0.720**	-0.295	**0.400**

sources: http://www.hedgeindex.com/hedgeindex/secure/en/datadownload.aspx?cy=USD
Bloomberg

I. Hedge Fund Performance: Index Bias

Brown, Goetzmann and Ibbotson (1999), Fung and Hsieh (2000, 2004), Liang (2000),Getmansky, Lo, and Makarov (2004), Bollen and Pool (2008), Agarwal, Fos and Jiang (2010) note and Kosowski, Naik and Teo (2012) document the following problems that might make data from HF indices suspect:

- Selection bias: HFs self-report
- Survivorship bias: HFs eliminated after they deliver bad returns
- Instant History bias: new HFs bring their histories upon entry
- Short History bias: we may have measured an idiosyncratic episode
- Smoothing bias: positive correlation in illiquid assets

II. The Parable of 100 Horses

- A Brooklyn wise-guy knows 100 people who bet on horses
- Suppose that 10 horses are always run in any race
- Wise-guy calls 10 people on his list and tells them, “the first horse in the first race tomorrow will win…” He calls the next 10 people on his list and says “the second horse in the first race tomorrow will win…” and so on.
- After the first race, 10 bettors think the wise-guy called that race correctly; the wise-guy proceeds to make 10 more calls telling each bettor a different horse will win the second race
- After the second race, one bettor thinks the wise-guy has correctly called 2 races in a row and is offered the opportunity to ***purchase*** the name of the winner of the next race…
- Can this bettor spot the scam?

II. 100 Horses: Conditional Probability

Prob[horse wins 3^{rd} race | wise-guy honest] =1

Prob[horse wins 3^{rd} race | wise-guy dishonest] = 0.1

The key is knowing if this wise-guy is "honest" or not. By honest we mean you can trust him to competently carry out fraud on your behalf; he is dishonest if he is perpetrating fraud against you.

In Brooklyn, 1 wise-guy out of 20 is "honest". Given this wise-guy has just given you the names of two winning horses prior to their races, do you think the likelihood of his honesty is greater than 5%, the unconditional odds?

II. 100 Horses: Conditional Probability

Bayes Theorem applied:

$$P\left[wise-guy\quad honest \mid H1\& H2\quad won\right]=$$

$$\frac{P\left[H1\& H2\quad won \mid honest\right]\times P\left[honest\right]}{P\left[H1\& H2\quad won \mid honest\right]\times P\left[honest\right]+P\left[H1\& H2\quad won \mid dishonest\right]\times P\left[dishonest\right]}$$

Without survivorship bias $P[H1\ \&\ H2\ won \mid dishonest]$ = 0.01 (the wise-guy had to have gotten lucky on his two phone calls to the bettor)

$$P\left[wise-guy\quad honest \mid H1\& H2\quad won\right]=\frac{1.0\times 0.05}{1.0\times 0.05+0.01\times 0.95}=0.84$$

II. 100 Horses: Survivorship Bias

But, given the wise-guy made 110 prior phone calls, *P*[*H1 & H2 won* | *dishonest*] =1.0, not 0.01! One of his 100 bettors was inevitably going to get two correct phone calls. Consequently,

$$P\left[wise-guy \quad honest \,|\, H1 \& H2 \quad won\right] = \frac{1.0\times 0.05}{1.0\times 0.05 + 1.0\times 0.95} = 0.05$$

So you have to weight your odds by the probability with wise-guy is honest or dishonest:

$$P\left[H3 \quad wins\right] = 1.0\times P\left[honest\right] + 0.1\times P\left[dishonest\right] = 1.0\times 0.05 + 0.1\times 0.95 = 0.145$$

This illustrates two types of adverse selection:

- A large population of dishonest wise-guys
- The wise-guy that called you made 108 other phone calls

III. Bayesian Analysis of HF Returns

HF investors face a similar predicament to that of the horse bettors of the example: biases in reported historical performance can be large and prevalent.

