

# **Theory of Finance - Università Bocconi**

**Stefano Guglielmetto**  
**Portfolio Management**  
**Deutsche Bank**

**November 20<sup>th</sup>, 2014**

---

---

# Mean Variance Models

---

# An application: the foreign exchange market

---

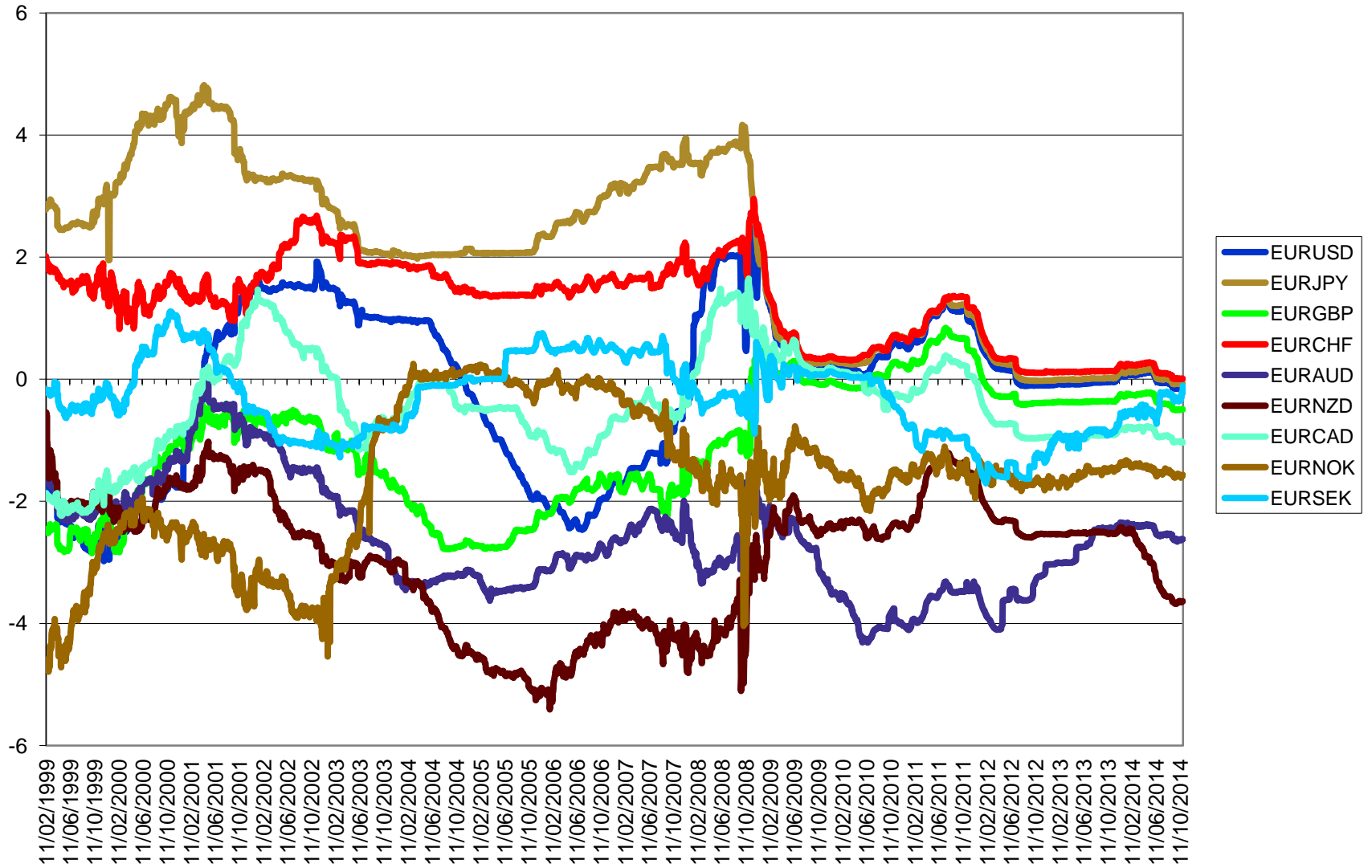
- 9 currency pairs (developed markets)
- 1 month rolling investment horizon
- Expected return = 1 month carry (deposit rate)
- 250 days rolling Var/Cov matrix
- Maximize expected return with the following constraints:
  - Expected Volatility  $\leq$  5% annualized
  - Max Absolute weight for each currency: 100%

