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Dynamische risikogesteuerte Kapitalanlage

Investment-Forum - 8. Frankfurter Investmenttag

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Natixis – Equity Derivatives Sales

GROUPE BPCE

Worum geht es? (1)

Dynamische

risikogesteuerte

Kapitalanlage

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Worum geht es? (2)

–Kapitalanlage → Asset Allocation

–Dynamisch >--< Statisch

Statisch: - z.B.

Equity/Cash Portfolio:
60% SX5E, **40%** 3M-EURIBOR und
60% = const., **40%** = const.

Dynamisch: - z.B.

***Risiko*klasse**	**Grün**	**Gelb**	**Orange**	**Rot**
SX5E	**100%**	**2/3**	**1/3**	**0%**
3M-EURIBOR	**0%**	**1/3**	**2/3**	**100%**

–Risikogesteuert

Steuergrösse = ein Risikomass
Das Risikomass « bestimmt » die Gewichte des Portfolios

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Übersicht

1. Einleitung: Grundfragen der Kapitalanlage
2. Eigenschaften der Volatilität
3. Risikomass ARPI
4. Dynamische Kapitalanlage

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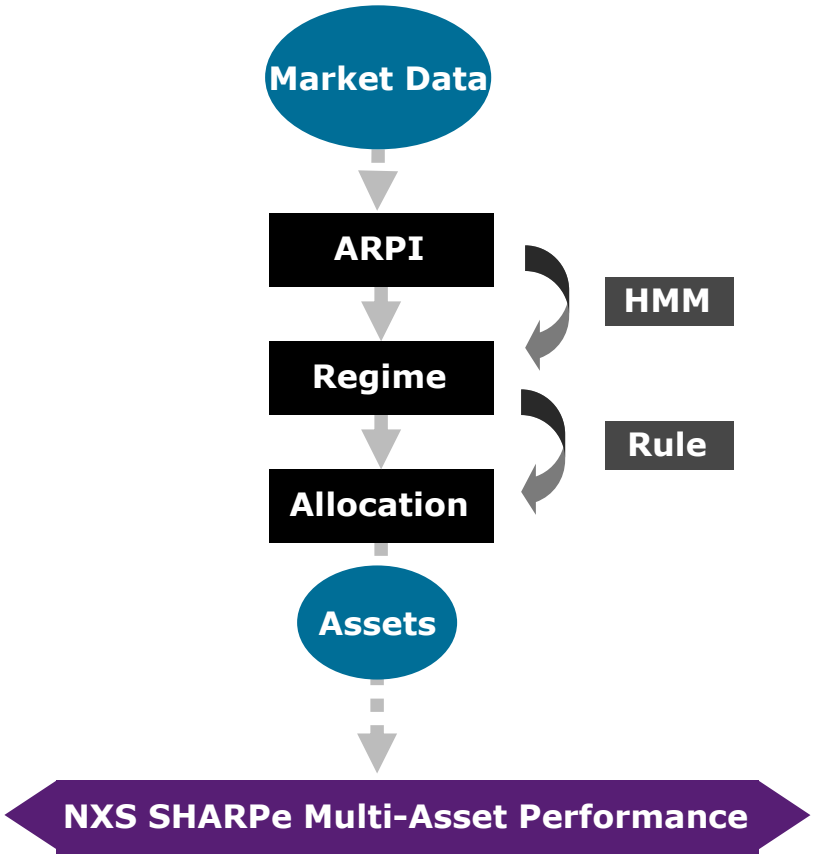
Berechnungsschema



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1 Einleitung: Grundfragen der Kapitalanlage

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Grundfragen der Kapitalanlage

–Asset Allocation

Welche Assetklassen? Welche Länder?
Welche Sektoren? Welche Gewichtungen? ...

–Timing

Wann? Wie lange? Trends? Zyklen? Blasen? Wie oft? ...

–Risiko-Ertrags Management

Ertrag (Return **R**) vs. Risiko (σ)
Ziel: Optimierung der «**R**/σ» Ratio
Aber: Wie wird das Risiko gemessen?
→ σ ... Volatilität (Standardabweichung von ln R)
→ Modell von Volatilitäts-*Regimes*!

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Volatilität verringert den Gesamtertrag (1)

Warum ist Risikokontrolle wichtig?

2-Periodenfall:

Return 1. Periode = a
Return 2. Periode = b **und a>b**

➔ **__b____R____a_____** **…** **$R = \frac{1}{2}(a+b)$, $\sigma = \frac{1}{2}(a-b)$**

σ σ **$a = R+\sigma$, $b = R-\sigma$**

$$a*b=(R+\sigma)*(R-\sigma)=R^2-\sigma^2 \leq R^2$$

$$R^2-\sigma^2 = R^2 \Leftrightarrow \sigma = 0$$

Gesamtreturn = $\sqrt{a*b} \leq R = \frac{1}{2}(a+b)$ = Durchschnittsreturn

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Volatilität verringert den Gesamtertrag (2)

Allgemeiner Fall:

n Returns (geordnet): $a \leq b \leq c \leq d \leq \ldots$ und $(a+b+c+d+\ldots)/n = R$

Gesamtertrag = $a*b*c*d* \ldots =$

$= (R-\alpha)*(R-\beta)*(R-\gamma)* \ldots \quad *(R+\phi)*(R+\rho)*\ldots \leq (!)\ R^n$

↑ ↑ ↑ ↑ ↑

diese Returns sind geringer als R

diese Returns sind grösser als R

($\alpha, \beta, \gamma, \phi, \rho, \ldots \geq 0$)

↑

daher wollen wir die Volatilität kontrollieren…

(!)Ungleichung: Geometrisches Mittel ≤ Arithmetisches Mittel

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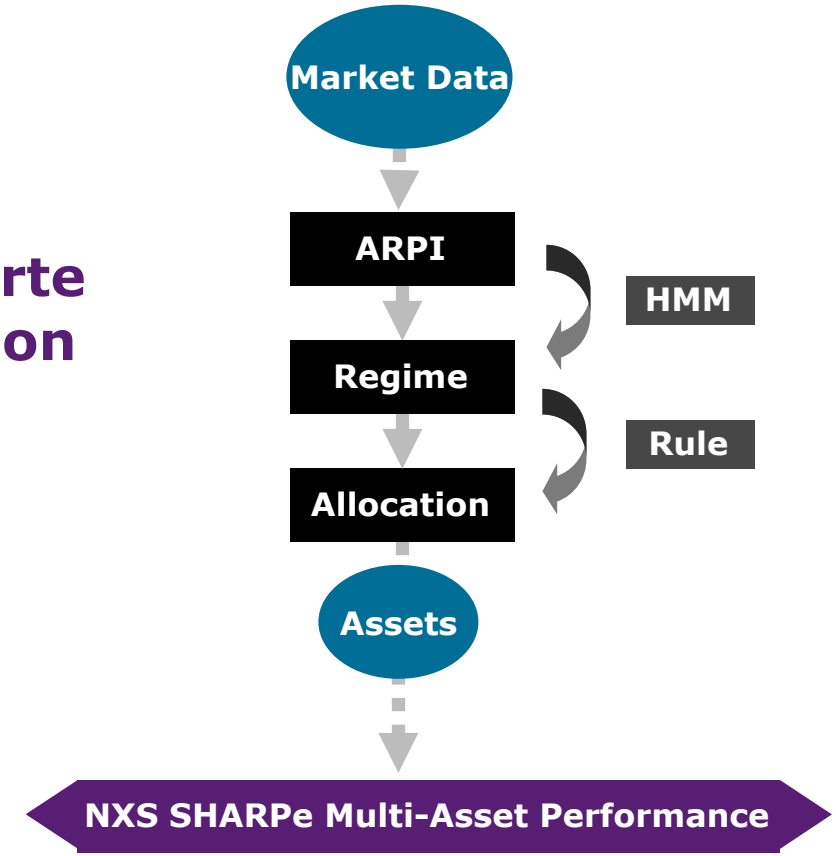
Vom Risikomass zur Asset Allocation

Das Risikomass wird *modelliert* und bestimmt Asset Allocation und Timing.

Ergebnis:

Dynamische risikogesteuerte Asset Allocation



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2 Eigenschaften der Volatilität

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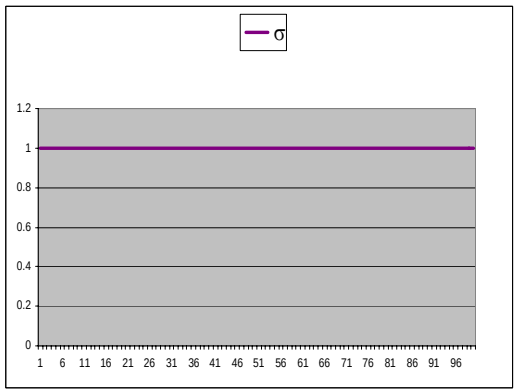
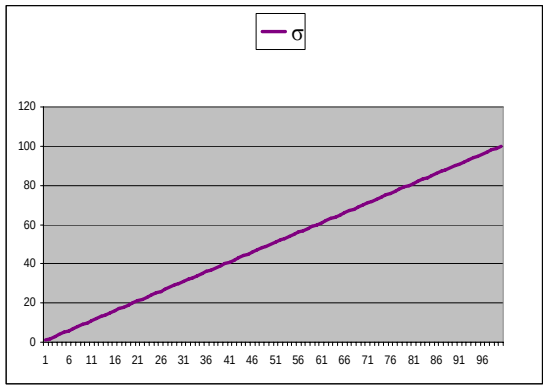
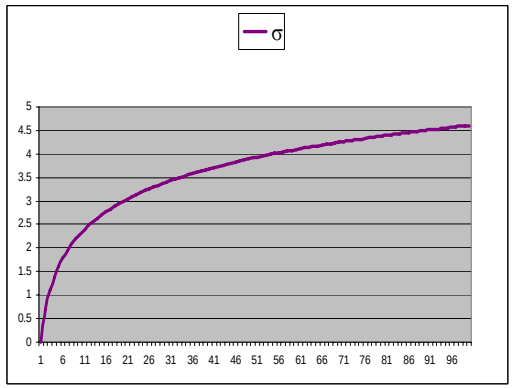
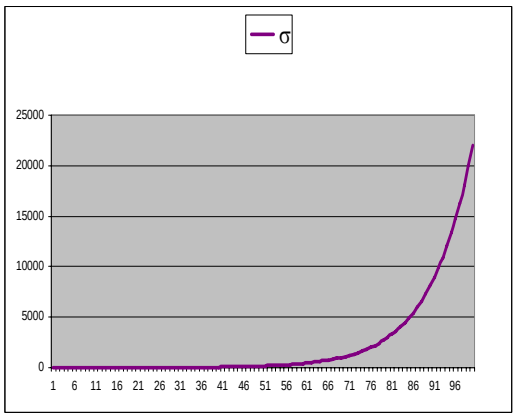
(Nicht) Eigenschaften der Volatilität (1)

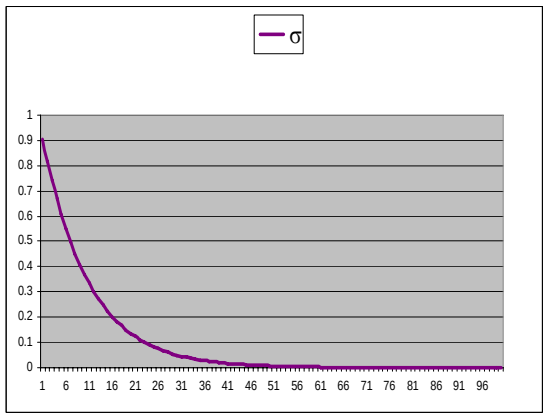
Volatilität σ (als Funtion der Zeit t) ist nicht konstant, nicht linear, nicht logarithmisch, nicht exponentiell wachsend oder abnehmend, nicht periodisch

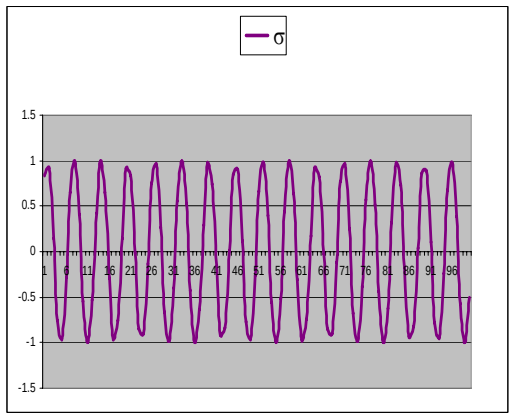












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(Nicht) Eigenschaften der Volatilität (2)

Die Graphiken (s.o.) zeigen *mögliches* Volatilitätsverhalten im Zeitablauf.

Tatsächlich zeigt die Volatilität typischerweise ein anderes Verhalten.

Die Graphiken sollen nicht verwechselt werden mit der *Termstructure* der impliziten Volatilität!