How to model:

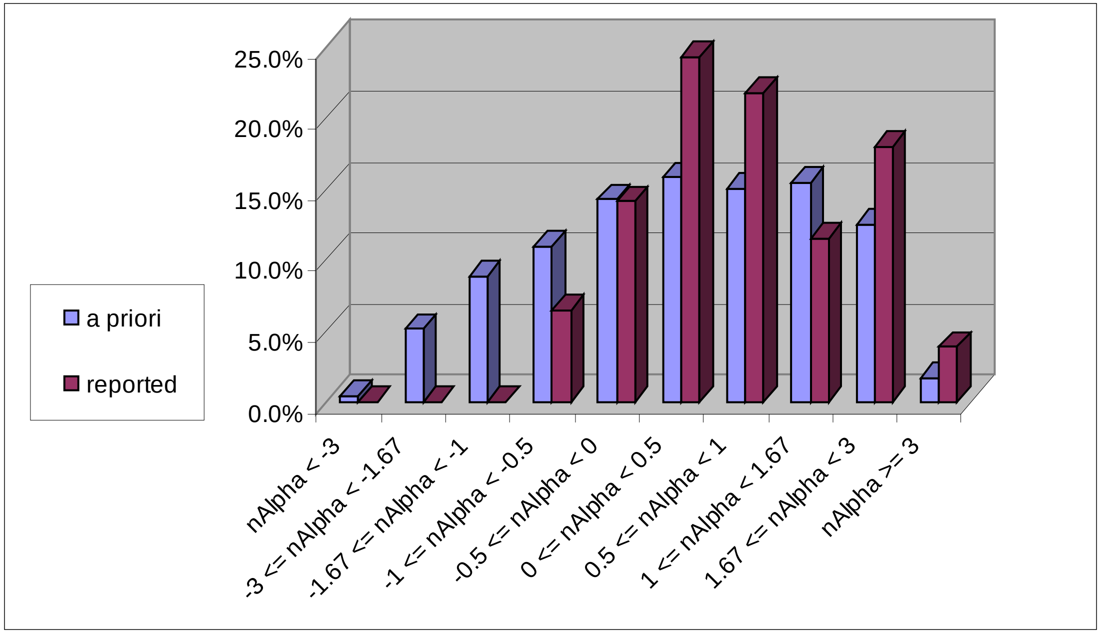
1. Create a (unobserved) frequency distribution of nAlphas that accounts for the many forms of selection bias (our “prior distribution”)

2. Use that to show what conditional probabilities really are

3. Use both prior and conditional probabilities to compute expected alphas given revealed alphas for different sample periods and confidence levels

III. Bayesian Analysis of HF Returns

Observed nAlphas (with bias) vs assumed "a priori" nAlphas:



	a Priori	Reported
nAlpha < -3	0.4%	0.0%
-3 <= nAlpha < -1.67	5.1%	0.0%
-1.67 <= nAlpha < -1	8.9%	0.0%
-1 <= nAlpha < -0.5	11.0%	6.4%
-0.5 <= nAlpha < 0	14.3%	14.1%
0 <= nAlpha < 0.5	15.8%	24.4%
0.5 <= nAlpha < 1	15.0%	21.8%
1 <= nAlpha < 1.67	15.4%	11.5%
1.67 <= nAlpha < 3	12.6%	17.9%
nAlpha >= 3	1.6%	3.8%

- Sample shown (purple bars): nAlpha over 3-year intervals across CSDJ HF index categories; overall mean is 0.55 across categories, full sample.
- A priori distribution (of managers' nAlpha) is normal, mean = 0.33.