# An academic exercise? Barclays ICI Index



Source Bloomberg: Barclays Intelligent Carry EUR Index

# 1 month interest rate differential



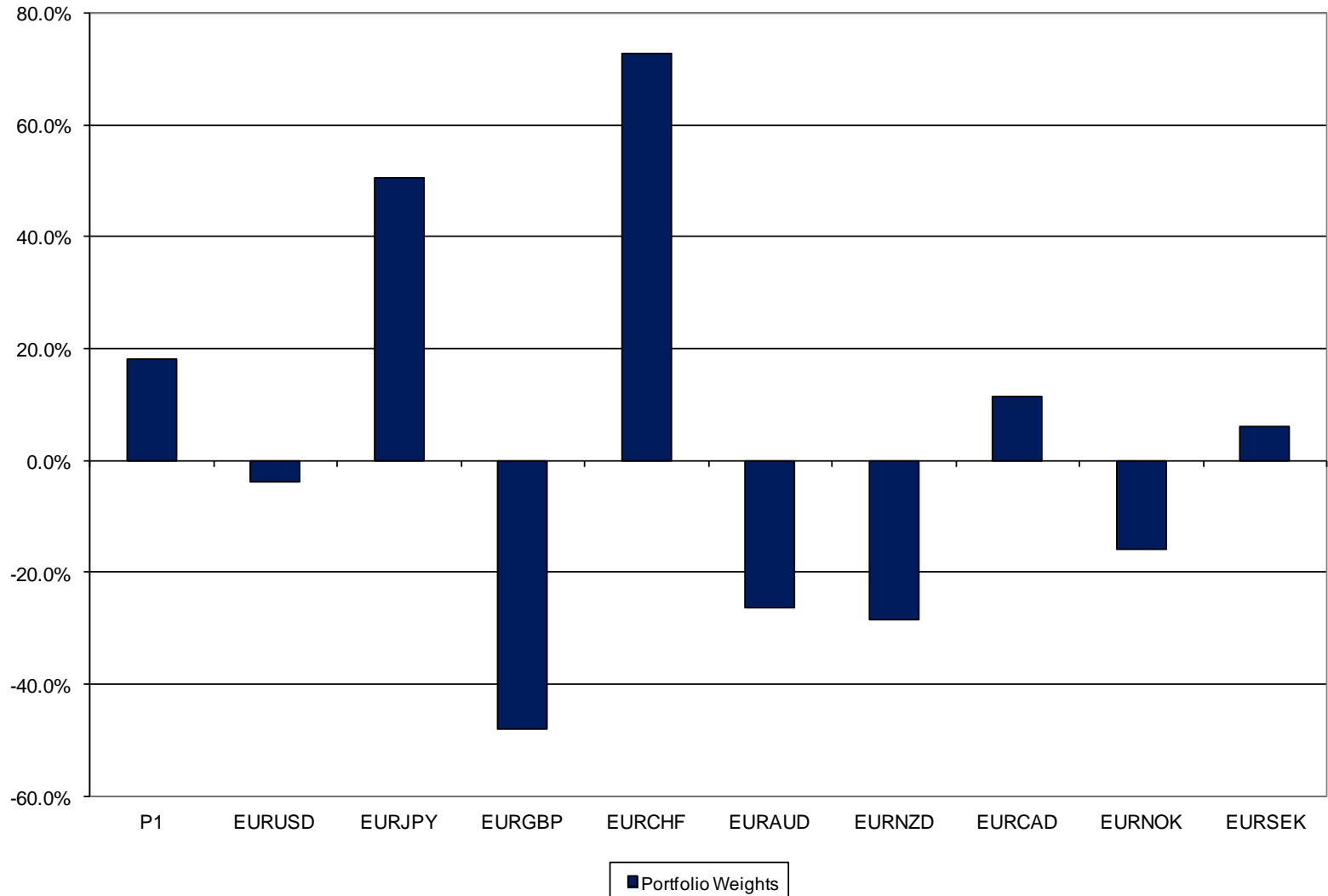
# Correlation matrix as of October 2013

---

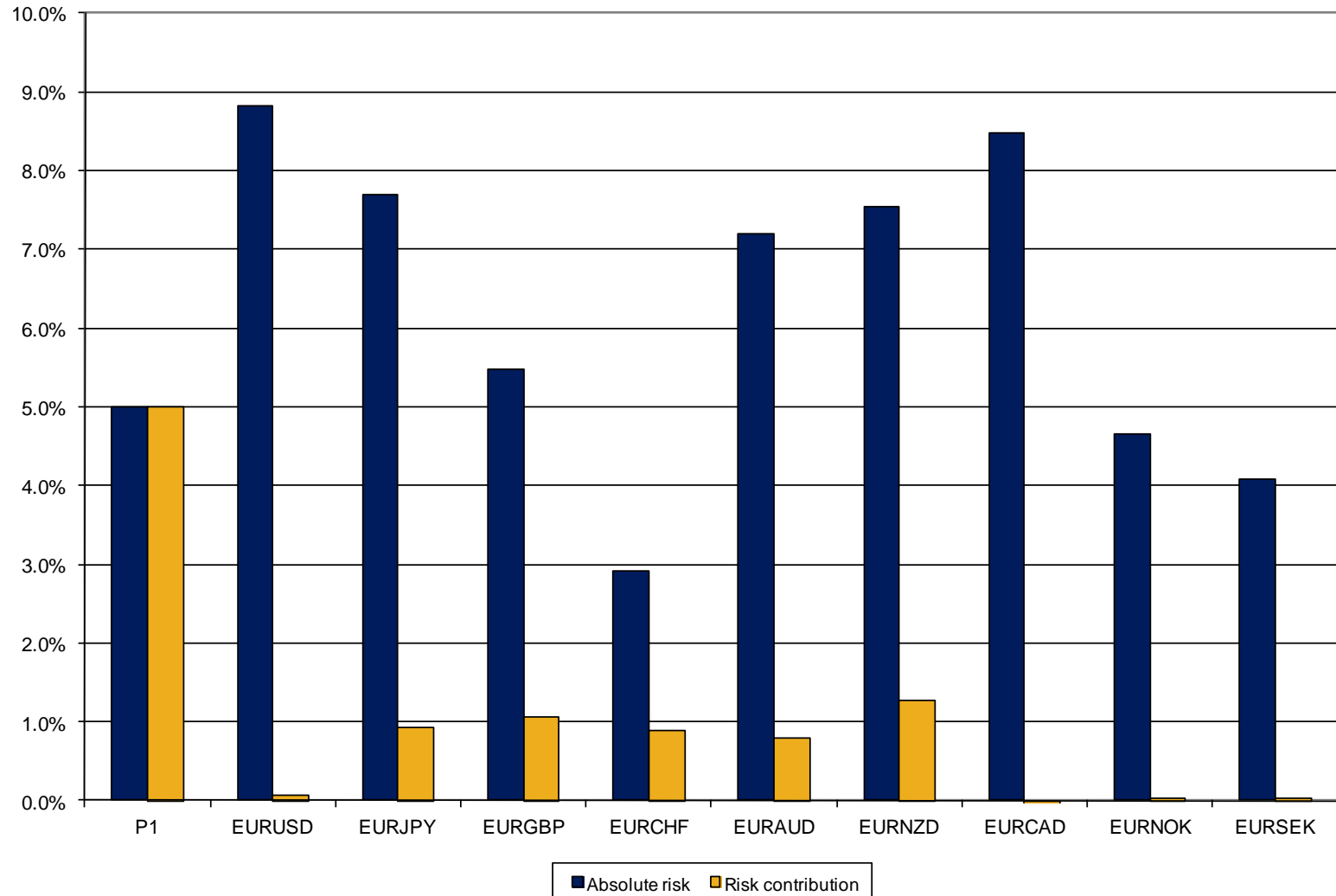
	EURUSD	EURJPY	EURGBP	EURCHF	EURAUD	EURNZD	EURCAD	EURNOK	EURSEK
EURUSD	100%	42%	49%	0%	38%	30%	67%	-3%	-7%
EURJPY	42%	100%	49%	45%	43%	36%	46%	13%	12%
EURGBP	49%	49%	100%	32%	41%	35%	50%	7%	-5%
EURCHF	0%	45%	32%	100%	0%	2%	7%	-7%	2%
EURAUD	38%	43%	41%	0%	100%	78%	58%	33%	28%
EURNZD	30%	36%	35%	2%	78%	100%	53%	36%	28%
EURCAD	67%	46%	50%	7%	58%	53%	100%	22%	12%
EURNOK	-3%	13%	7%	-7%	33%	36%	22%	100%	58%
EURSEK	-7%	12%	-5%	2%	28%	28%	12%	58%	100%