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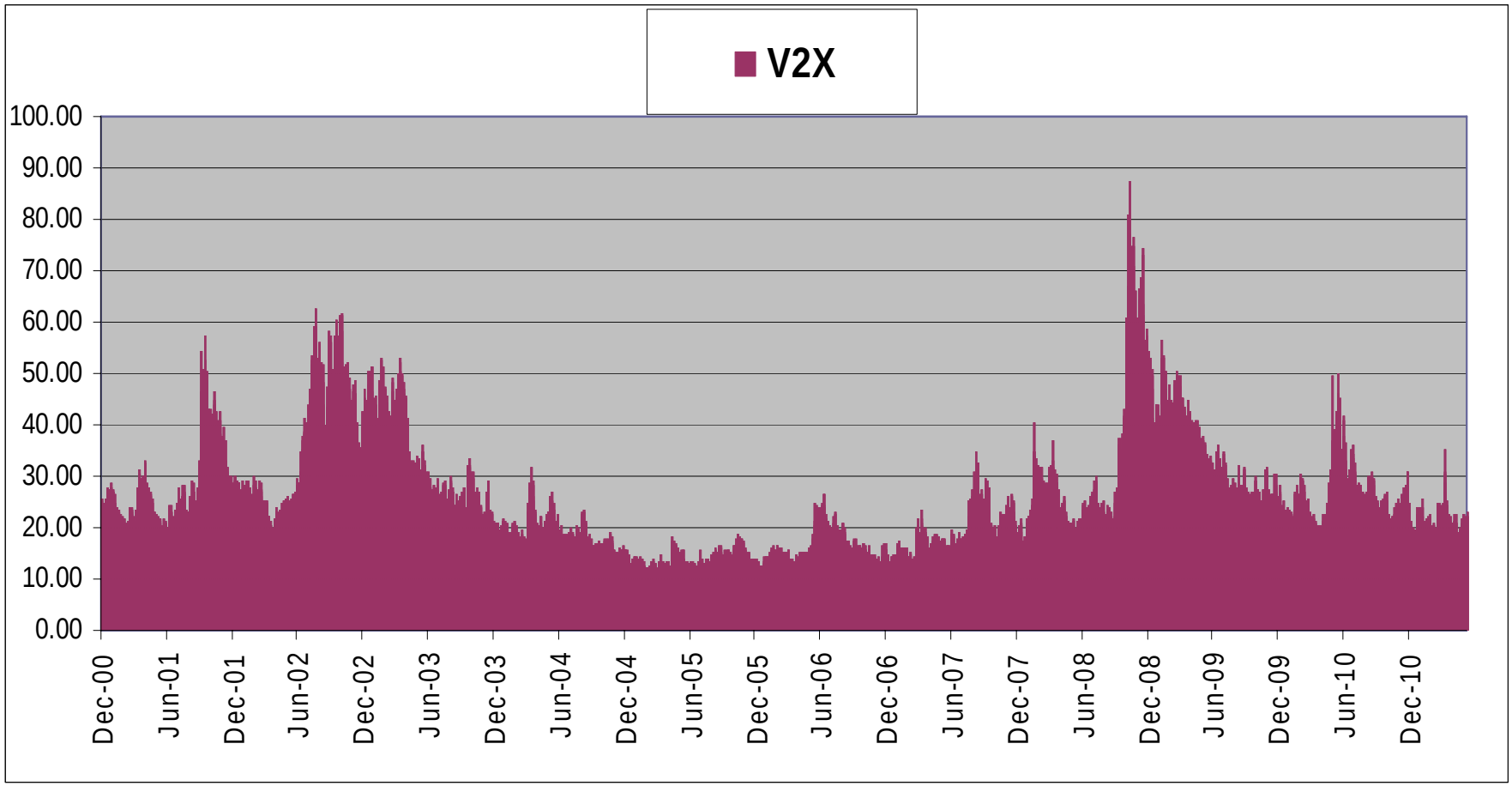
Zeitverhalten des V2X

V2X = Volatilitätsindex des SX5E



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V2X

Das V2X Chart (S. 11) legt nahe:

Volatilität ist *nicht* konstant und *nicht* deterministisch.

**Volatilität ist ein zeitabhängiger Zufallsprozess,
ein stochastischer Prozess.**

Phasen hoher Volatilität und niedriger Volatilität wechseln einander ab. Die Phasen sind unterschiedlich lang und folgen keinem erkennbaren Muster.

Wir wollen nun durch einige *Transformationen* der Daten versuchen, das Zeitverhalten des V2X besser sichtbar zu machen.

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Renormalisierung

Angenommen X ist eine Zufallsvariable (ZV) mit Erwartungswert μ und Varianz σ^2.

Dann hat die *renormalisierte* ZV

$$Z := (X-\mu)/\sigma \quad \text{Erwartungswert} = 0 \text{ und Varianz} = 1$$

V2X wird nun renormalisiert: $Z_{V2X} = (V2X-\mu)/\sigma$

Ist $V2X_t \sim N(\mu_t, \sigma_t^2)$ verteilt → $Z_{V2X|t} \sim N(0,1)$ verteilt.

Für die Charts wurden μ_t und σ_t aus einem 500 BD rolling Window ermittelt.

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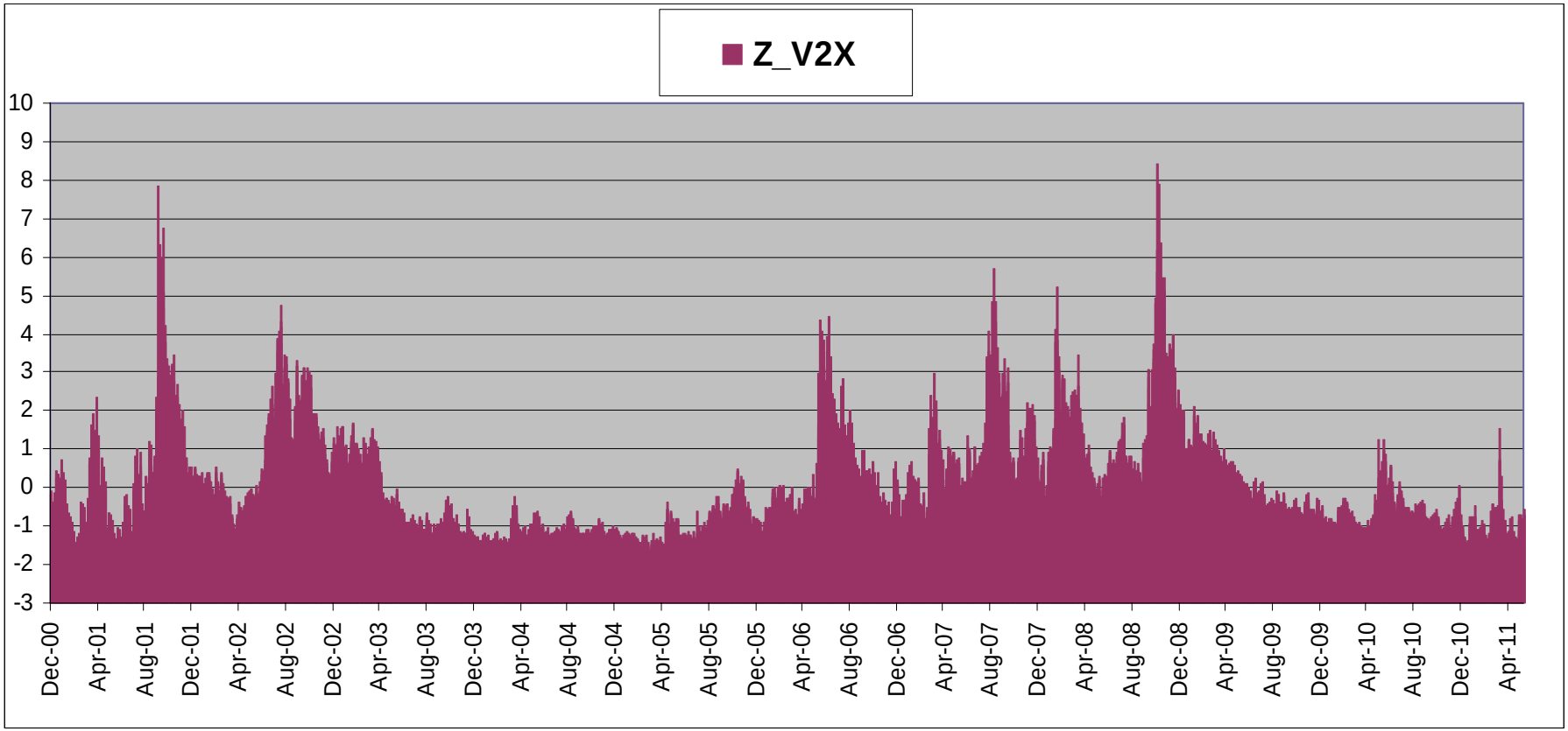
Renormalisierung: Z_{V2X}



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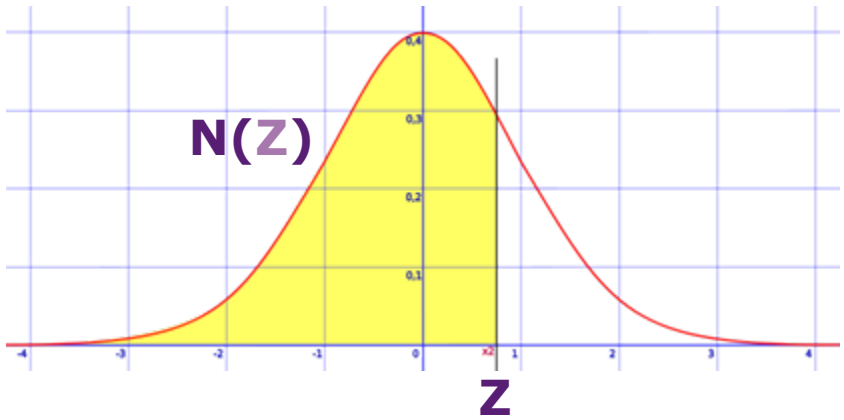
Wie extrem ist Z_{V2X}? $N(Z_{V2X})$ misst die Normalität (1)

Nehmen wir an, dass Z_{V2X} zu einem beliebigen Zeitpunkt t N(0,1) verteilt ist.

Die *Normalverteilungs*funktion N(.) ordnet Z_{V2X} eine Zahl zwischen 0 und 1 zu.

N(Z) ist die gelbe Fläche unter der Gauss-Glocke von -∞ bis Z:



$$N(Z) = 1/\sqrt{2\pi} \int_{-\infty}^{Z} e^{-\frac{1}{2}x^2}\, dx$$

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Wie extrem ist Z_{V2X}? $N(Z_{V2X})$ misst die Normalität (2)

Beispiel: Interpretation von N(Z) Werten

N(Z) ~ 0.00 → Z ist (sehr) negativ / sehr weit links

N(Z) ~ 0.25 → Z ist an der Grenze 1./2. Quartil

N(Z) ~ 0.50 → Z liegt nahe am Erwartungswert (= 0) / zentral

N(Z) ~ 0.75 → Z ist an der Grenze 3./4. Quartil

N(Z) ~ 1.00 → Z ist (sehr) gross / sehr weit rechts

Z = 6 … Black Swan (6σ-Event)!

$N(Z_{V2X})$ ist stets < 1

Dadurch ist der Graph kompakter, die Blöcke und Phasen werden besser sichtbar.

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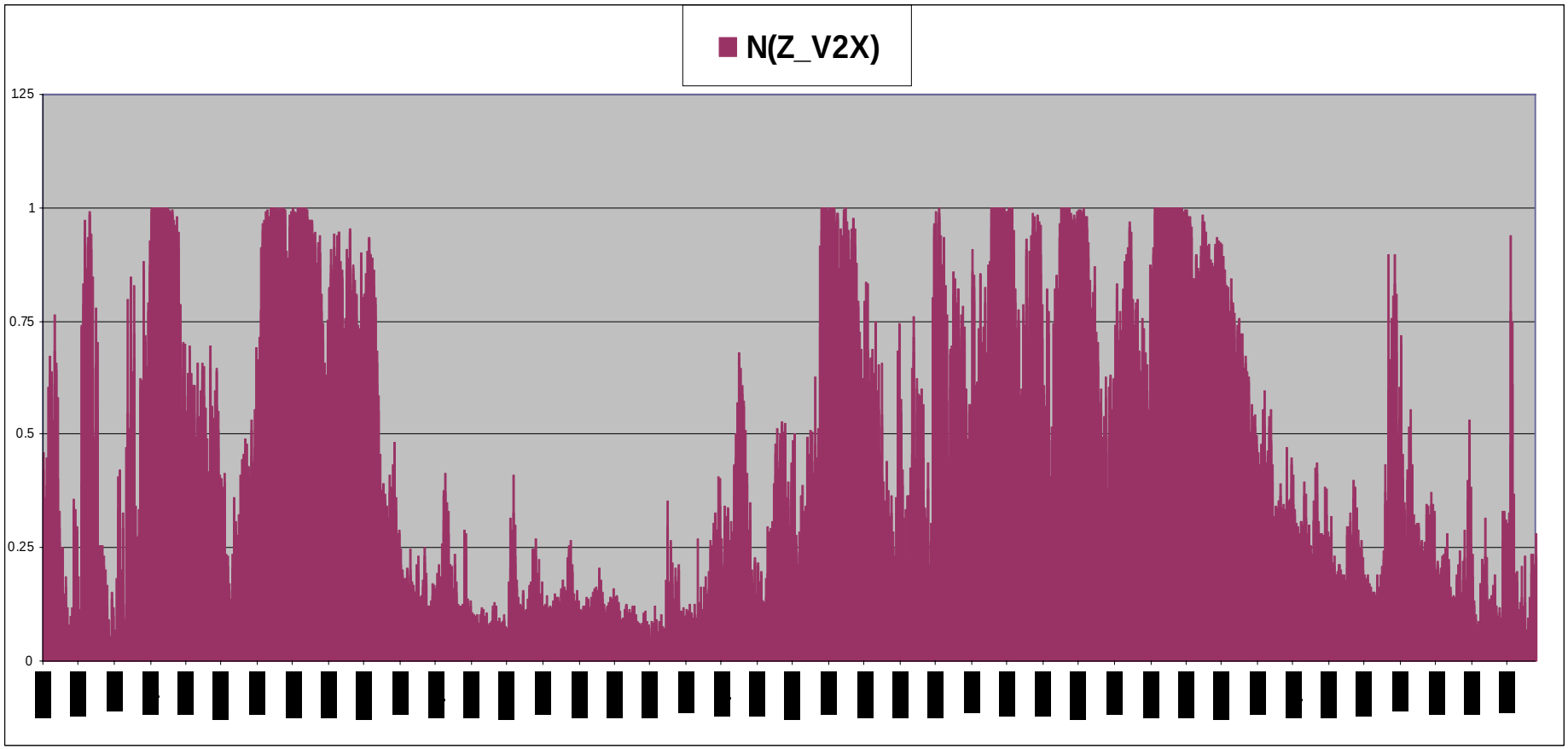
$N(Z_{V2X})$: Blöcke / Phasen werden besser sichtbar



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Digitalisierung von $N(Z_{V2X})$

Durch $N(Z_{V2X})$ sind die Phasen von hoher bzw. niedriger Volatilität schon ganz gut erkennbar. Wir wollen aber wirkliche Blöcke sehen!