III. Bayesian Analysis of HF Returns

Using the prior frequency distribution shown above, here are some conditional probabilities (see Appendix for computation details):

	1y sample	3y sample	5y sample	10y sample
$P\left[\alpha_i \leq 0 \mid \hat{\alpha} = -0.25\right]$	0.631	0.740	0.802	0.888
$P\left[\alpha_i \leq 0 \mid \hat{\alpha} = 0.0\right]$	0.537	0.581	0.610	0.661
$P\left[\alpha_i \leq 0 \mid \hat{\alpha} = 0.5\right]$	0.347	0.252	0.197	0.118
$P\left[\alpha_i \leq 0 \mid \hat{\alpha} = 1.0\right]$	0.191	0.063	0.025	0.003
$P\left[\alpha_i \geq 0.5 \mid \hat{\alpha} = -0.25\right]$	0.269	0.132	0.072	0.018
$P\left[\alpha_i \geq 0.5 \mid \hat{\alpha} = 0.0\right]$	0.355	0.247	0.185	0.098
$P\left[\alpha_i \geq 0.5 \mid \hat{\alpha} = 0.5\right]$	0.543	0.572	0.588	0.614
$P\left[\alpha_i \geq 0.5 \mid \hat{\alpha} = 1.0\right]$	0.720	0.849	0.907	0.968

III. Bayesian Analysis of HF Returns

The impact of priors: diffuse skeptical (skp), standard (std), confident (cnf):

	1y sample	3y sample	5y sample	10y sample
$P_{skp}\left[\alpha_i \leq 0 \mid \hat{\alpha} = 0.75\right]$	0.385	0.208	0.122	0.037
$P_{std}\left[\alpha_i \leq 0 \mid \hat{\alpha} = 0.75\right]$	0.263	0.136	0.079	0.024
$P_{cnf}\left[\alpha_i \leq 0 \mid \hat{\alpha} = 0.75\right]$	0.228	0.122	0.073	0.022

IV. Identifying Alpha *a Priori*

- What is the manager's edge, what makes them unique? Why does the market give up excess returns to their investment process?
- Is the investment process consistently replicable and will it work throughout the cycle?
- What doesn't the manager know?
- Is it alpha or "alternative beta"?
- Could the process be short "jump diffusion" events?