# Portfolio Weights as of November 2005

---

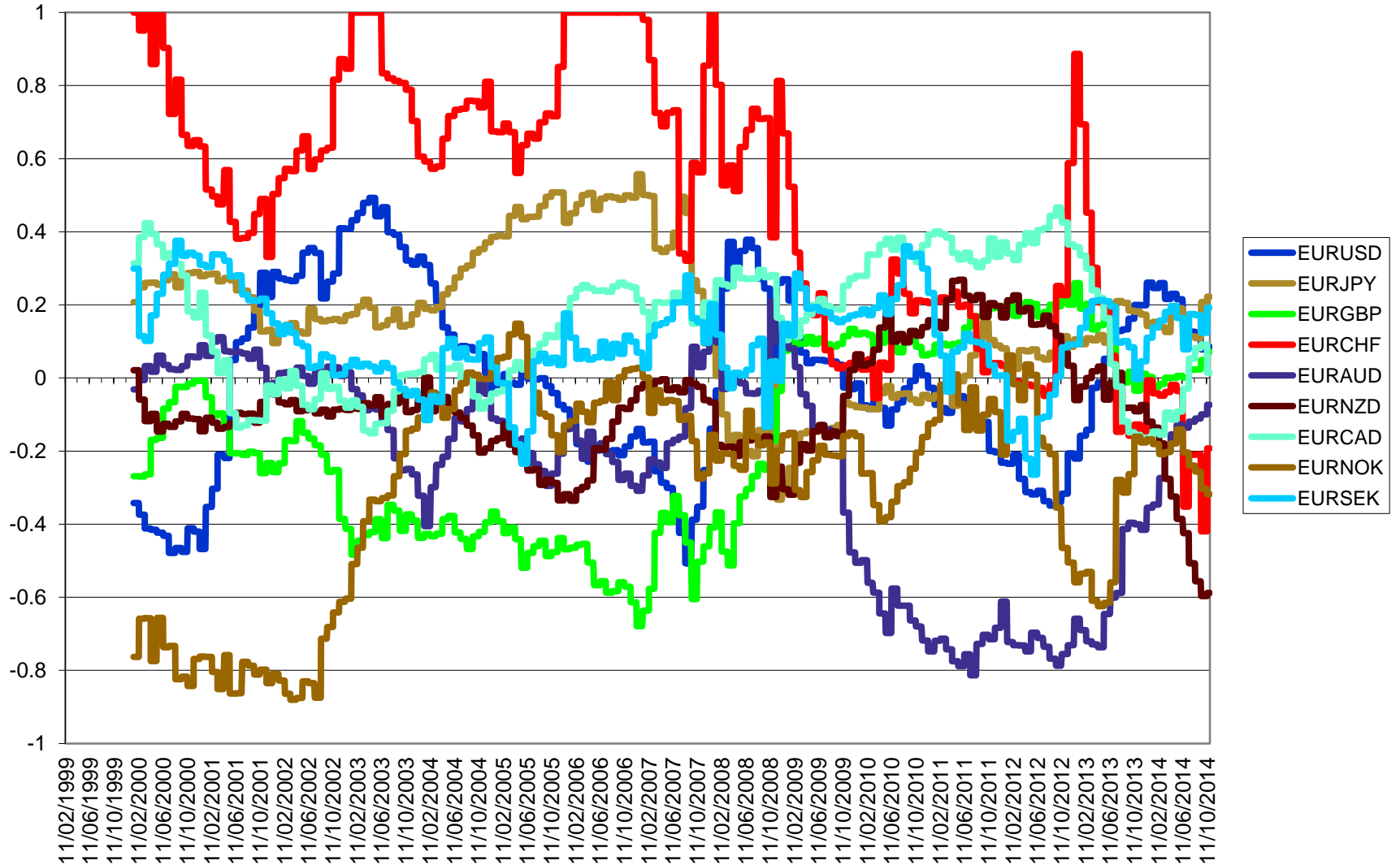


# Contribution to risk as of November 2005





# Asset Allocation

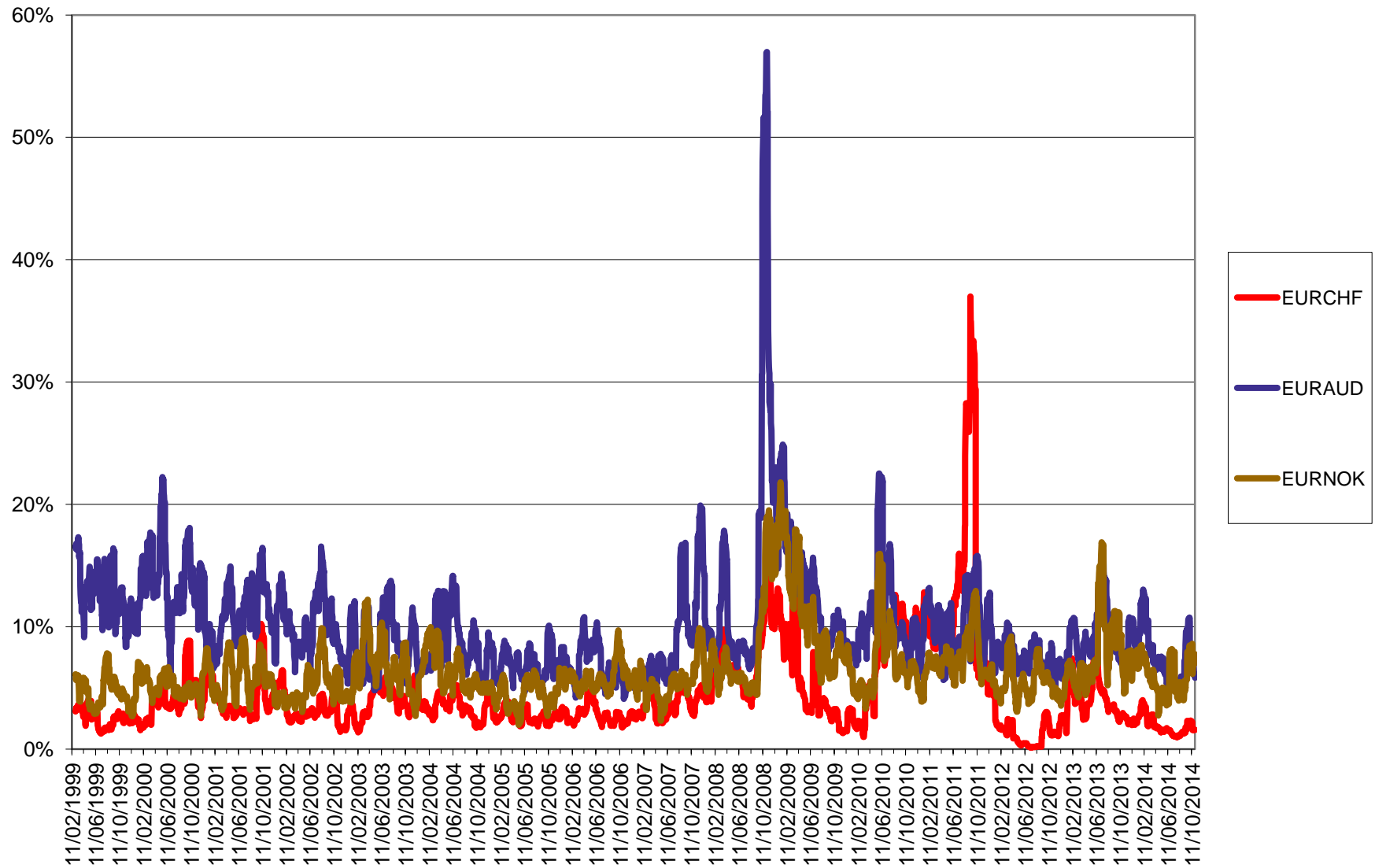


# A few pitfalls

---

- Risk is modeled according to historical behavior
- It takes time to accommodate shocks in the covariance matrix. Moreover, we are assuming that it is stable during the period, but unfortunately it is not
- Ex post volatility is slightly higher than the ex ante one and exhibits disturbing spikes
- Risk perception is not symmetric: it is highly influenced by the “first move” and by cumulated performance
- Returns distribution does not appear to be a normal one
- Leverage can be an issue as the 2008 financial crisis showed