Im letzten Schritt *digitalisieren* wir $N(Z_{V2X})$ zu Blöcken indem wir die *Quartile* mit dem Faktor 4 strecken und jeweils *einer* Zahl so zuordnen:

$$N(Z_{V2X}) \in (0.00, 0.25) \times 4 = Q1\ [0,1) \rightarrow 1$$

$$N(Z_{V2X}) \in [0.25, 0{,}50) \times 4 = Q2\ [1,2) \rightarrow 2$$

$$N(Z_{V2X}) \in [0.50, 0.75) \times 4 = Q3\ [2,3) \rightarrow 3$$

$$N(Z_{V2X}) \in [0.75, 1.00) \times 4 = Q4\ [3,4] \rightarrow 4$$

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Digitalisierung: Colorcode

Quartil
Q4: 3-4
Q3: 2-3
Q2: 1-2
Q1: 0-1

Volatilität
4 = sehr hoch
3 = hoch
2 = mittel
1 = niedrig

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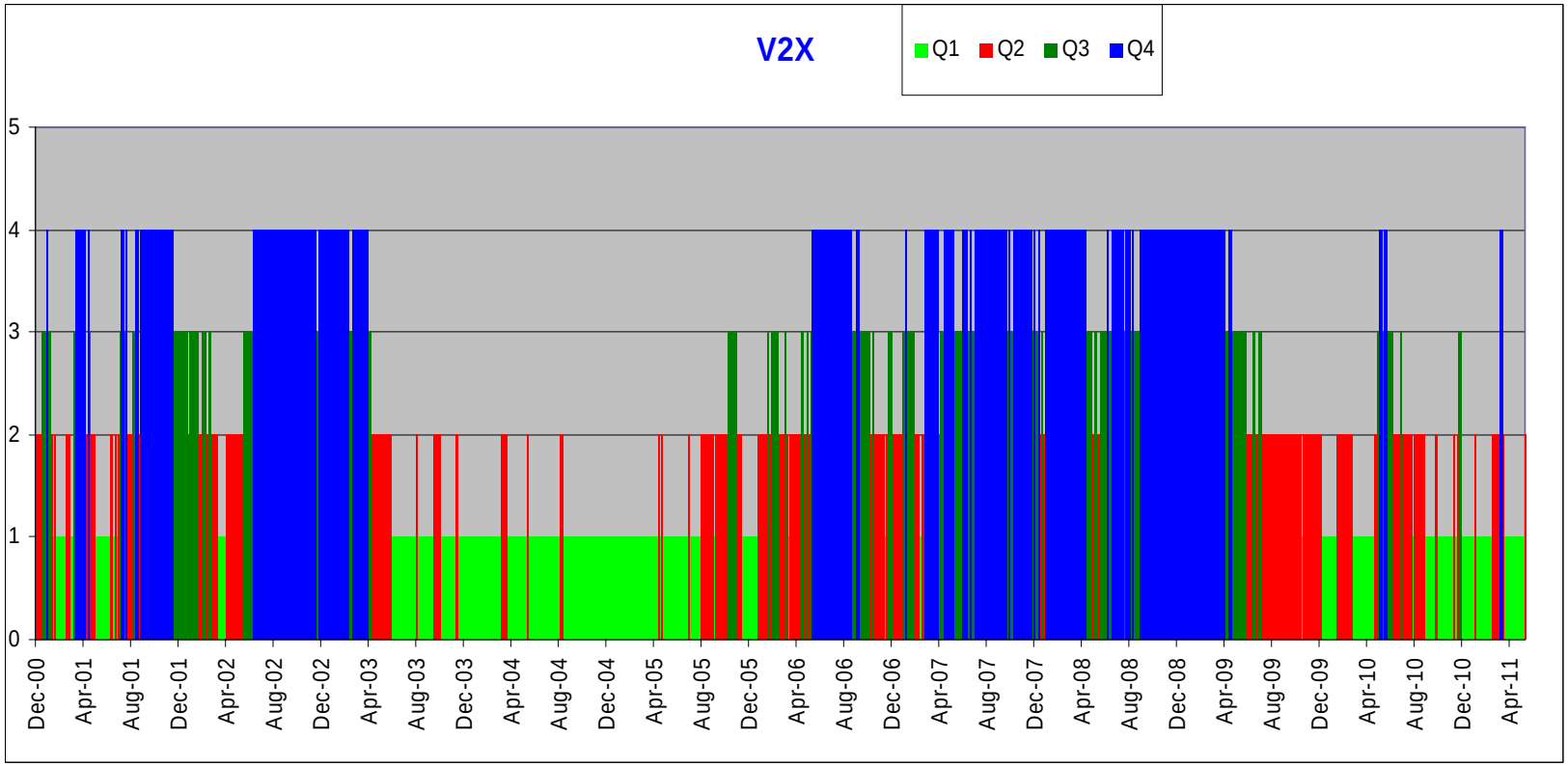
Eigenschaften der Volatilität: V2X



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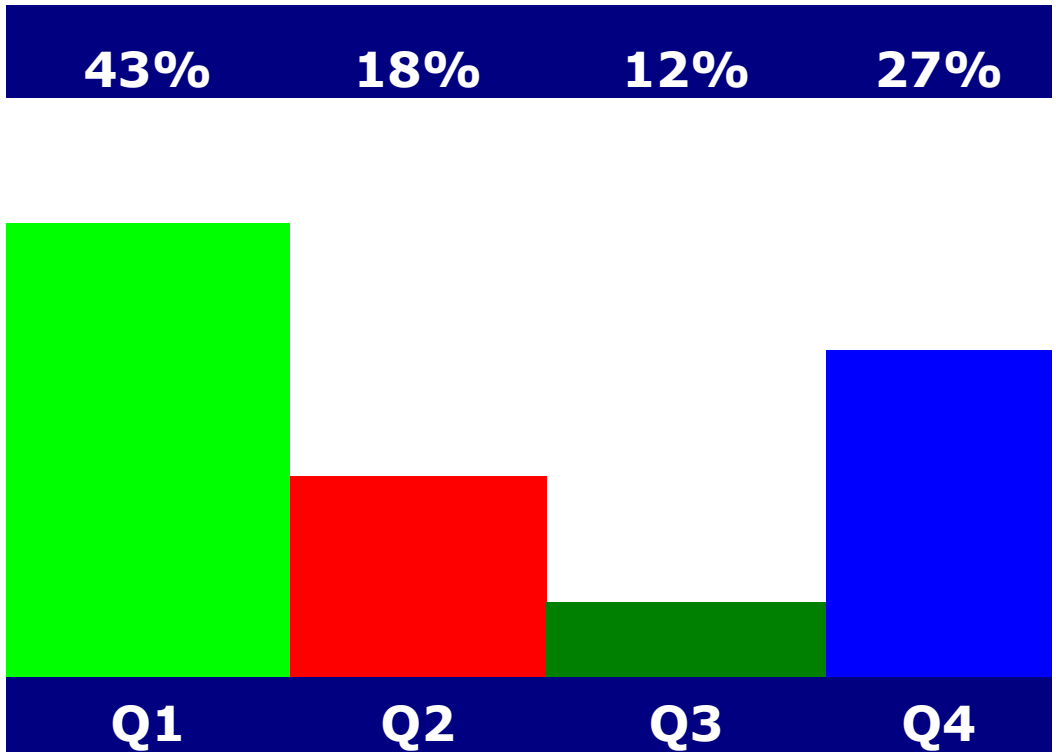
Häufigkeitsverteilung der $N(Z_{V2X})$ Quartile



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Eigenschaften der Volatilität: V2X

V2X Volatilität ist stochastisch und scheint « ein Gedächtnis » zu haben – also kein Random Walk, kein Markov Prozess.

V2X Volatilität zeigt deutliche Cluster (Blöcke, Regime).
V2X ist (positiv) *autokorreliert* d.h. $V2X_t$ und $V2X_s$ sind nicht unabhängig.

V2X hat offensichtlich auch eine Tendenz zur *Mean Reversion*:
Blöcke hoher und niedriger Volatilität wechseln einander ab:
V2X kehrt (immer wieder mal) zu einem mittleren Wert zurück.

Diese wesentlichen Eigenschaften werden in stochastischen Volatilitätsmodellen berücksichtigt.

ACHTUNG! Dies sind nur Beobachtungen – keine Naturgesetze.

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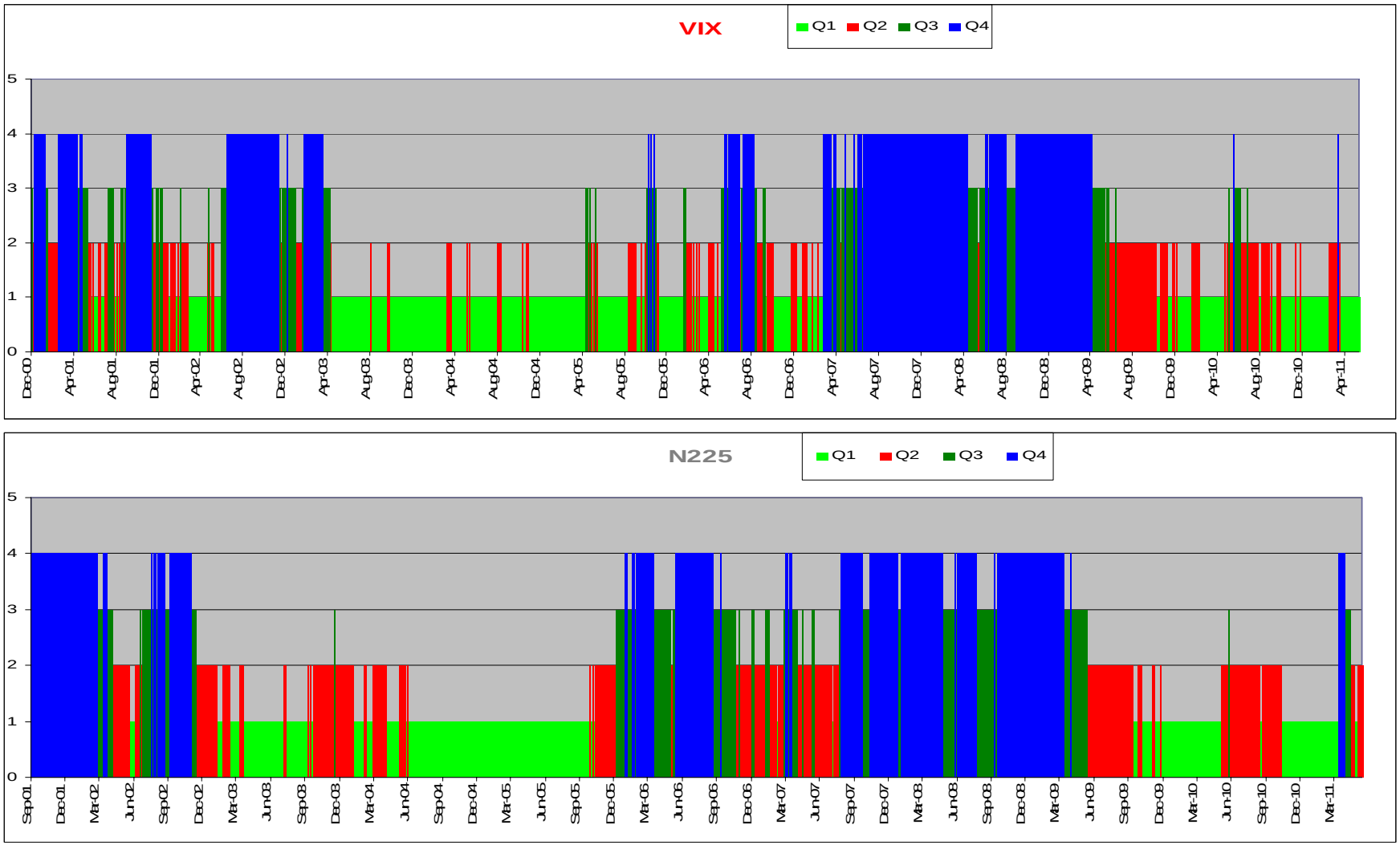
Eigenschaften der Volatilität: VIX und N225



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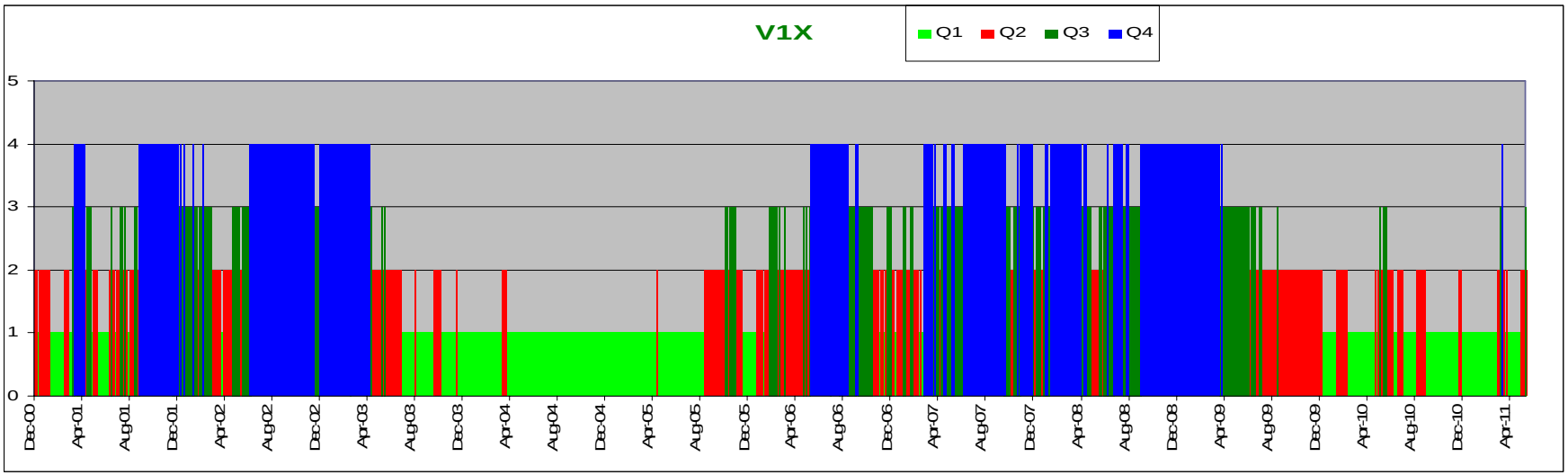
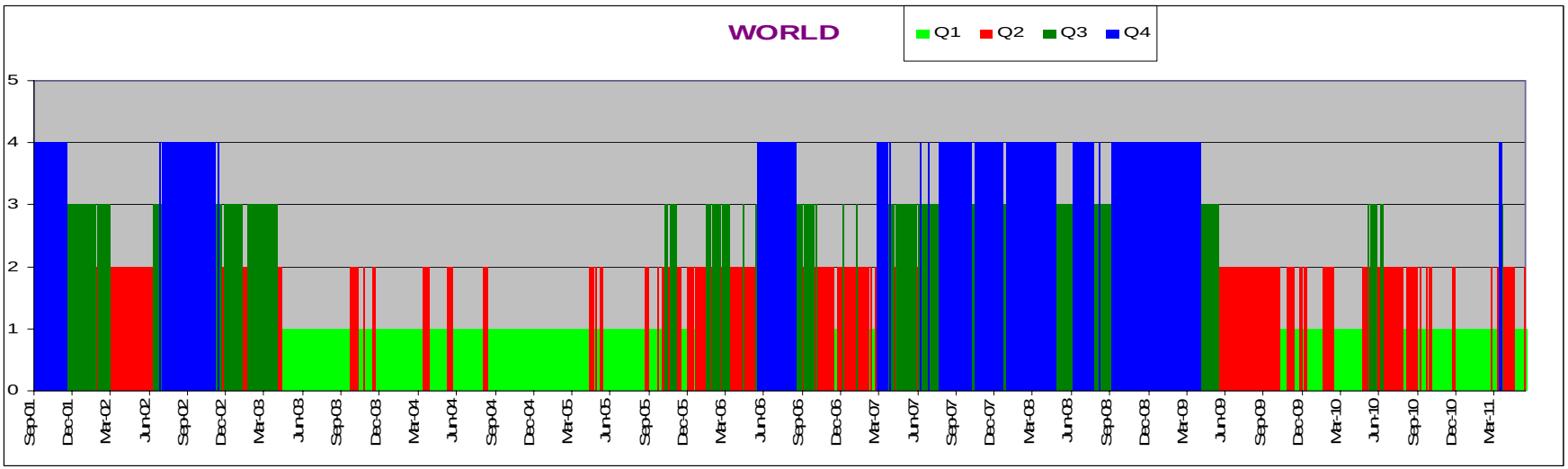
Eigenschaften der Volatilität: V1X und World





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Volatilitäts-Spike März 2011?