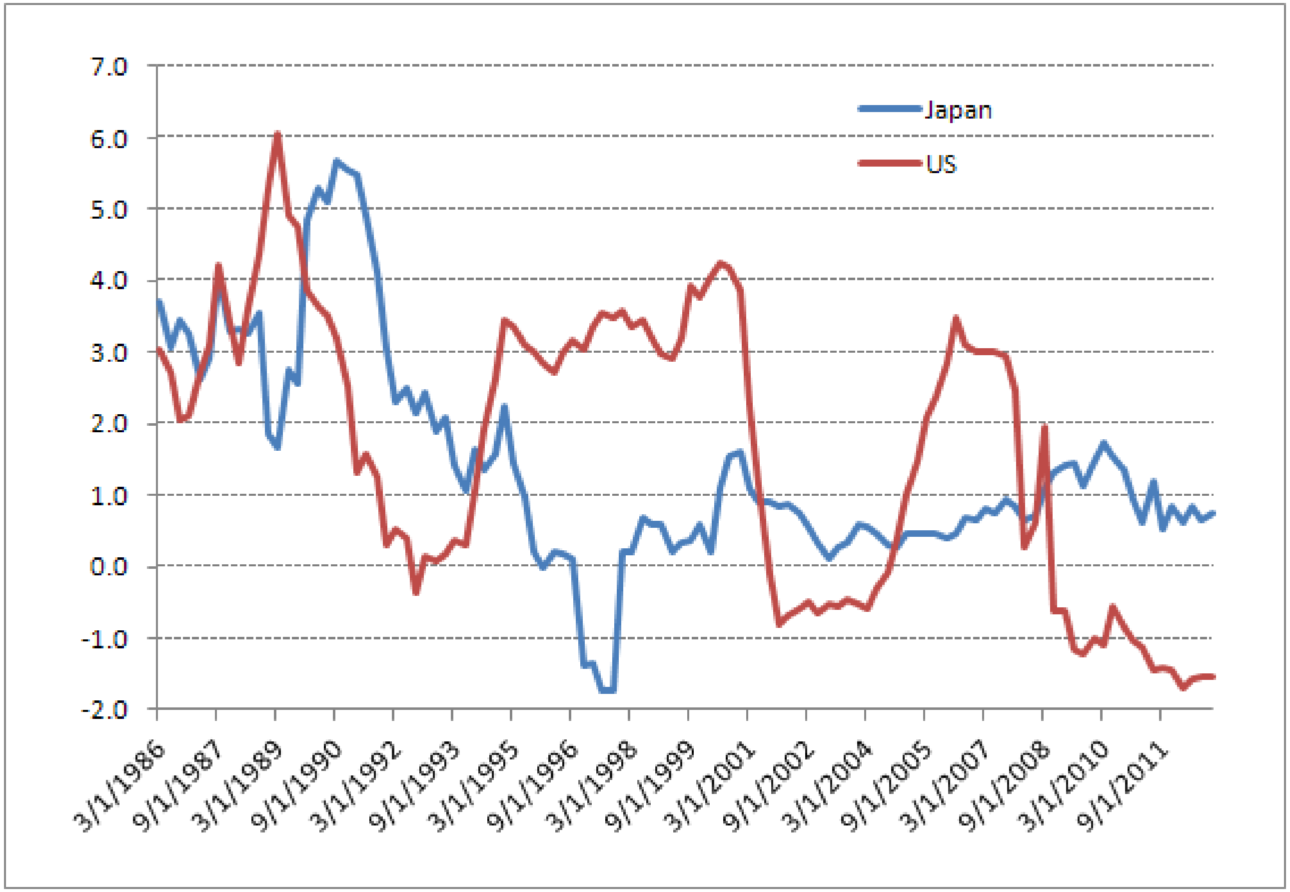
Conclusions

- Good hedge funds have weak spells, but many biases conspire to make mediocre hedge funds look good
- Sampling bias and short histories make narrow performance-based selection criteria misleading
- Long track records really help when they are available
- Policy recommendation: detailed research on the investment process itself, performance statistics, and judgment
- *Don't chase returns*

V. A Bit of Macro: Liquidity Traps 101

- Weak economy leads central bank to bring nominal interest rate target to 0, its technical lower bound
- If inflation is too low, real interest rates will not be sufficiently negative to provide sufficient monetary ease (negative real interest rates are most appropriate for structural adjustment environments)
- Banks, Financial institutions hold cash, reserves since the opportunity cost of doing so is so low, making their demand self-fulfilling
- Links to financial crises (capital scarcity, balance sheet reduction, heightened liquidity needs)
- Solution 1 (Keynes): fiscal stimulus
- Solution 2 (Krugman): positive inflation and inflationary expectations

Japan: where are the negative real yields?