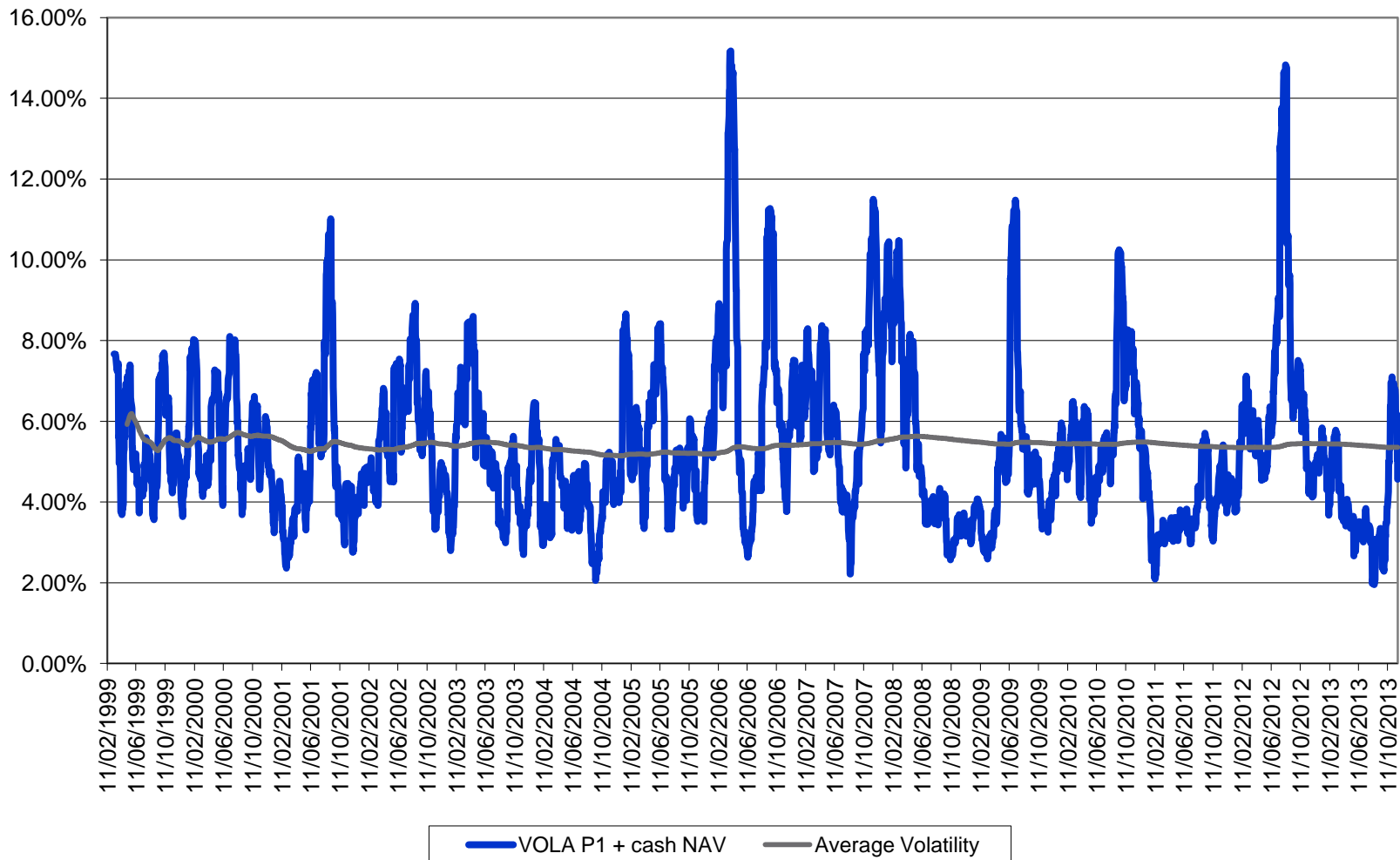
# 1 month rolling volatility – an example



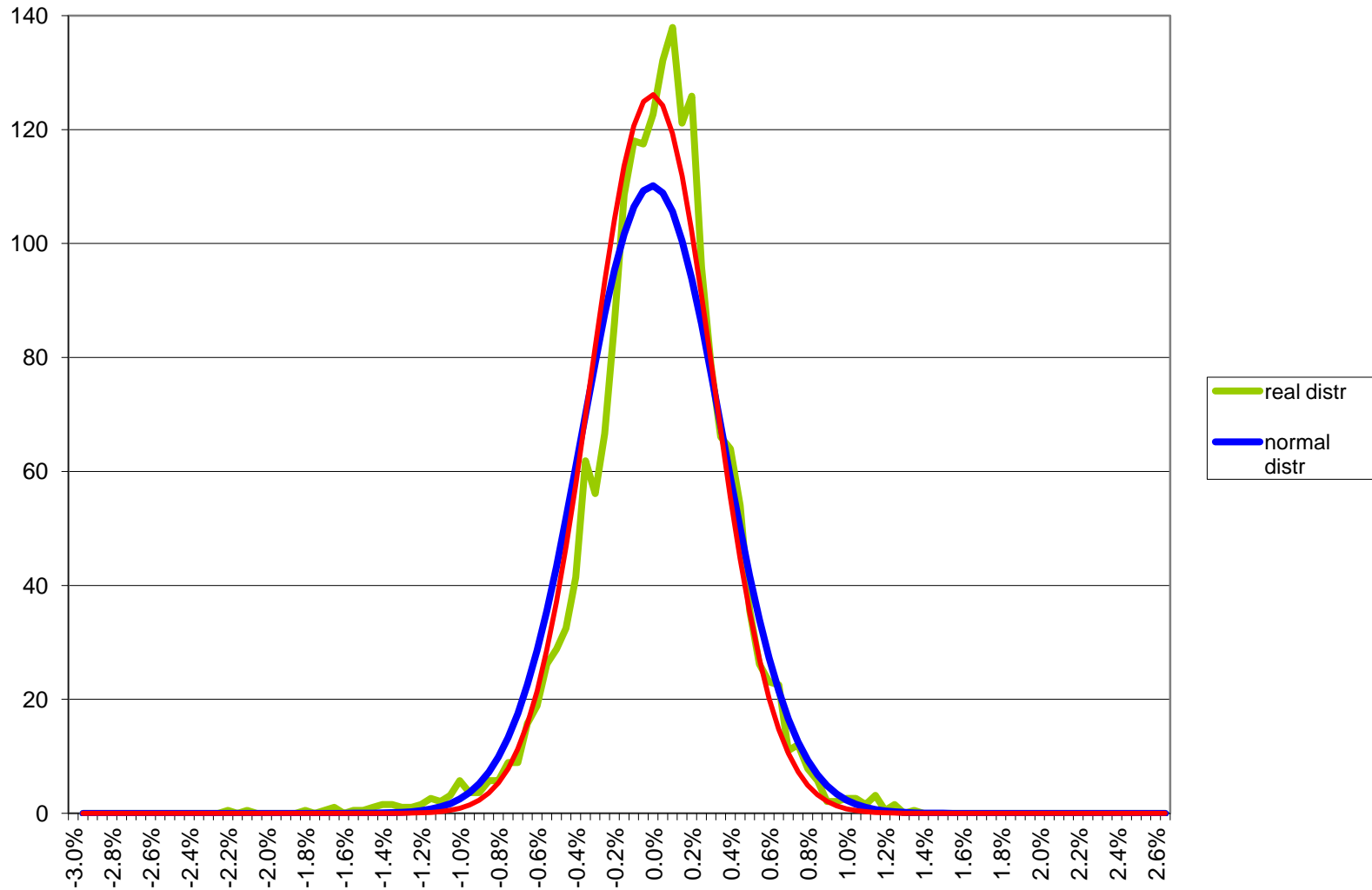
# 12 month rolling correlation – EurChf and EurNok