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(Un)known unknowns?

Die Märkte durchlaufen Zyklen von Volatilitäts-Regimes. Warum?

Man könnte argumentieren:
Die Volatilität ist ein Mass der Unwissenheit der Marktteilnehmer.

Viel Information → geringe Volatilität

Wenig Information → hohe Volatilität

Pointiert:

«[T]here are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know.»

Donald Rumsfeld Feb, 2002

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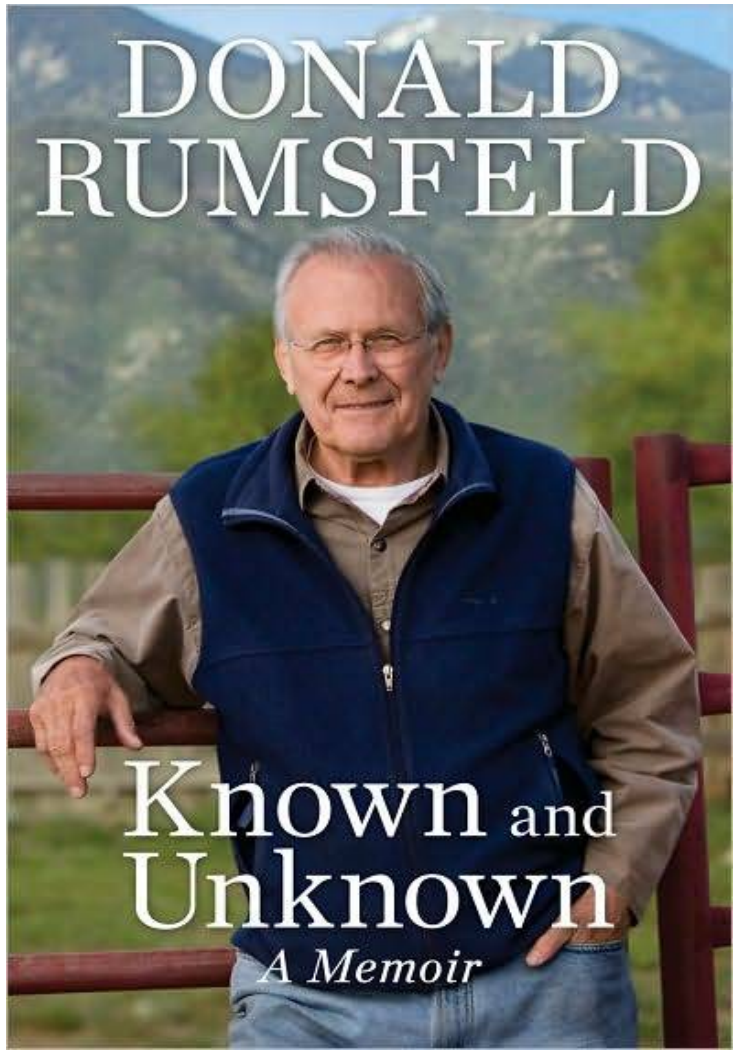
(Un)known unknowns?



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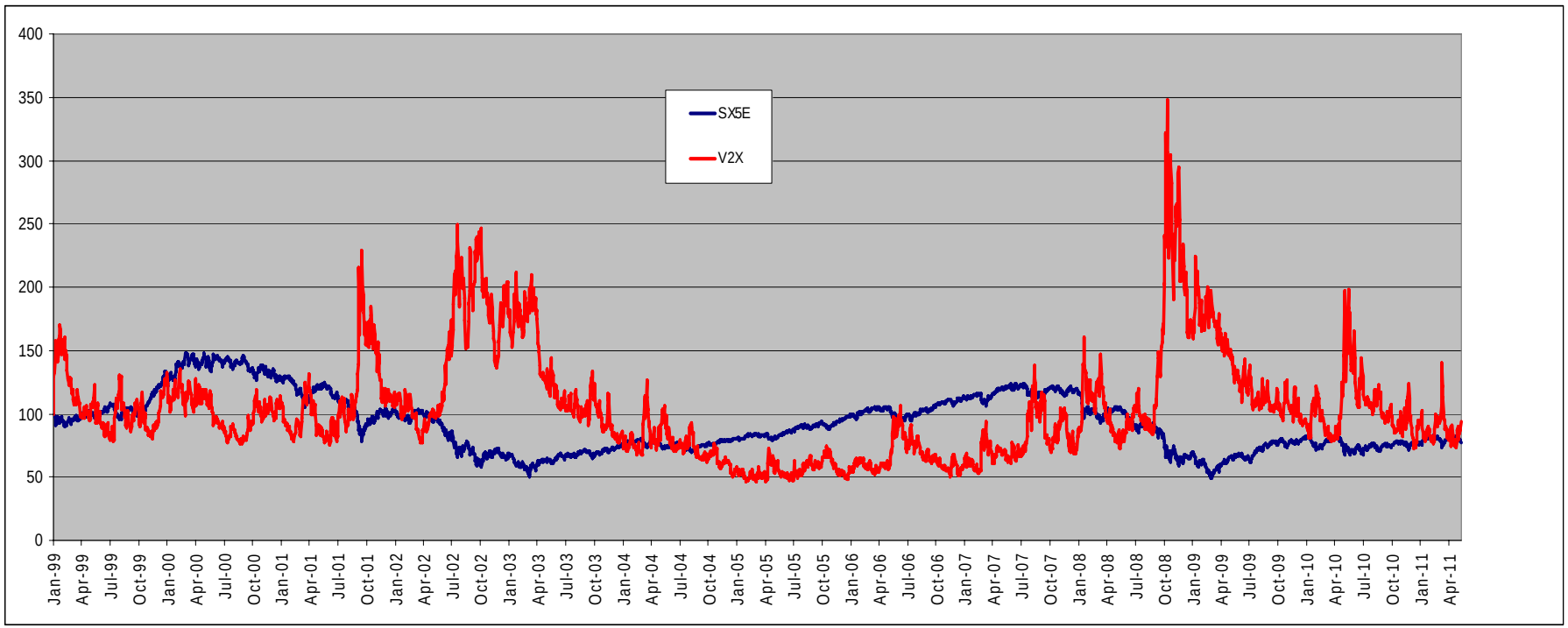
Noch eine Eigenschaft der Volatilität

Volatilität (V2X – SX5E Volatilitätsindex) und Index (SX5E) sind offensichtlich negativ korreliert. Fällt der Index, so steigt die Volatilität an. Steigt der Index, so nimmt die Volatilität tendenziell ab. Bei stark fallendem Index ist die Beziehung am deutlichsten ausgeprägt.



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3 Risikomass ARPI

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ARPI

ARPI = Advanced Risk Perception Indicator

ARPI basiert u. a. auf den Levels von VIX (SPX) und V2X (SX5E.)

Insgesamt berücksichtigt ARPI acht verschiedene Marktindices, die das Risikoniveau unterschiedlicher Asset Klassen repräsentieren: Aktien, Credit und EUR Interest Rates.

Abgesehen von der Aktienindexvolatilität verwendet die ARPI Berechnung auch CDS Indexlevels und die Steilheit der EUR Zinskurve.

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8 (6) ARPI Komponenten

ARPI Komponenten	Bloomberg Ticker	Markt Index Beschreibung
Equity Implied Volatility	VIX Index V2X Index	SPX Volatility VSTOXX Index
Credit Spread	ITRX EUR CDSI Generic 5Y Corp XOVER CDSI Generic 5Y Corp	ITRX Europe ITRX EUR XOVER
Interest Rate Slope (1Y-5Y, 2Y-10Y)	EUSA1 Curncy EUSA5 Curncy EUSA2 Curncy EUSA10 Curncy	EUR Swap 1Y EUR Swap 5Y EUR Swap 2Y EUR Swap 10Y

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ARPI

ARPI wird aus 6 *renormalisierten* Risikomassen Z_{VIX}, Z_{V2X}, … Z_{2Y-10Y} zu 3 Komponenten so zusammengesetzt:

$$\text{ARPI} := \tfrac{1}{3} N(\tfrac{1}{2}[Z_{VIX}+Z_{V2X}]) + \tfrac{1}{3} N(\tfrac{1}{2}[Z_{ITRX}+Z_{XOVER}]) + \tfrac{1}{3} N(\tfrac{1}{2}[Z_{1Y-5Y}+Z_{2Y-10Y}])$$

N(.) ist wieder die *Normalverteilungs*funktion von N(0,1).

ARPI ist daher eine Zahl zwischen 0 und 1.

Zur Renomalisierung wird ein rolling Window von n BD verwendet.

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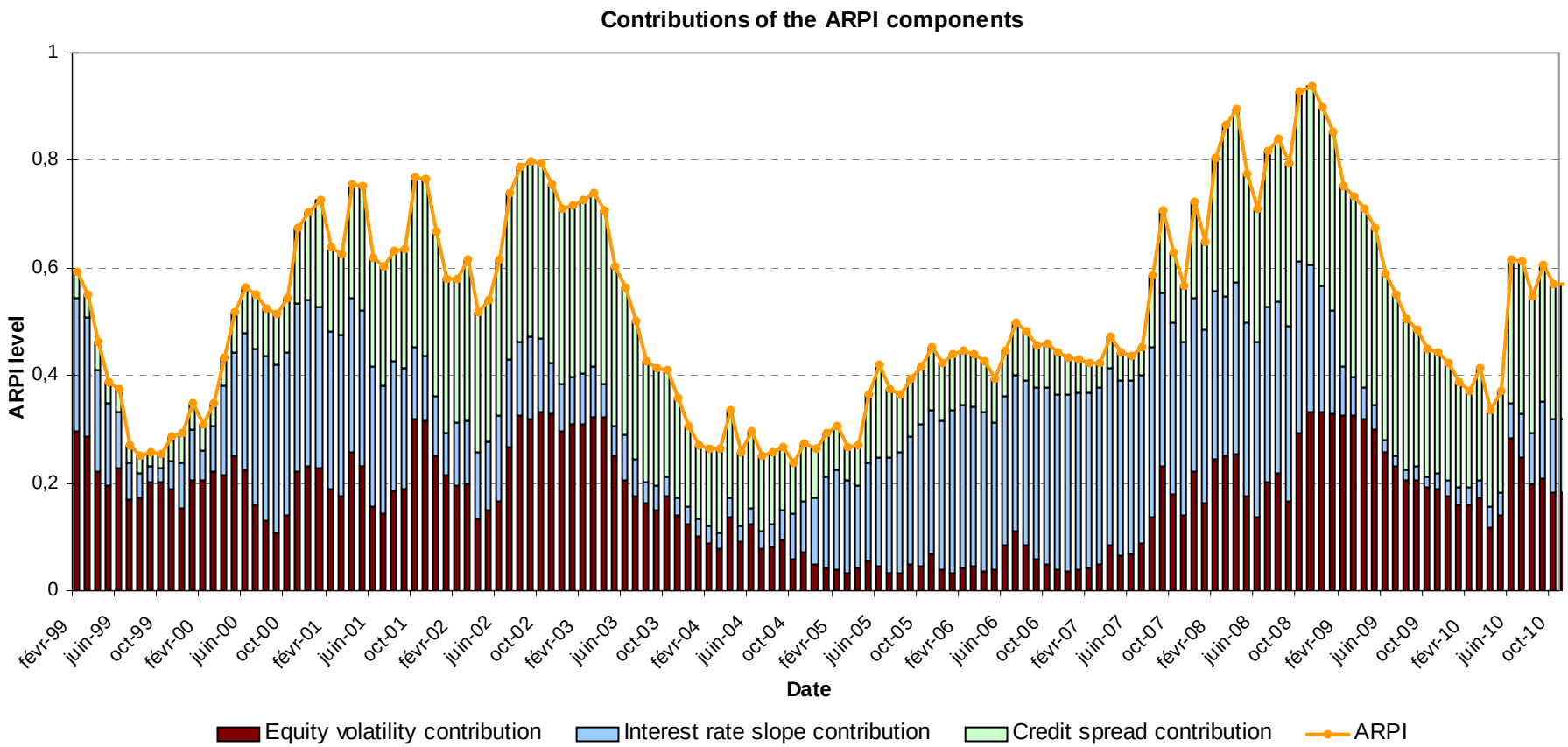
ARPI und seine 3 Komponenten



Sources : Bloomberg, Natixis

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4 Dynamische Kapitalanlage

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Von ARPI zu SHARPe™ (1)

Wir könnten nun wie im Fall des V2X
- genauer: $N(Z_{V2X})$ – auch ARPI den 4 Regimes [0.00, 0.25], [0.25, 0.50], … [0.75, 1.00] fix zuordnen (vgl. S 22).

Nachteil: Häufige Regimewechsel und keine Modellierung der Regimedynamik.

Daher wird ARPI nun als Datenbasis für ein Modell der *Regime*dynamik verwendet.

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Von ARPI zu SHARPe™ (2)

Dazu wird ein Hidden Markov Modell (HMM) verwendet.

D.h. es wird angenommen, dass hinter ARPI ein Markov Prozess von Volatilitäts*regimes* abläuft. Dieser zugrundeliegende Prozess ist verdeckt (*hidden)* und hat selbst kein Gedächtnis (*Markov*).

Die Marktregime folgen *diesem* Markov Prozess und können über ARPI (indirekt) beobachtet werden.