Source: Bloomberg

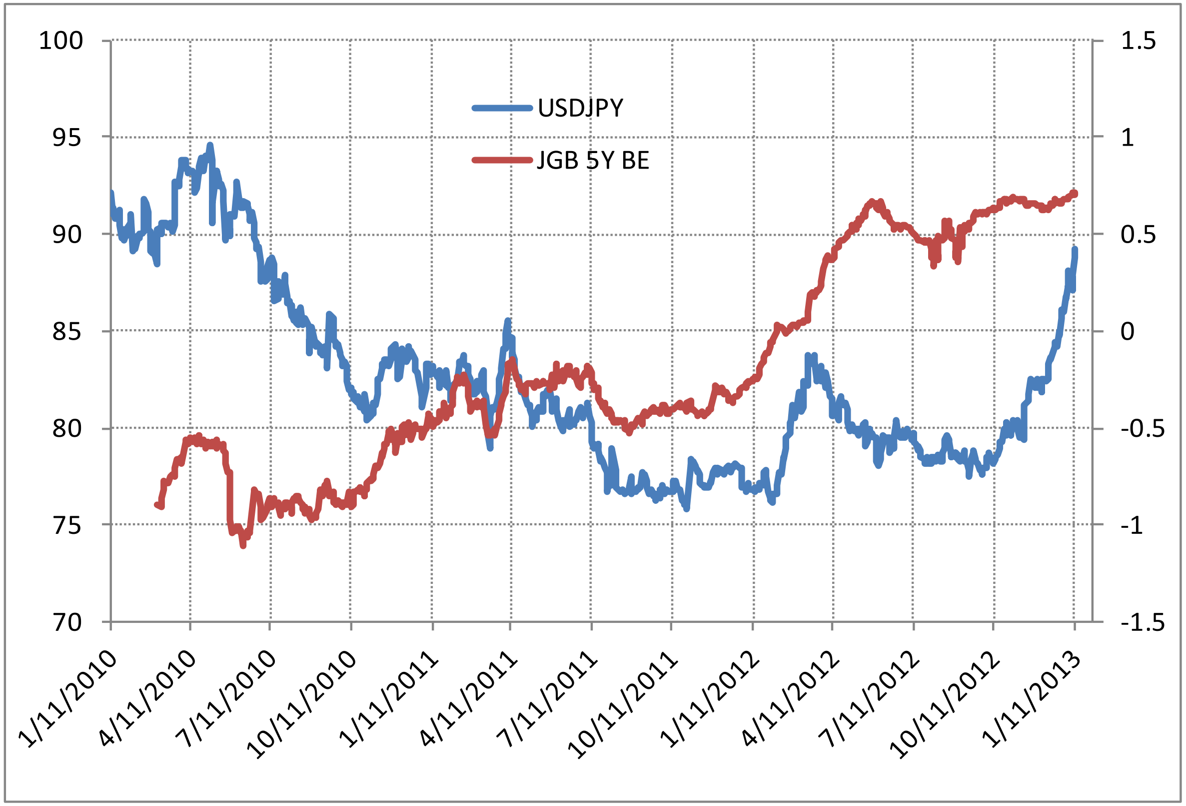
Japan: the Liquidity Trap and Monetary Neutrality

- Monetary impulses impact output at a 2yr-5yr horizon
- Over spans of decades, microeconomic adjustment can take place – money is neutral at long horizons -- difficult to argue that monetary phenomena impact growth at structural frequencies
- There are more obvious for low growth in the last decade than the liquidity trap in Japan's case: demographics

	GDP growth per capita ages 15-64					
	Japan	US	Canada	Germany	Italy	UK
2002-2011	1.22%	0.63%	0.61%	1.45%	-0.19%	0.71%
1992-2001	0.81%	2.01%	2.23%	1.32%	1.74%	2.62%

Source: Bloomberg, World Bank

Japan: Are the proposals credible with markets?