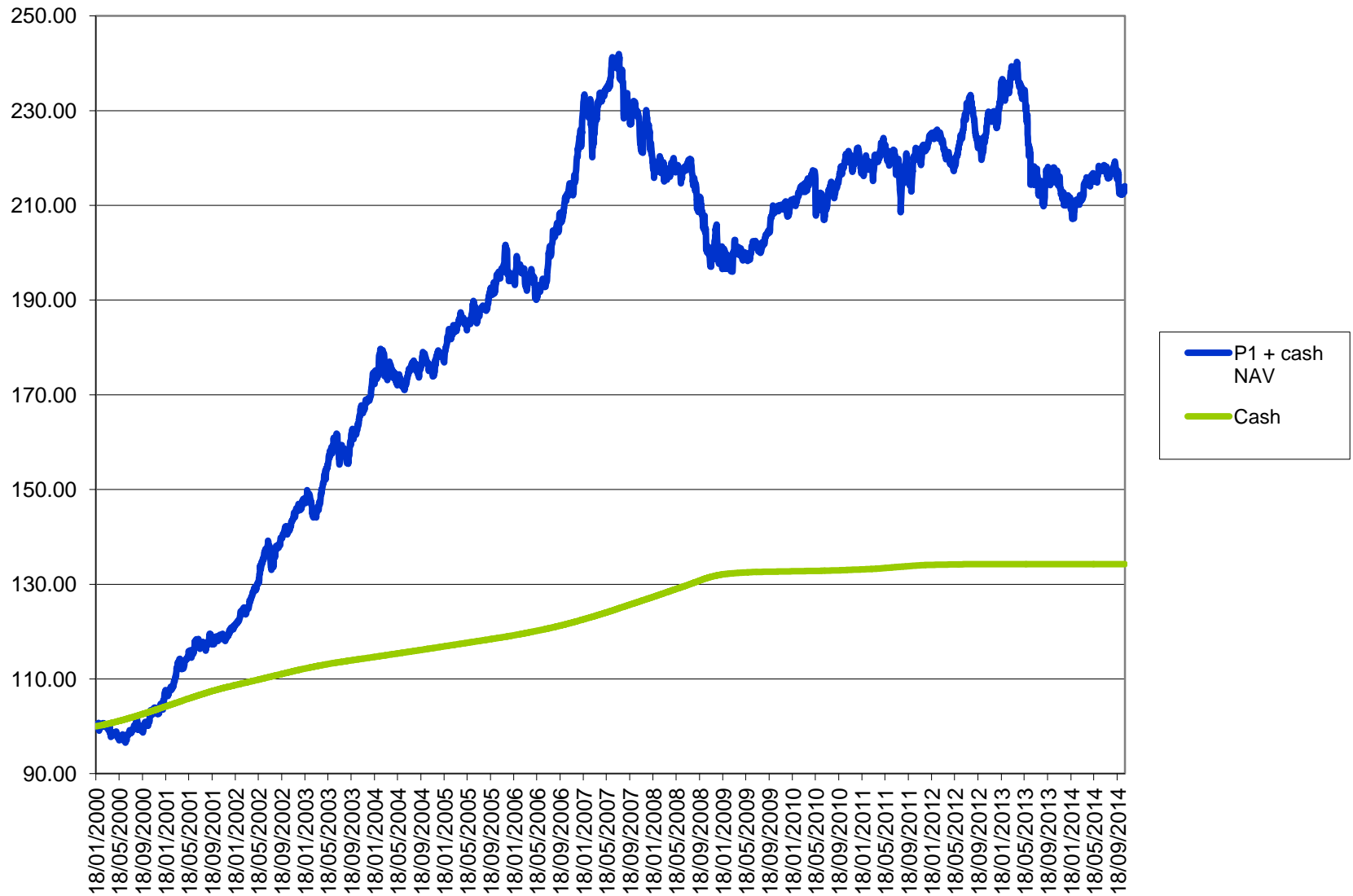
# Ex post volatility



# Realized returns distribution



# Performance looks (or looked) nice...

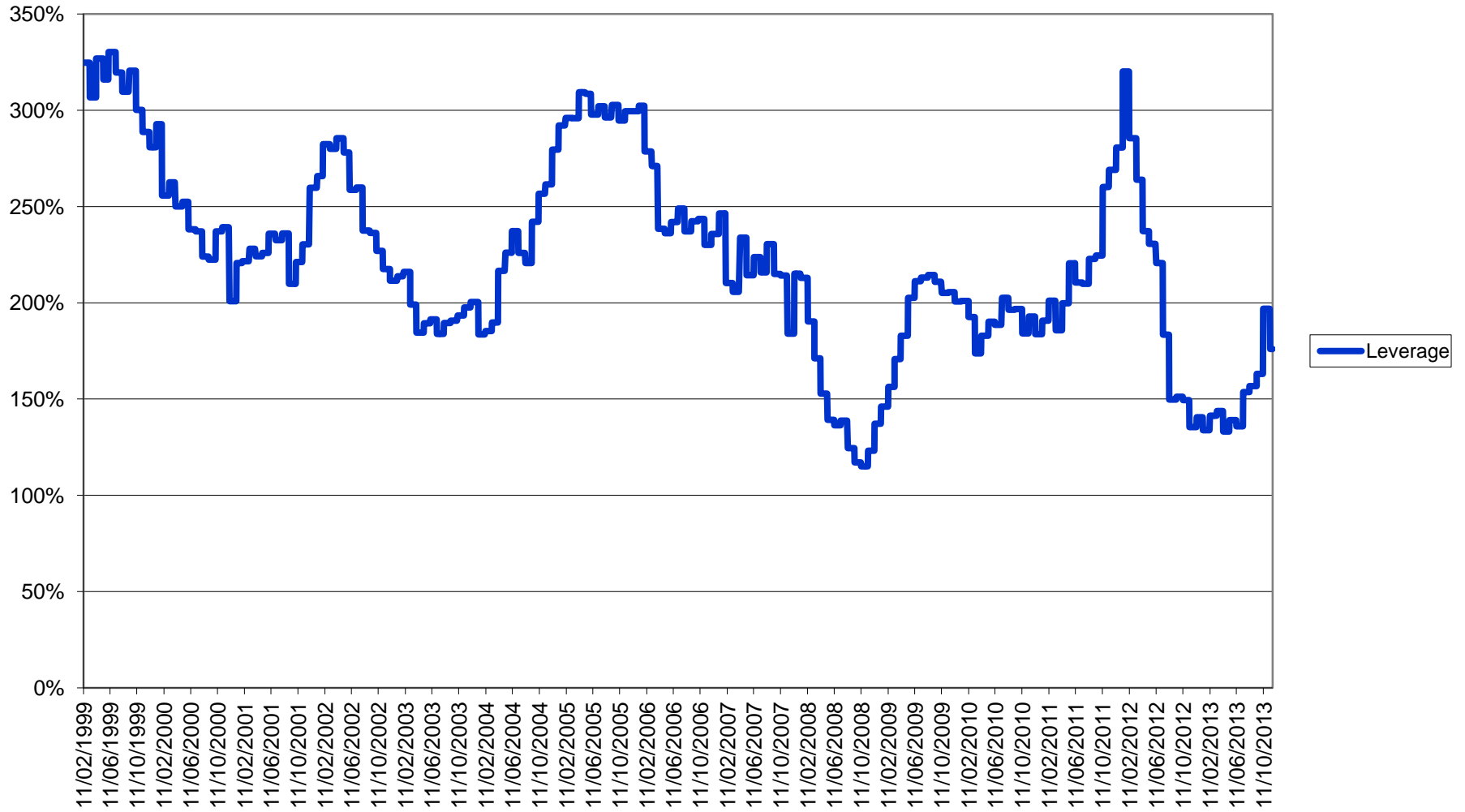


# ...but can be a nightmare if you choose the wrong timing!

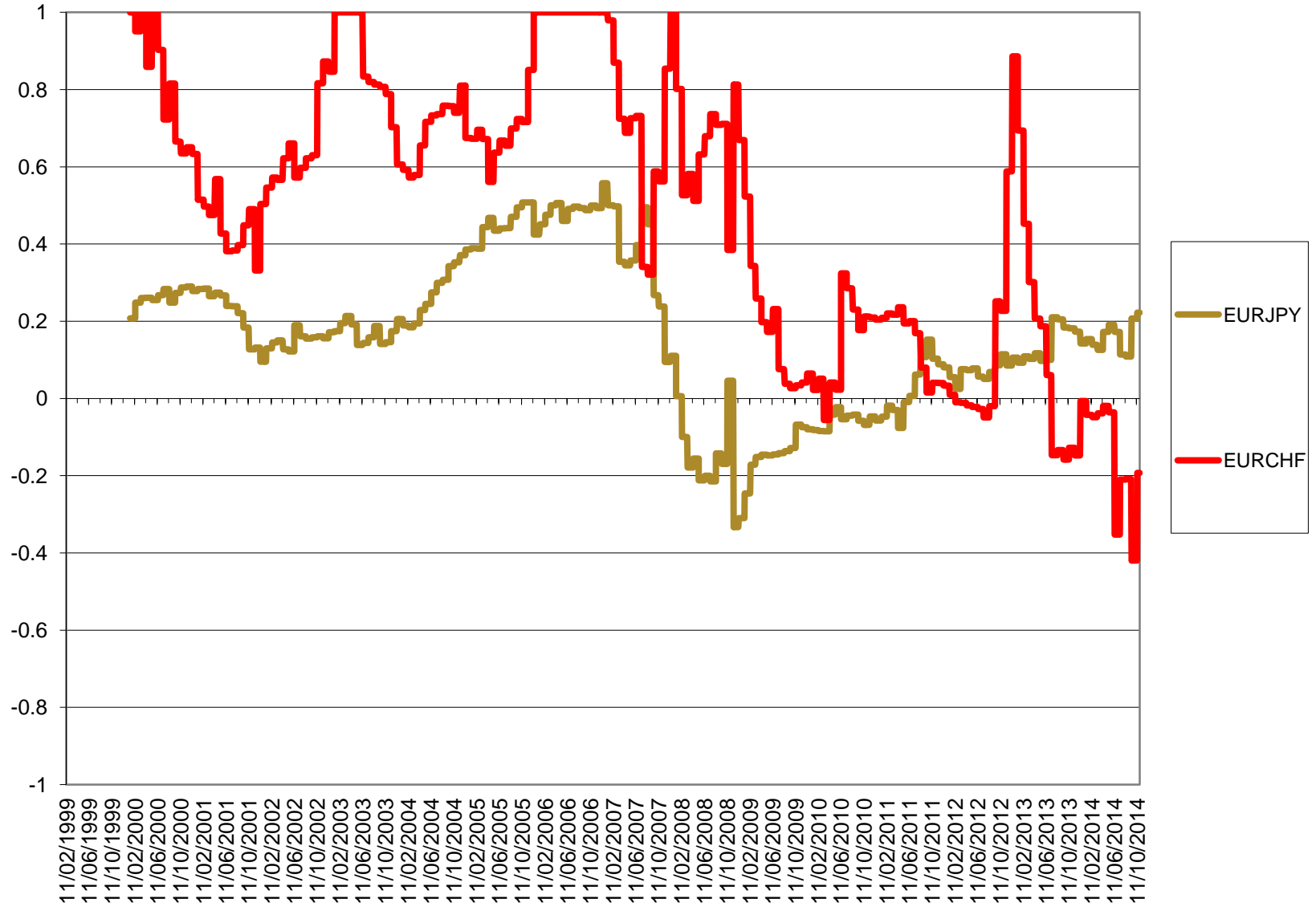




# Leverage



# How is leverage financed?



# Mean Variance – a recap

---

- Input: expected returns, expected risks and correlations
- Optimize and create an efficient frontier
- Pick up the efficient portfolio which suits any given investor risk appetite

Easy but...

- Portfolios are often highly concentrated and unintuitive
- It is tempting to impose constraints up to the point of making the exercise meaningless
- Portfolios can be unstable with a slight change in the assumptions
- Where do I get the expected returns and the risk numbers?