Kurz: ARPI → HMM → Volatilitäts*regime*

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4 Regimes: Colorcode

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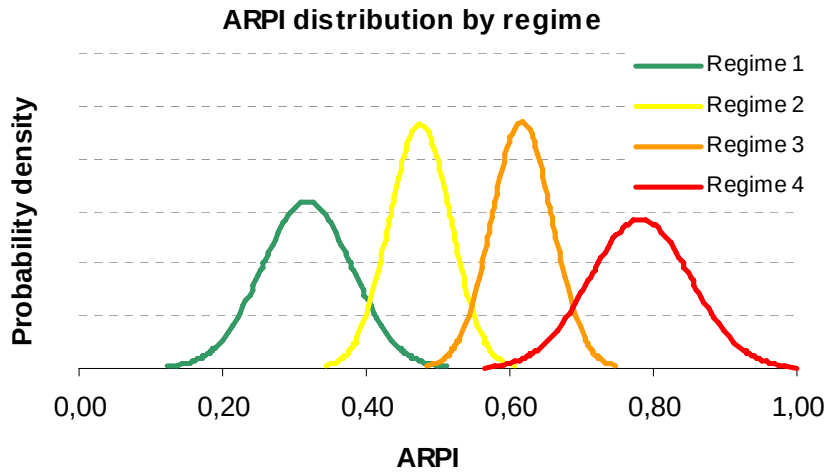
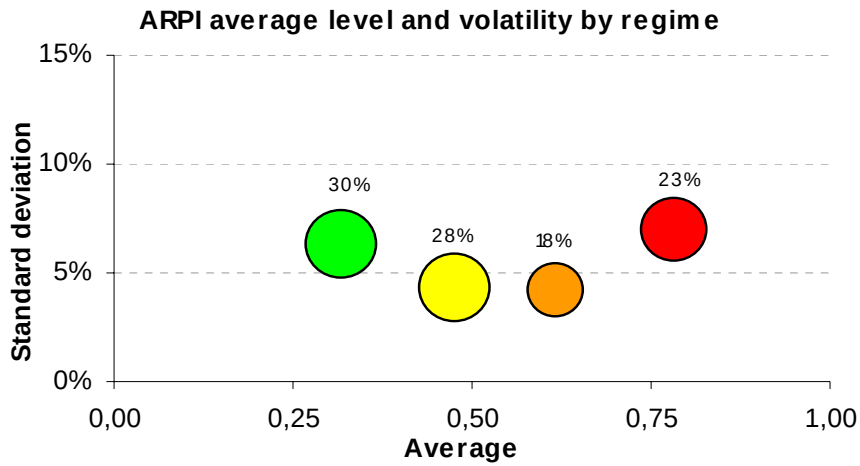
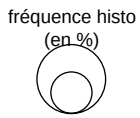
ARPI Verteilung & Regimes







Sources : Bloomberg, Natixis

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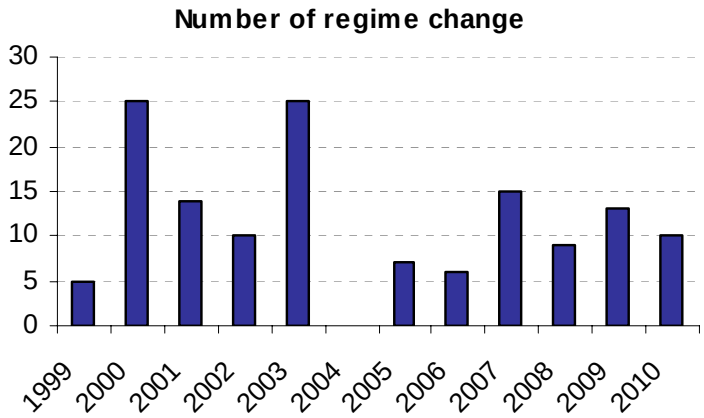
Nur wenige Regimeswechsel



Number of regime changes over the period from 06/01/1999 to 24/09/2010 = 139

139 / 3057 ~ 4.55%

Important inertia in the HMM model (probability of remaining in the current regime from one day to another ~ 95%)

⇒ Minimization of transaction costs in implementing a reallocation strategy

Transition probabilities (to 1 day)

	Regime 1	Regime 2	Regime 3	Regime 4
Regime 1	96,19%	3,07%	0,00%	0,00%
Regime 2	3,81%	93,78%	3,47%	0,00%
Regime 3	0,00%	3,15%	94,04%	3,59%
Regime 4	0,00%	0,00%	2,49%	96,41%

Sources : Bloomberg, Natixis

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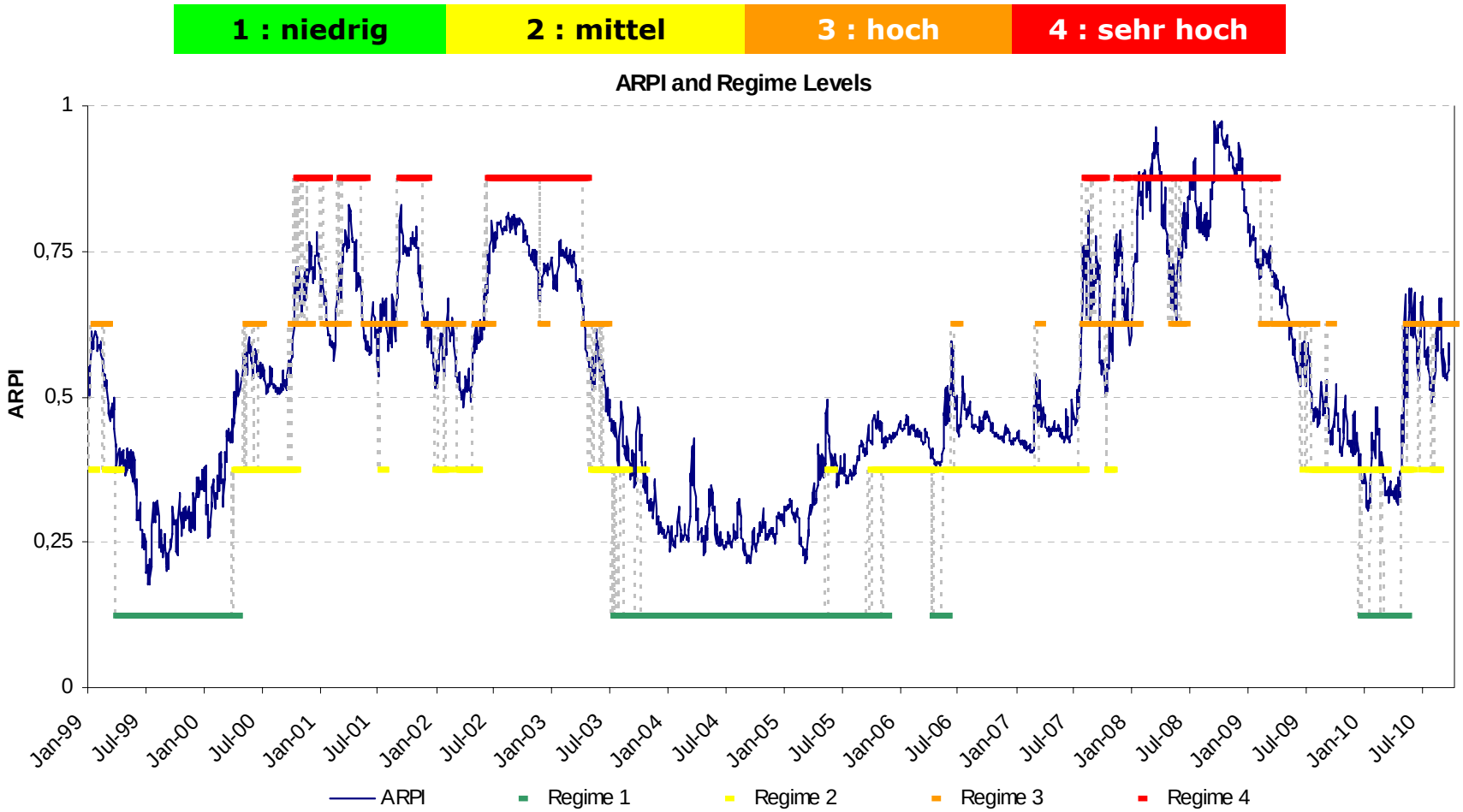
4 Regimes 1999 - 2010



Sources : Bloomberg, Natixis

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Von ARPI zu SHARPe™ (2)

Der nächste Schritt ist die Zuordnung Volatilitäts*regimes* → Asset Allocation

Systematic HMM (based) Allocation for Replication Portefeuille

Der gesamte Prozess heißt kurz: SHARPe™

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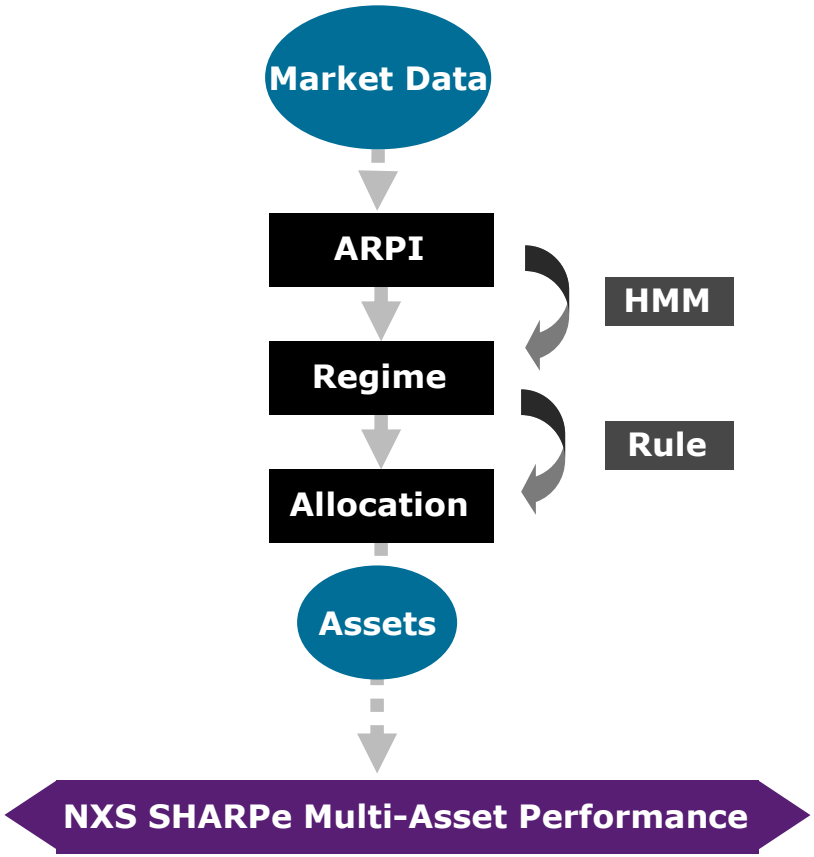
Berechnungsschema



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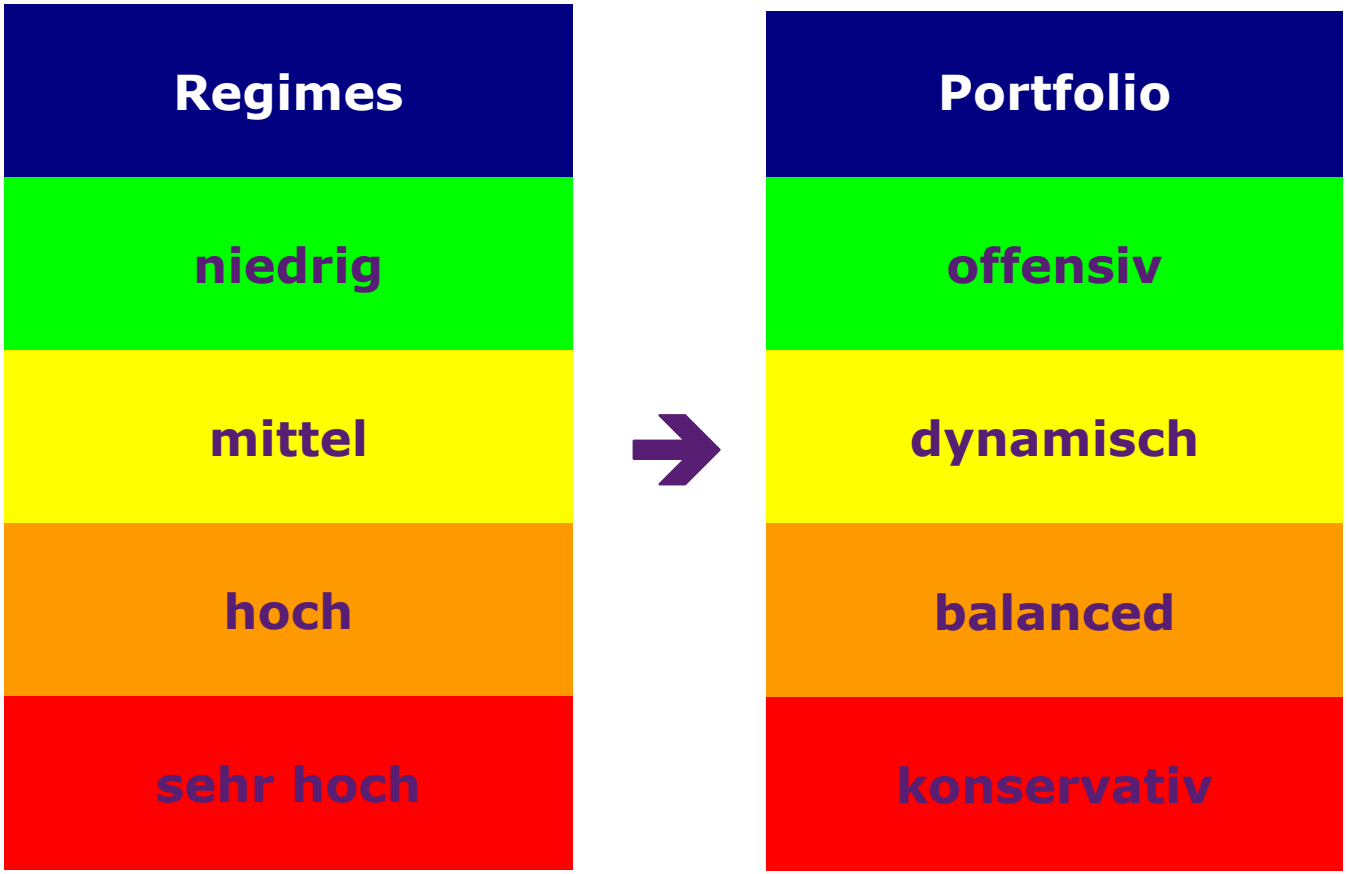
Zuordnung: 4 Regimes - 4 Portfolio Profiles