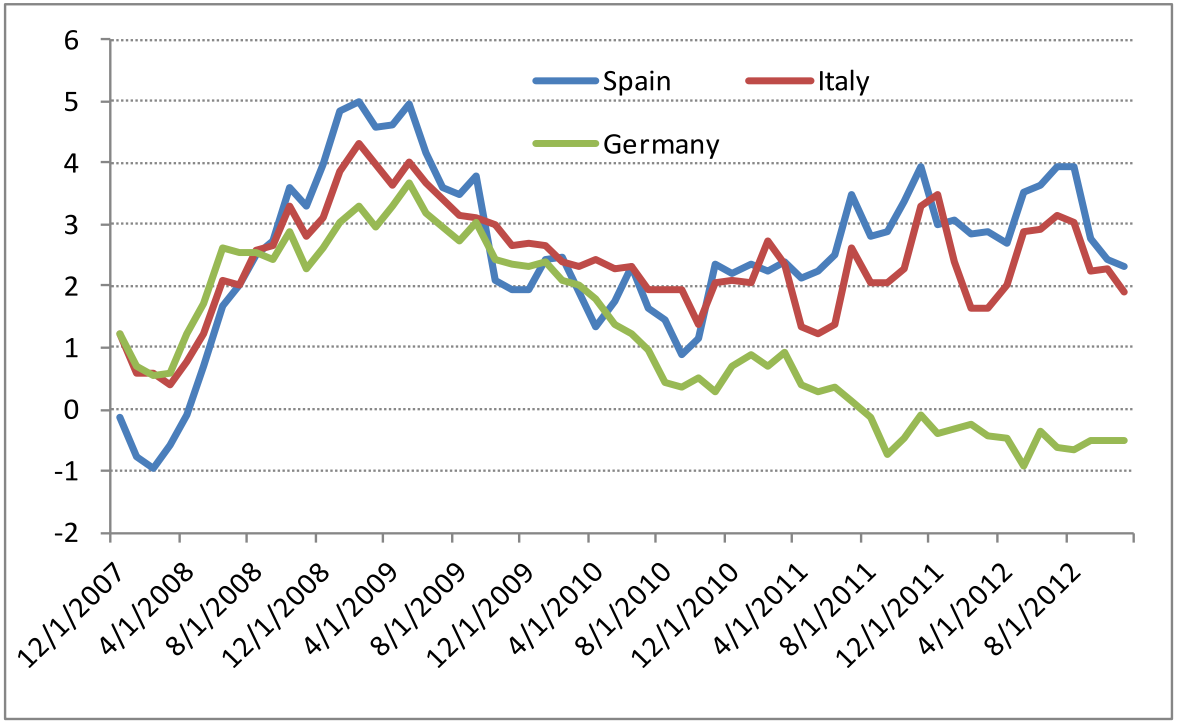
Source: Bloomberg

- JGBs, break-even inflation follow only moderately

The ECB

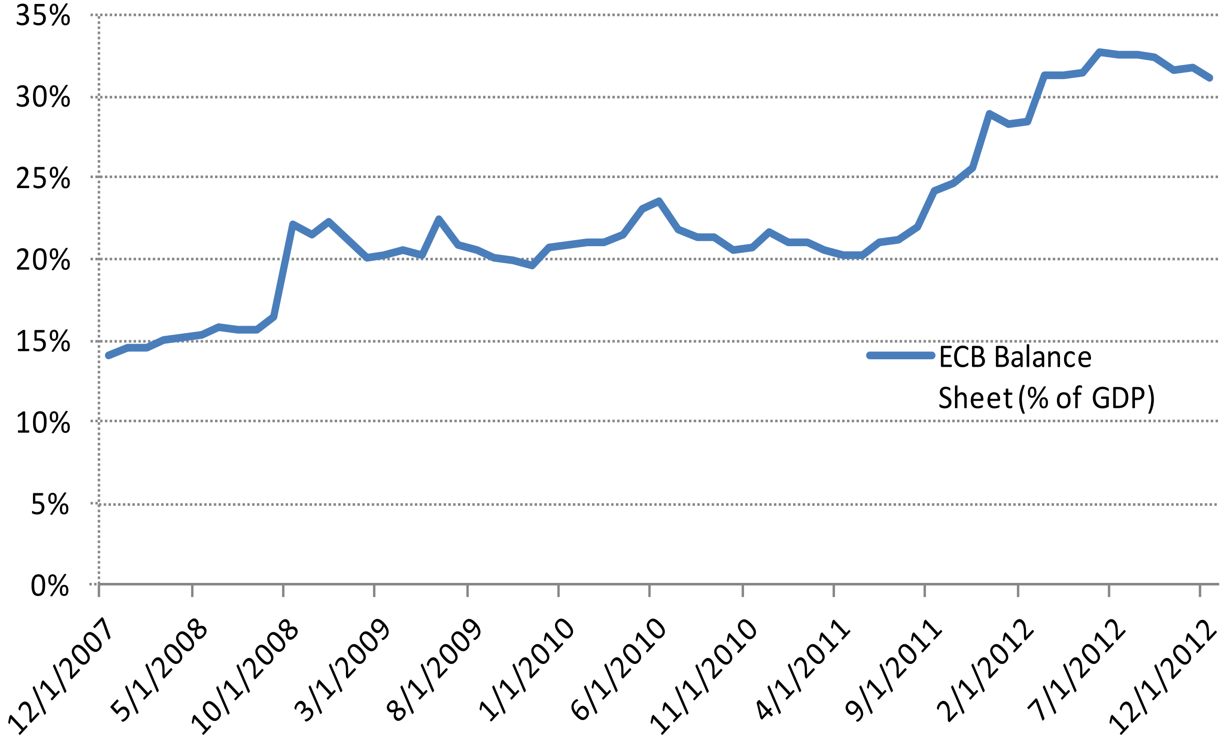
- The European periphery is a cautionary tale: losing market access prior to completing fiscal adjustment
- Impact on Europe: very much like a classic liquidity trap; high real rates, shrinking credit, hoarding of liquid reserves in peripheral countries
- Financial re-regulation without recapitalization: more credit withdrawal
- In Europe, aggregate financial sector balance sheets = 3 x GDP
- ECB balance sheet expansion has stalled