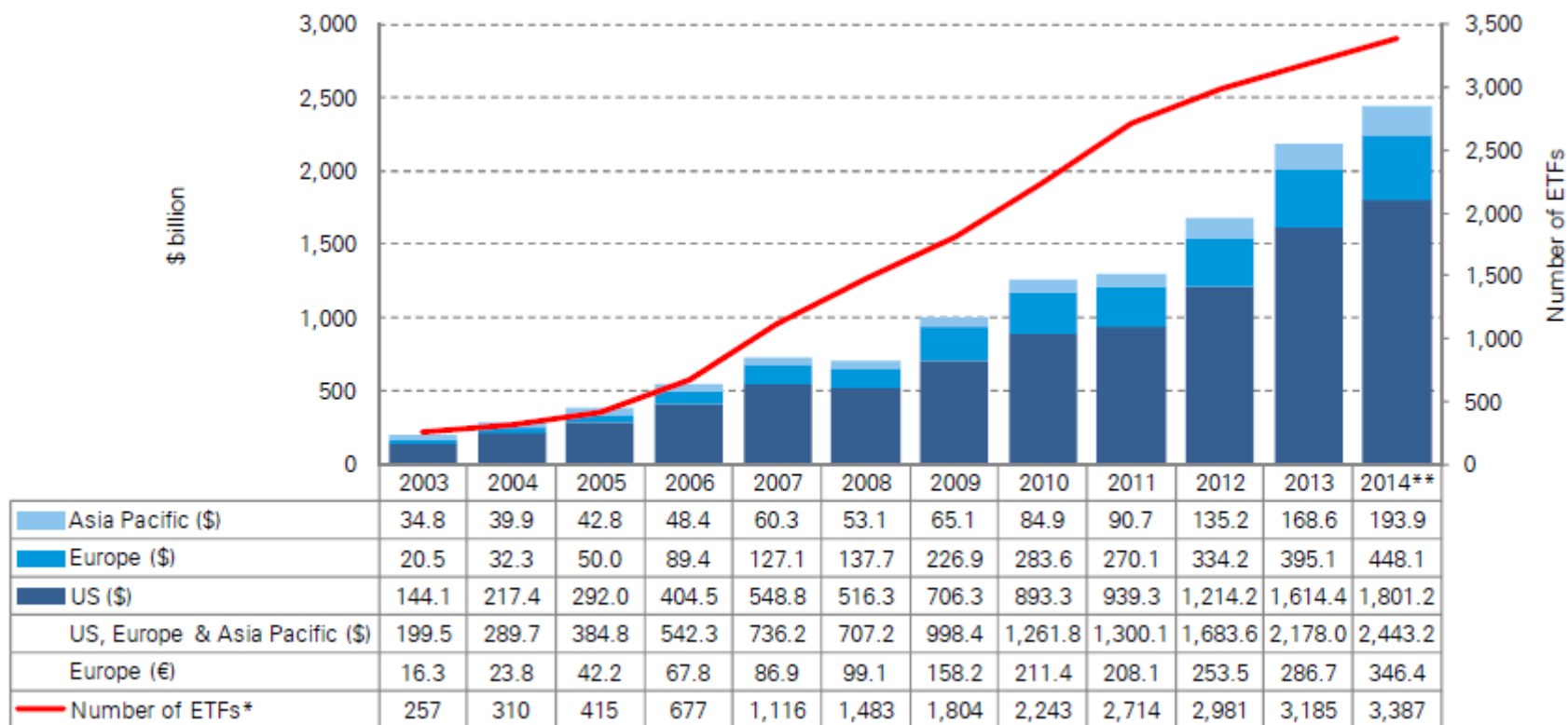
---

**What's next?**

---

# Global ETF industry evolution

## Assets by region



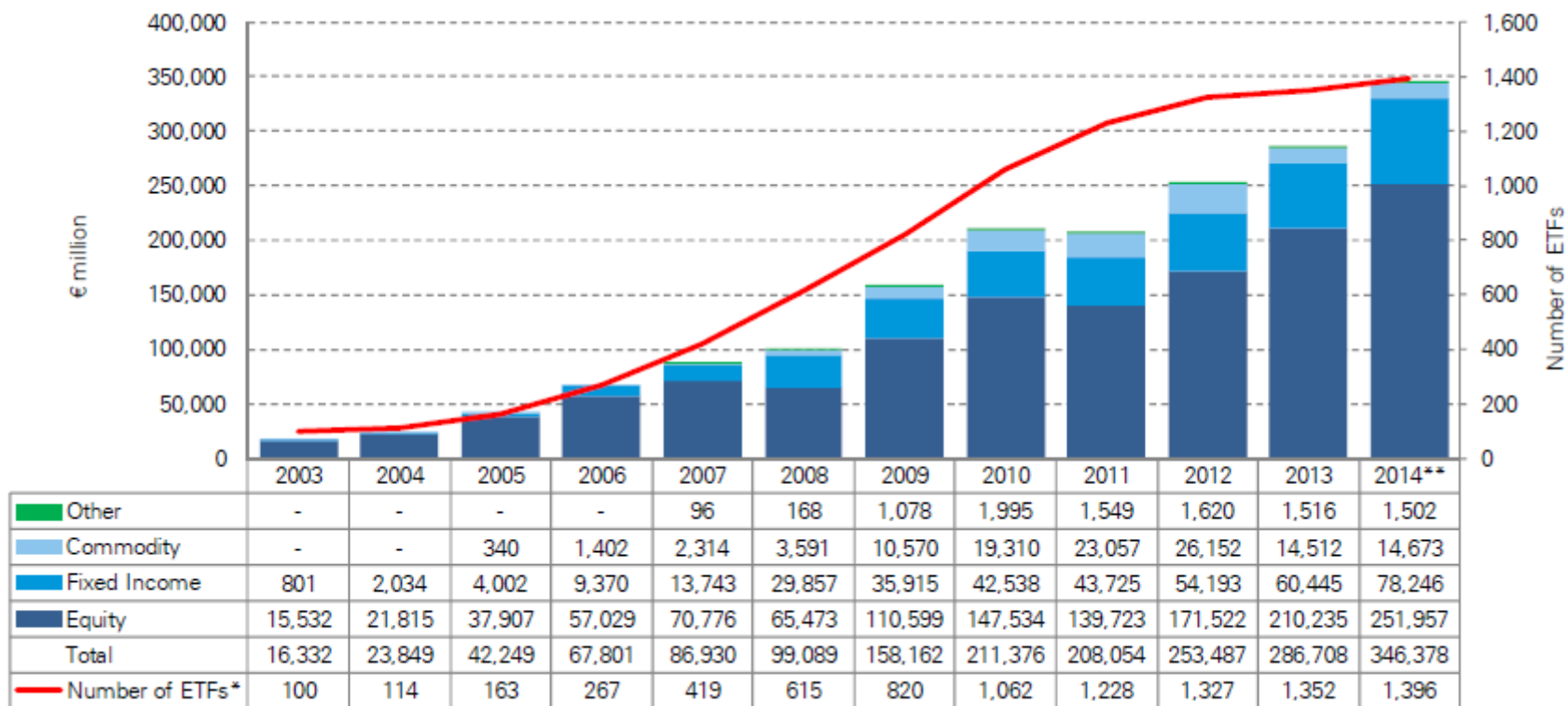
Source: European Weekly ETF market Review, Deutsche Bank, 16 September 2014