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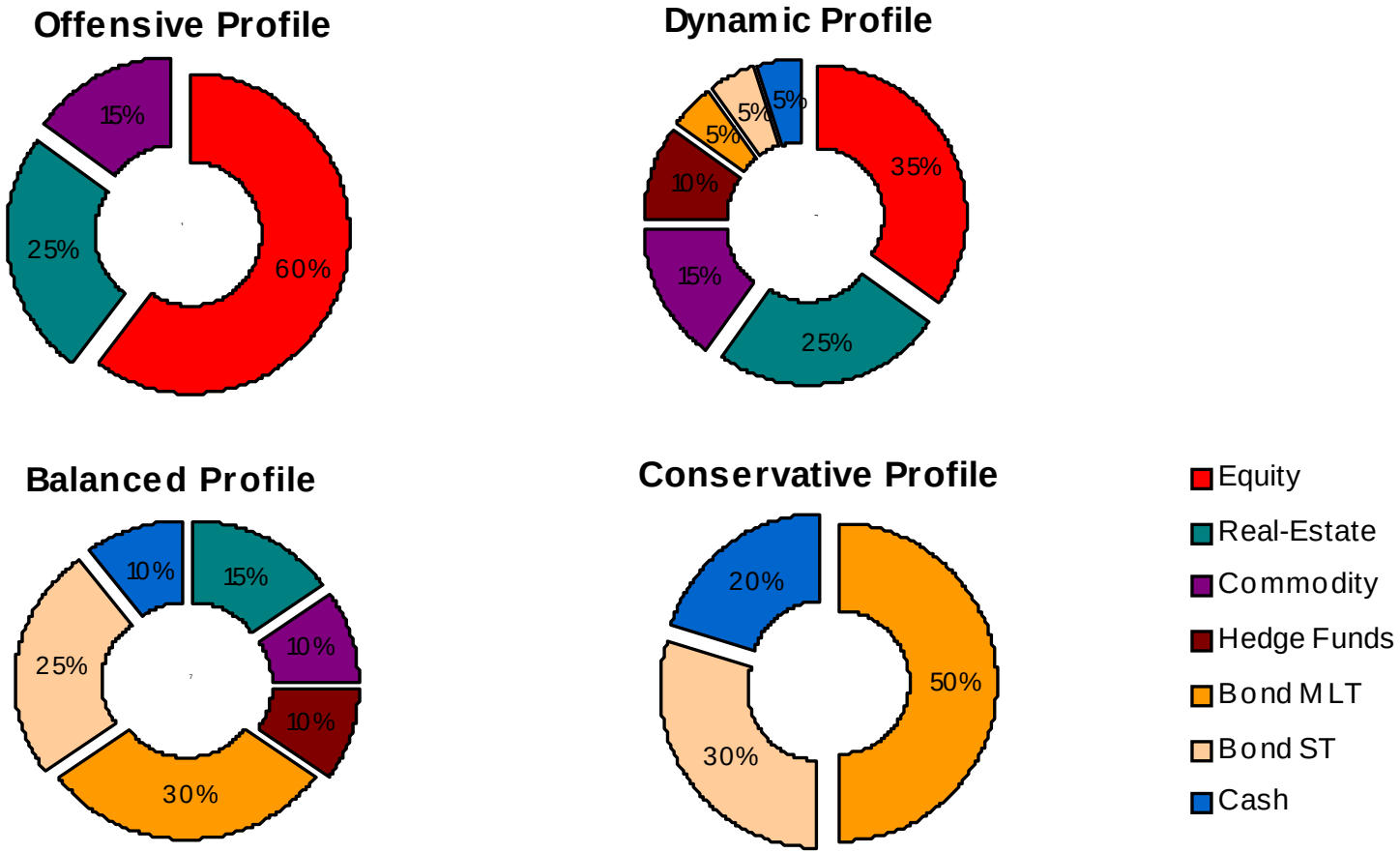
4 Portfolio Profiles – 7 Asset Klassen



Die Portfolio Profiles wurden von Analysten – nicht vom HMM - festgelegt!

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7 Asset Klassen - 7 Indices

Equity:	**Dow Jones EURO STOXX 50 NRT Index <SX5T Index>**	
Real Estate:	**FTSE EPRA/NAREIT Developed TR Eur Index <RPRA Index>**	
Commodities:	**S&P GSCI TR Index**	**<SPGSCIPTR Index>**
Hedge Funds:	**NXS – AIR Index**	**<IQHGIXIS Index>**
Bonds MLT:	**IBOXX & EZSOV TR 5-7 Index**	**<QW1M Index>**
Bonds ST:	**IBOXX & EZSOV TR 1-3 Index**	**<QW1E Index>**
Cash:	**EONIA Capitalization 7D Index <EONCAPL7 Index>**	

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ALLOCATION

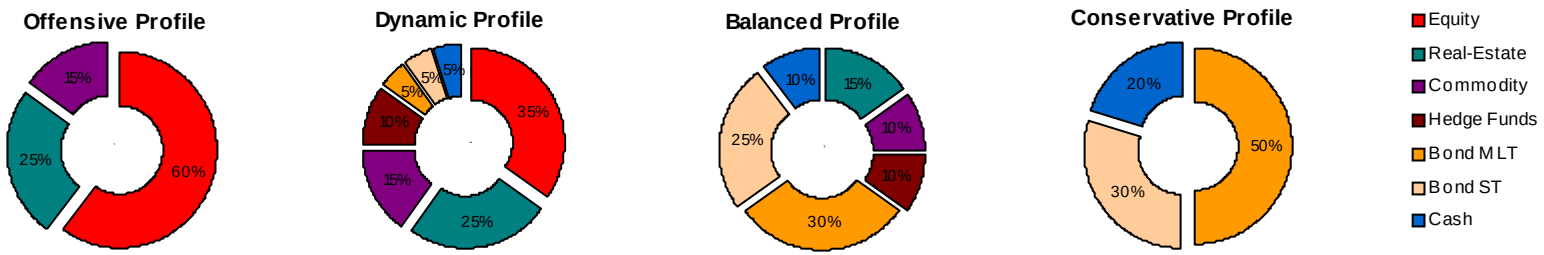
Portfolio Allocation: 7 Asset Klassen

Switching between 4 risk / return profiles that reflect different exposures to asset classes:

- **Offensive**
  Invested only in assets with high volatility
- **Dynamic**
  Overweighting assets with high volatility
- **Balanced**
  Overweighting assets with low volatility
- **Conservative**
  Invested only in assets with low volatility

Representation of major asset classes in the Euro area by the following indices:

- **Equity :** Dow Jones EURO STOXX 50 Tot Return Index (Ticker Bloomberg : SX5T Index)
  The Dow Jones EURO STOXX 50 Return Index is the total return index representing the equity market of the Euro area
- **Real-Estate :** FTSE EPRA/NAREIT Developed Eur TR Index (Ticker Bloomberg : RPRA Index)
  The FTSE EPRA / NAREIT Eur Developed Index represents the total return index composed of the real estate stocks the most traded in Europe
- **Commodities :** S&P GSCI Tot Return Index (Ticker Bloomberg : SPGSCIPTR Index)
  The S&P GSCI Tot Return Index is an index of futures on physical commodities
- **Hedge Funds :** NXS-AIR Index (Ticker Bloomberg : IQHGIXIS Index)
  The NXS-AIR Index is an investable index that aims to generate returns such as alternative investments using liquid securities as components
- **Mid-Long Term Bonds :** IBOXX € EZSOV TR 5-7 Index (Ticker Bloomberg : QW1M Index)
  The IBOXX € EZSOV TR 5-7 Index represents the total return performance of the Euro zone sovereign debt with a maturity of 5 to 7 years
- **Short Term Bonds :** IBOXX € EZSOV TR 1-3 Index (Ticker Bloomberg : QW1E Index)
  The IBOXX € EZSOV TR 1-3 Index represents the total return performance of the Euro zone sovereign debt with a maturity of 1 to 3 years
- **Cash :** Eonia Capitalization 7D Index (Ticker Bloomberg : EONCAPL7 Index)
  The Eonia Capitalization 7D Index is the short-term rate of return on cash



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ALLOCATION

Regimes, Volatilities und Returns

Volatilities by asset classes and regime

	Equity	Real-Estate	Commodity	Hedge Funds	Bond MLT	Bond ST	Cash
1	15,70%	9,11%	22,87%	7,65%	3,33%	1,06%	0,17%
2	17,85%	15,21%	21,94%	5,94%	3,03%	1,01%	0,22%
3	24,07%	20,61%	23,20%	5,22%	3,77%	1,45%	0,24%
4	39,11%	28,31%	31,92%	8,36%	4,41%	1,68%	0,28%
Total	24,97%	18,79%	25,06%	6,97%	3,60%	1,27%	0,14%

Returns by asset classes and regime

	Equity	Real-Estate	Commodity	Hedge Funds	Bond MLT	Bond ST	Cash
1	18,80%	19,89%	29,12%	13,06%	3,18%	2,21%	2,15%
2	8,96%	27,29%	20,40%	8,75%	1,67%	2,07%	2,70%
3	-0,52%	16,43%	1,96%	8,93%	7,01%	4,54%	2,84%
4	-21,91%	-35,95%	-29,70%	-6,53%	9,25%	6,93%	3,63%
Total	3,10%	8,50%	8,13%	6,57%	4,85%	3,69%	2,78%

Investment in the strategy and asset classes achieved from 06/01/99 to 10/02/10

Sources : Bloomberg, Natixis

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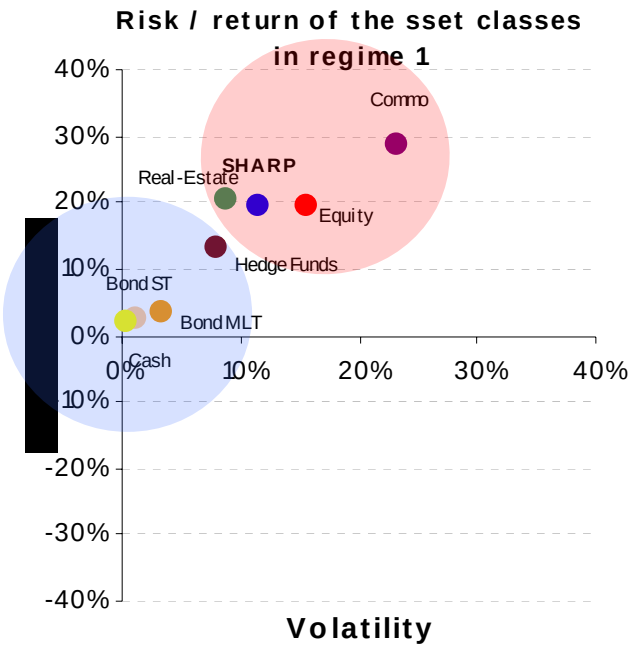
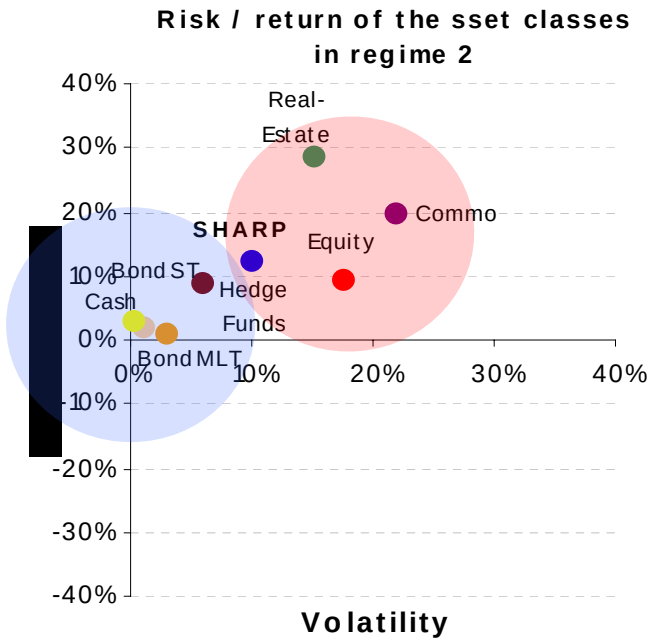
ALLOCATION

Asset Classes per Regimes 1999 – 2010 (1)





Sources : Bloomberg, Natixis

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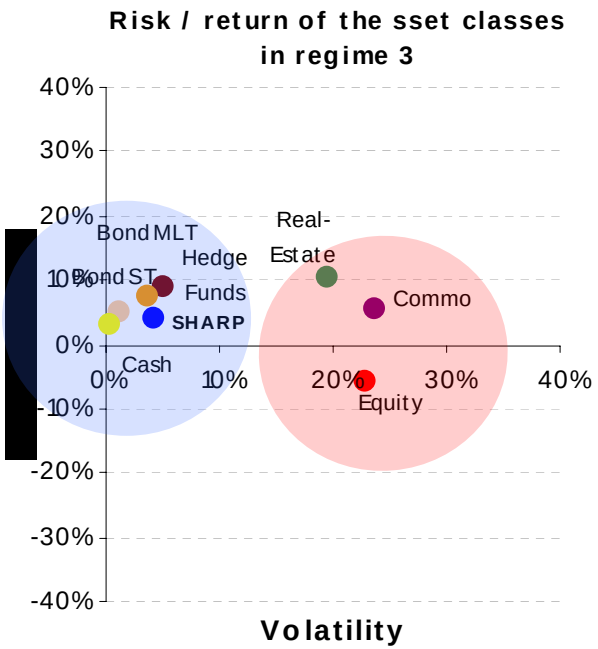
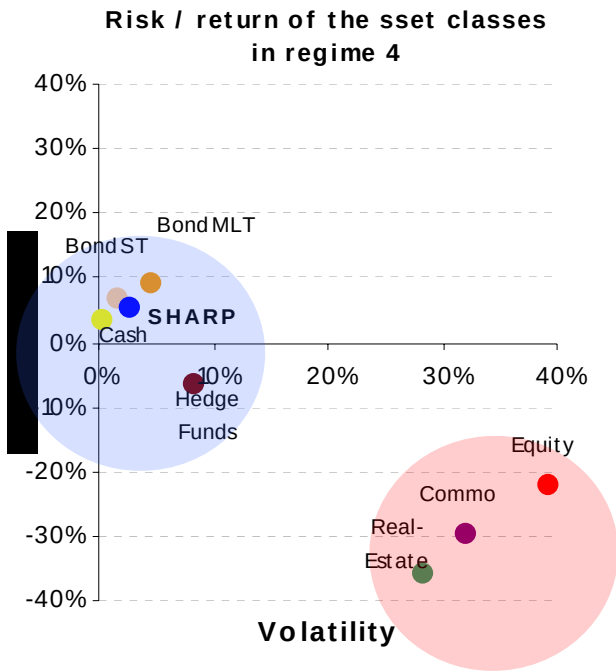
Asset Classes per Regimes 1999 – 2010 (2)