The ECB



Source: Bloomberg

The ECB



Source: Bloomberg

Appendix

Bayes' rule for hedge fund normalized alphas, Type I error:

$$P_{post}\left[\alpha_i > 0.5 \mid \alpha_{observed} = 0\right] = \frac{P_{cond}\left[\alpha_{observed} = 0 \mid \alpha_i > 0.5\right] \cdot P_{prior}\left[\alpha_i > 0.5\right]}{P_{cond}\left[\alpha_{observed} = 0 \mid \alpha_i > 0.5\right] \cdot P_{prior}\left[\alpha_i > 0.5\right] + P_{cond}\left[\alpha_{observed} = 0 \mid \alpha_i \le 0.5\right] \cdot P_{prior}\left[\alpha_i \le 0.5\right]}$$

Continuous case:

$$P_{cond}\left[\alpha_{observed} = 0 \mid \alpha_i = a\right] \sim f\left(\alpha_{observed} \mid a\right)$$

$$P_{prior}\left[\alpha_i = a\right] \sim g\left(a\right)$$

$$P_{prior}\left[\alpha_i \le a\right] = \int_{-\infty}^{a} g\left(a\right) da$$

$$P_{post}\left[\alpha_i > a \mid \alpha_{observed} = 0\right] = \frac{1 - \int_{-\infty}^{a} f\left(\alpha_{observed} = 0 \mid \alpha_i = a\right) g\left(a\right) da}{1 - \int_{-\infty}^{\infty} f\left(\alpha_{observed} = 0 \mid \alpha_i = a\right) g\left(a\right) da}$$

Appendix

Bayes' rule for hedge fund Sharpe Ratios, Type II error

$$P_{post}\left[\alpha_i < 0 \mid \alpha_{observed} = 0.5\right] = \frac{P_{cond}\left[\alpha_{observed} = 0.5 \mid \alpha_i < 0\right] \cdot P_{prior}\left[\alpha_i < 0\right]}{P_{cond}\left[\alpha_{observed} = 0.5 \mid \alpha_i < 0\right] \cdot P_{prior}\left[\alpha_i < 0\right] + P_{cond}\left[\alpha_{observed} = 0.5 \mid \alpha_i \geq 0\right] \cdot P_{prior}\left[\alpha_i \geq 0\right]}$$

Continuous case:

$$P_{post}\left[\alpha_i < a \mid \alpha_{observed} = 0.5\right] = \frac{\int_{-\infty}^{a} f\left(\alpha_{observed} = 0.5 \mid \alpha_i = a\right) g\left(a\right) da}{\int_{-\infty}^{\infty} f\left(\alpha_{observed} = 0.5 \mid \alpha_i = a\right) g\left(a\right) da}$$

Bibliography

Agarwal, Fos, and Jiang 2010

Bollen and Pool 2008

Brown, Goetzmann and Ibbotson 1999

Fung and Hsieh 2000

Fung and Hsieh 2004

Getmansky, Lo, and Makarov (2004)

Liang (2000)

Lo, Andrew W., 2002, "The Statistics of Sharpe Ratios," Financial Analysts Journal, July/August 2002: 36 – 52.

Kosowski, Naik and Teo, 2012. "Do Hedge Funds Deliver Alpha? A Bayesian and Bootstrap Analysis," forthcoming, *Journal of Financial Economics*.