\*Number of ETPs at the end of the year is net of delistings for the period

\*\*As of 12° September 2014

# European ETF industry evolution

## ETF assets by asset class



Source: European Weekly ETF market Review, Deutsche Bank, 16 September 2014

\*Number of ETPs at the end of the year is net of delistings for the period

\*\*As of 12<sup>o</sup> September 2014

# Mean Variance – again

---

- CAPM → return is a linear function of beta (risk)
- The more risk I am willing to take, the higher return I will get
- (Un)fortunately it has been studied that portfolios of low volatility stocks tend to produce higher returns than portfolios of high risk stocks
- Similar results have been observed in the high yield market
- It seems that investors systematically misprice risks...
- ...and this means that there is money waiting to be picked up

# The low volatility anomaly

---

- Monthly stock returns (1968-2005)
- Separate stocks in quintiles for each month, based on their previous five year volatility
- Build five portfolios and rebalance them every month

	Monthly Standard Deviation	Average Monthly Return
<i>A. Volatility during NBER contractions (70 months)</i>		
Quintile 1 (low volatility)	5.2%	0.5%
Quintile 2	6.2	0.0
Quintile 3	7.9	-0.2
Quintile 4	9.2	-0.1
Quintile 5 (high volatility)	11.7	-0.4
<i>B. Volatility during NBER expansions (386 months)</i>		
Quintile 1 (low volatility)	3.4%	1.1%
Quintile 2	4.2	1.2
Quintile 3	5.2	1.3
Quintile 4	6.6	1.2
Quintile 5 (high volatility)	8.2	1.0



# Example portfolio: low risk Asia-Pacific

---

## Context

- Institutional client looking for Investment Idea related to Asia Pac AC ex Japan
- Contemplated strategies: Quantitative, Enhanced Passive, Passive
- Relative risk: among others, 6% pa of Tracking Error against the benchmark.

## Initial Portfolio Methodology: Low Vol Country Allocation

- The Low Vol Anomaly is well documented by both academics and practitioners.
- The use of Country/Sector allocation to “harvest” the Low Vol Premia has been documented as well.

## A Core Satellite Approach

- The Core is made of the client’s benchmark
- The Satellite is the Low Vol Portfolio, and is calculated as the Minimum Variance Portfolio, only investing in Country ETFs.
- Allocation between Core and Satellite is determined in order to maintain the Portfolio Tracking-Error under the risk limit defined by the Client.

# Example portfolio: Low Risk Asia-Pacific

## Step 1: Construction of the Low Vol Portfolio (the Satellite)

### Methodology

#### Investment Universe:

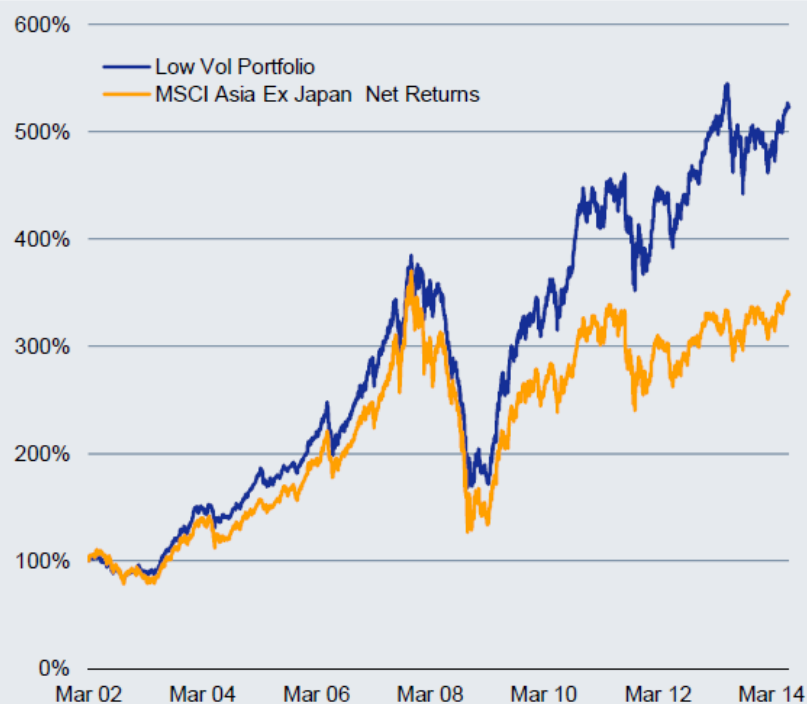
Asia Pac ex Japan, All Countries, physical ETFs only.

#### Methodology:

- Quarterly rebalancing,
- Minimum Variance methodology performed using a 252 days observation window for the variance-covariance matrix,
- Maximum exposure of 15% to any Low Vol Portfolio constituent,
- Minimum exposure of 0.5% to each Low Vol Portfolio constituent.

Main Statistics	Low Vol Portfolio	MSCI Asia Ex Japan Net Returns
Ann. Returns	14.37%	10.65%
Ann. Volatility	15.78%	21.21%
Sharpe Ratio	0.80	0.42
Drawdown	-56.20%	-65.79%
Tracking Error	10.03%	

### Simulated Past Performance

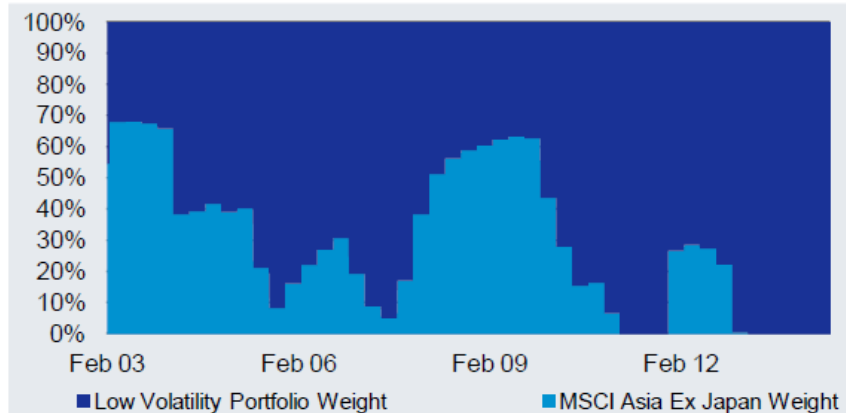


# Example portfolio: Low Risk Asia-Pacific

## Step 2: Construction of the Portfolio with the TE Target

Main Statistics	Portfolio with TE Target	MSCI Asia Ex Japan Net Returns
Ann. Returns	12.13%	10.65%
Ann. Volatility	17.78%	21.21%
Sharpe Ratio	0.58	0.42
Drawdown	-61.10%	-65.79%
Tracking Error	5.83%	

### Historical Composition (Weights in %)



### Simulated Past Performance