Sources : Bloomberg, Natixis

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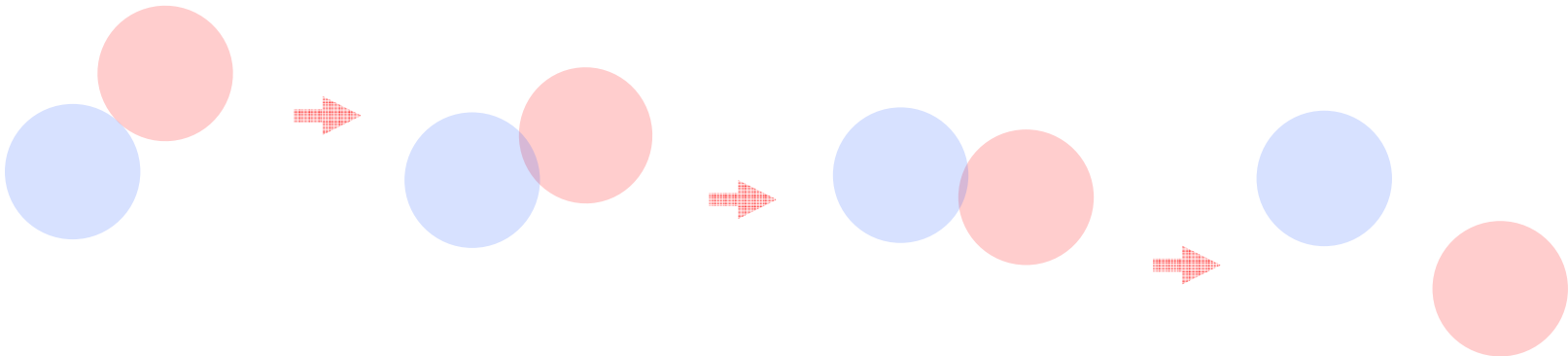
ALLOCATION

Fazit

In den Regimes mit niedriger oder mittlerer Volatilität erzielen die Volatileren Assets die höheren Erträge. Bei Wechsel in hoch-volatile Regimes wird es notwendig, in weniger volatile Assets umzuschichten:



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Sources : Bloomberg, Natixis

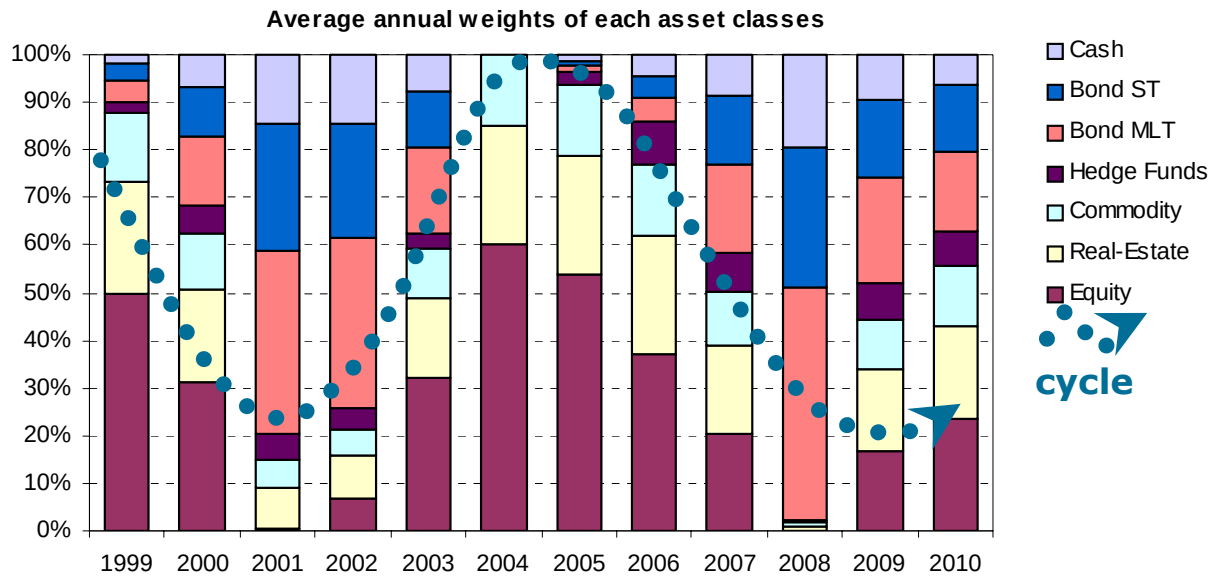
Gewichtsdynamik der Asset Klassen

In the period from 06/01/1999 to 24/09/2010 SHARPe is on average invested almost equally between the assets with high volatility and the assets with low volatility.

Average weights of each asset classes

Equity	28%
Real-Estate	17%
Commodity	11%
Hedge Funds	5%
Bond MLT	19%
Bond ST	13%
Cash	8%

A temporal analysis shows the existence of cycles of reallocation between the different asset classes.



Sources : Bloomberg, Natixis

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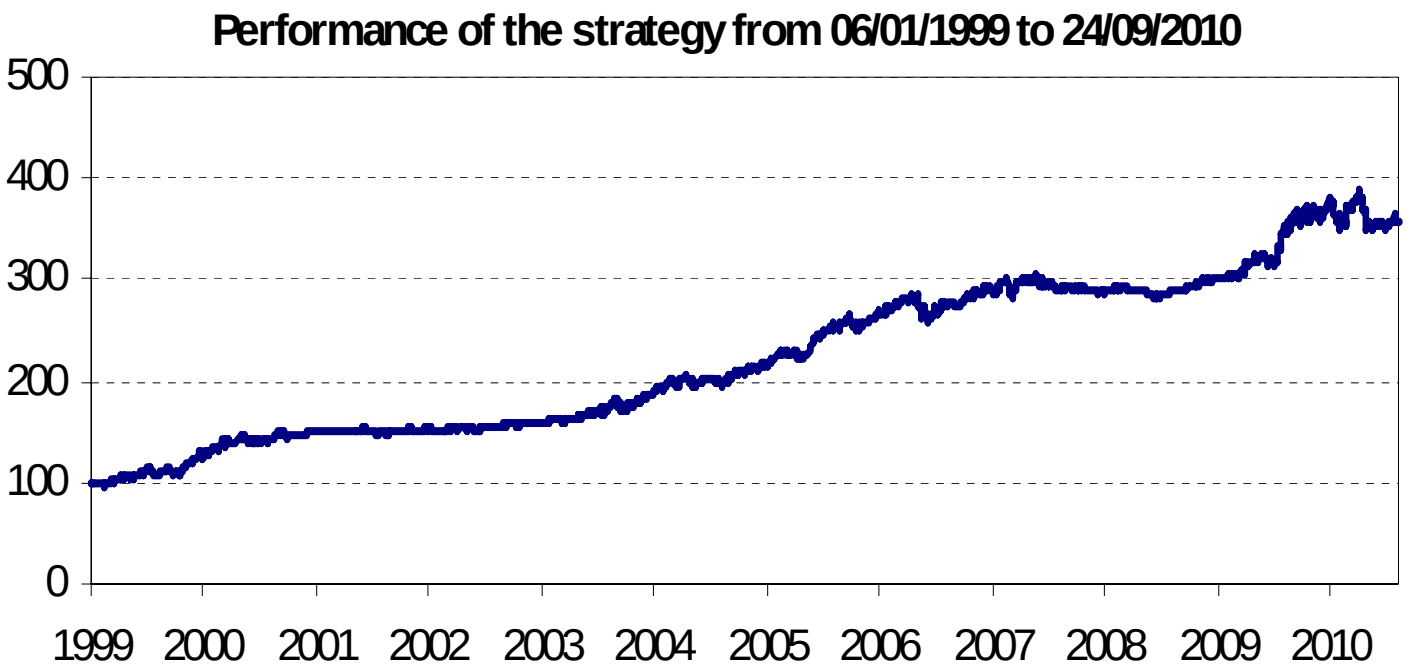
Performance der Strategie 1999 – 2010

The NXS SHARPe Multi-Asset strategy provides an average annual return of 11.14% for an investment made between 06/01/1999 and 24/09/2010.



Sources : Bloomberg, Natixis

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Rollierende 5Y Performance der Strategie

Täglich rollierende 5Y SHARPe Performance zwischen 06/01/1999 und 24/09/2005 erziehlt durchschnittlich 11.78%:

Sources : Bloomberg, Natixis

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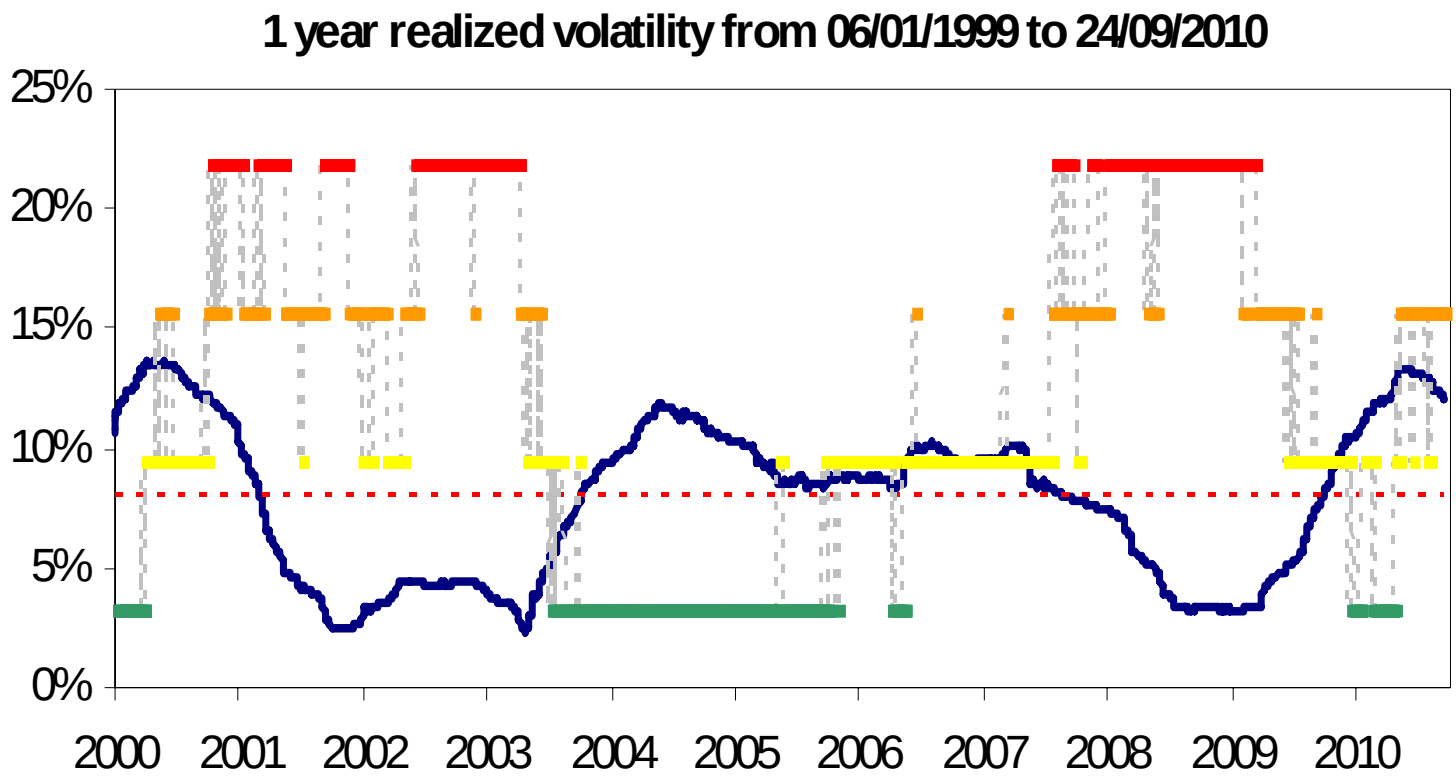
SHARPe 1Y Volatilität vs. Regimes

SHARPe hatte eine durchschnittliche realisierte 1Y Volatilität von 7.91%



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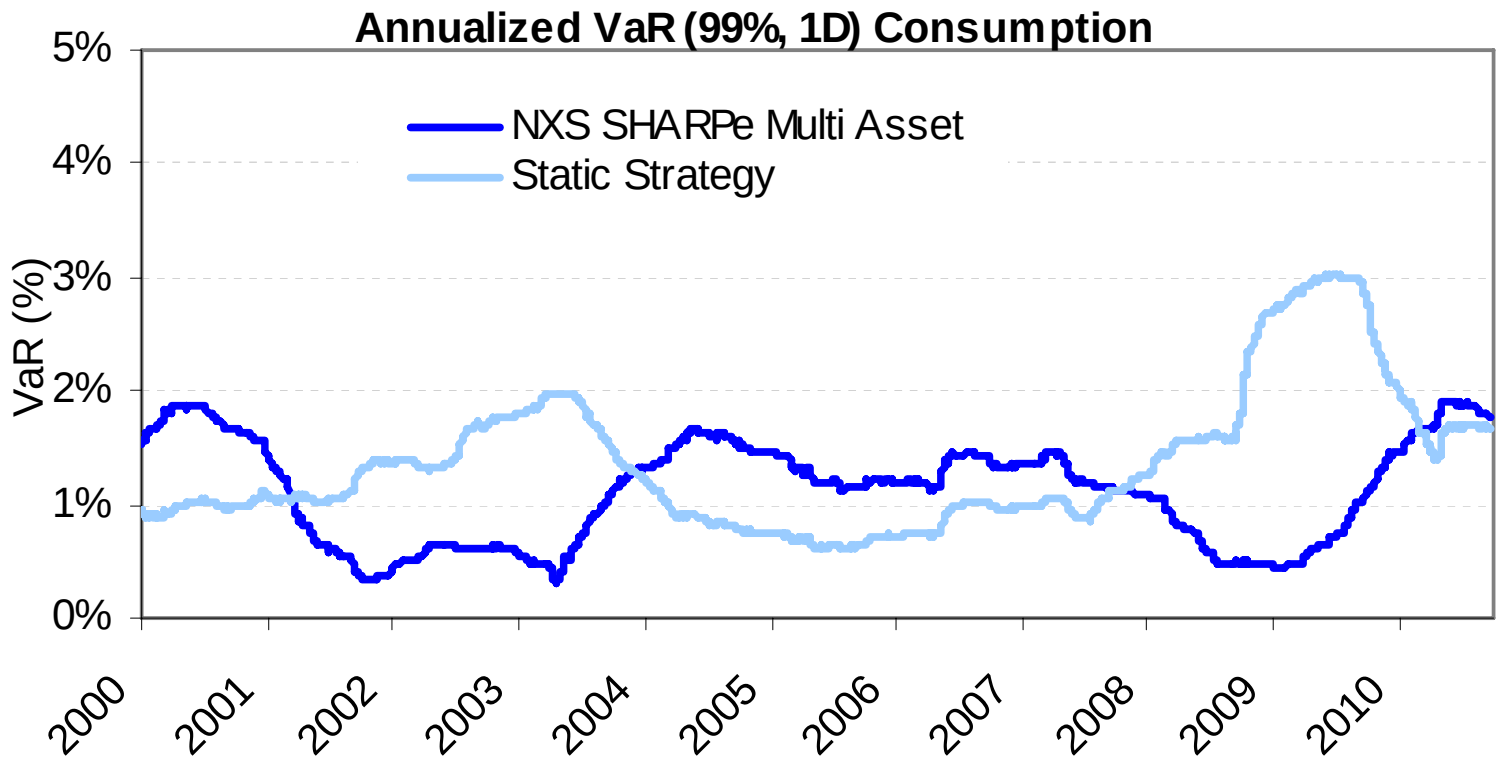
Antizyklischer VaR (99%, 1D) Effekt

SHARPe VaR verhält sich antizyklisch zum VaR einer statischen Strategie.



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Zusammenfassung statistischer Indikatoren

Statistics

	SHARPe Multi-Asset	Equity	Real-Estate	Commodity	Hedge Funds	Bond MLT	Bond ST	Cash
Average Annual Return	**11,14%**	3,10%	8,50%	8,13%	6,57%	4,85%	3,69%	2,78%
Volatility	**7,91%**	23,30%	16,17%	24,95%	6,29%	3,52%	1,21%	0,12%
Sharpe Ratio	**1,19**	0,01	0,35	0,21	0,60	0,59	0,75	0,00
Max Drawdown	**-10,09%**	-64,64%	-76,52%	-64,21%	-22,44%	-6,13%	-1,60%	0,00%
Calmar Ratio *(*)*	**1,21**	0,04	0,13	0,13	0,31	0,87	2,47	N/A
Volatility / Max Drawdown	**0,78**	0,36	0,21	0,39	0,28	0,57	0,76	N/A
Average Monthly Return	**0,88%**	0,14%	0,66%	0,63%	0,52%	0,38%	0,29%	0,22%
Max Monthly Return	**9,72%**	16,77%	24,82%	18,27%	8,53%	2,66%	1,63%	0,44%
Min Monthly Return	**-4,90%**	-15,93%	-22,01%	-26,62%	-8,54%	-2,10%	-0,68%	0,00%

(*) = Average Annual Return / Max Drawdown

Market Shocks (performance date to date)

	SHARPe Multi-Asset	Equity	Real-Estate	Commodity	Hedge Funds	Bond MLT	Bond ST	Cash
Internet Bubble (01/09/00 - 21/03/01)	**3,69%**	-18,86%	7,22%	-1,89%	2,40%	6,56%	4,22%	2,64%
11 September 2001 (01/08/01 - 01/11/01)	**1,67%**	-12,98%	-8,06%	-16,59%	-1,34%	3,49%	2,32%	0,99%
Equity Crisis 2002 (25/03/02 - 18/09/02)	**3,58%**	-22,20%	-1,20%	10,23%	2,18%	4,83%	3,00%	1,89%
Iraki Crisis (29/11/02 - 12/03/03)	**2,48%**	-11,11%	-4,33%	21,02%	2,40%	4,81%	2,07%	0,87%
Financial Crisis (13/07/07 - 09/03/09)	**1,77%**	-46,37%	-64,64%	-33,63%	-14,44%	14,33%	10,84%	6,61%

Correlation Matrix

	SHARPe Multi-Asset	Equity	Real-Estate	Commodity	Hedge Funds	Bond MLT	Bond ST	Cash
NXS SHARPe Multi-Asset	**100%**	**42%**	**34%**	**33%**	**17%**	**0%**	**1%**	**-1%**

Data for the period from 06/01/1999 to 24/09/2010

Sources : Bloomberg, Natixis

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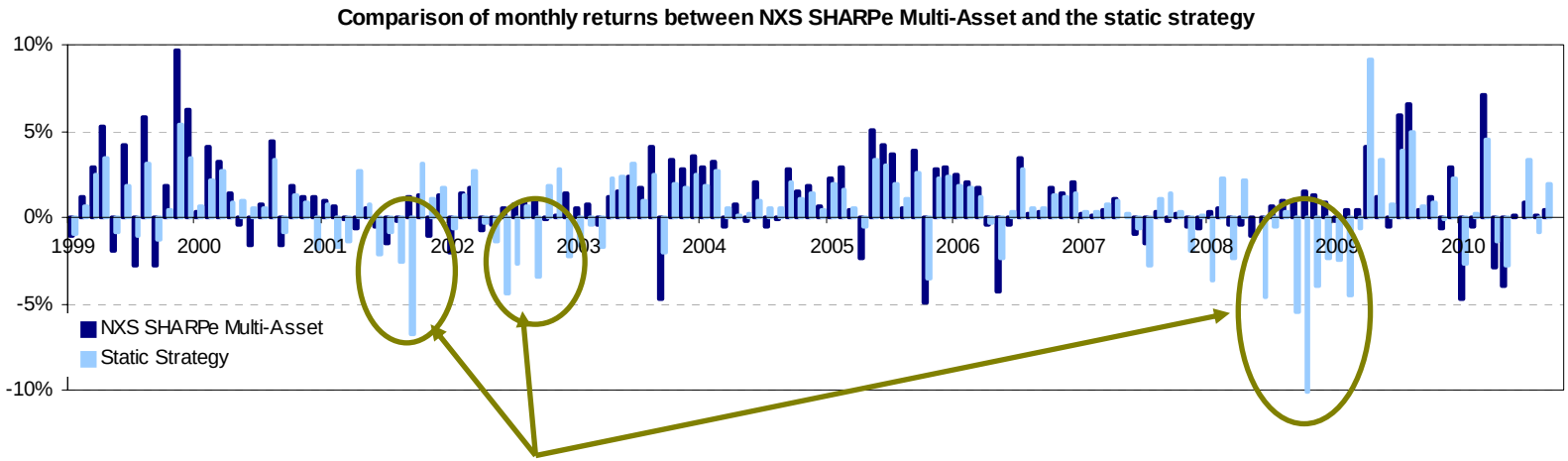
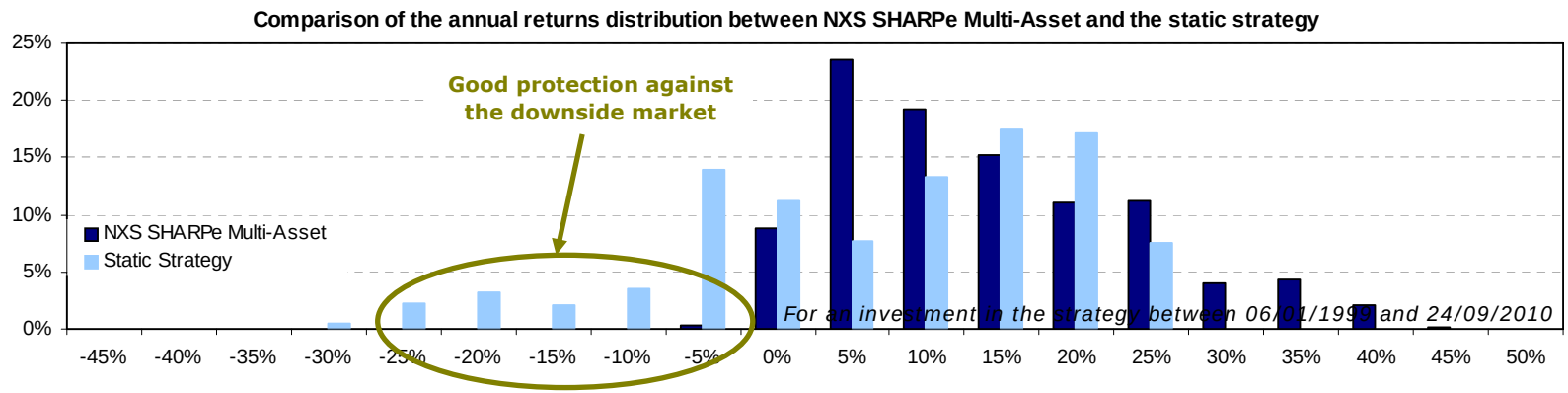
SHARPe Multi-Asset vs. statische Strategie

Statische Stretegie hat die durchschnittlichen SHARPe Gewichte: SHARPe vermeidet viele Monate mit negativem Return und outperformt.





Sources : Bloomberg, Natixis

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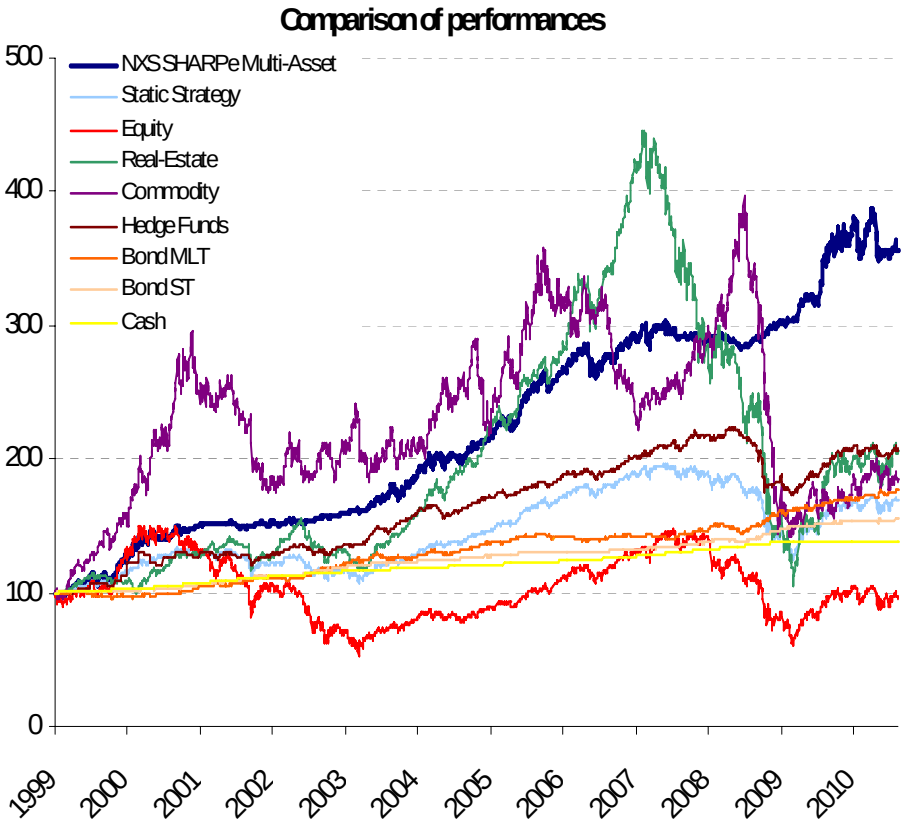
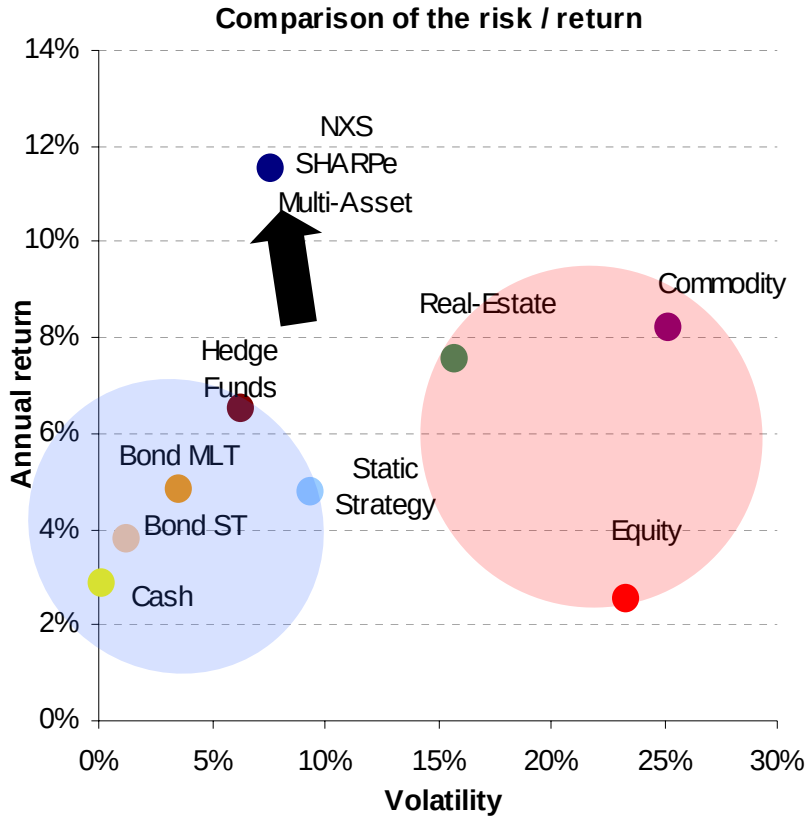
SHARPe™ hat die größte *Sharpe Ratio*





Sources : Bloomberg, Natixis

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Charakteristik der dynamischen Strategie

- **Transparente Asset Allocation:**
  - Risikoindikator ARPI wird auf Basis von Marktdaten berechnet
  - Portfolio investiert in handelbare Indices
  - Performance wird täglich auf Bloomberg - Ticker <NXSHMA Index> - veröffentlicht

- **Systematisch:**
  - Quantitatives Modell (HMM) ermittelt Risiko*regimes*
  - Objektives Management und automatische Allocation

- **Tägliche Liquidtät:**
  - SHARPe mark-to-market zu den Tagesschlusskursen
  - Täglicher Sekundärmarkt für SHARPEe basierte Produkte

- **Sophisticated Risk Management:**
  - Integrierter Investmentansatz
  - Antizyklisches VaR Verhalten

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Zentrale Grenzwertsätze

Warum die Normalverteilung (Gaußverteilung, Glockenkurve) „natürlich" ist:

Der Durchschnitt von „vielen" (unabhängigen – event. auch abhängigen*) Verteilungen nähert sich der Normalverteilung. (← math. super-unpräzise!)

Noch salopper:

Werden Daten von vielen zufälligen (unabhängigen, event. auch abhängigen) Faktoren bestimmt, so nähern sie sich der Normalverteilung …

z.B. IQ, Größen/Längen, Gewichte von biolog. Einheiten etc…

*** *mixing* etc…**

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The End

Danke sehr!

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