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Synthetic Options and Protection for Inflation-/Deflation

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Setting the Stage

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→ We are living in an environment of high uncertainty: The New Normal

- Since the credit and banking crisis started in 2007, we have experienced:
- Banks collapsing, banking system under persistent stress
- More frequent regulatory intervention
- Markets driven by politics
- Governments at the edge of defaulting [Greece, Ireland, Portugal]
- High debt burdens of industrial countries, and growing!
- Austerity measures forced upon nations by other nations, violent protests with casualties
- High vulnerability to [political / economic] shocks
- High, directionless volatility [from risk-free return to return-free risk]
- Tail risks with higher probability: One of the next tail risk events could be high or very high inflation or deflation, strongly rising interest rates or falling equity markets

→ **In the New Normal Environment, there is demand for Downside Protection / Tail Risk Insurance**

Implementation of Downside Protection / Tail Risk Insurance

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- Buy put options
  - Most effective
  - "Fire and forget"
  - **Very expensive!** Costs to insure CHF 100 for one month @ 15% vol = ca. CHF 1.8 or 12*1.8 = CHF 21.6 p.a.!
  - Modifications: Collar strategies

- Long volatility strategies
  - What do they actually do? Transparency?
  - Often implemented with not very liquid out-of-the-money options / OTC derivatives: Counterparty risks?
  - How do they fare if nothing happens? **Option premium is lost**
  - Typically hedge fund like investment vehicles with the common disadvantages of hedge fund investments, for example, illiquidity, lock-up periods

→ Both buying put options and long vol strategies lose the option premium if underlying event does not materialise

- Synthetic replication of options:
  - Based on delta-hedging
  - Based on their trading strategy

Synthetic Replication of [Put] Options

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- General idea is to use, for example, the Black/Scholes formula and delta-hedge
- Example: We want to insure equity exposure of CHF 10 mln against falling prices
- Idea is to replicate a put option with strike X=100
- At trade inception, S=X, delta = -0.50: We sell CHF 5 mln of equity futures short
- If equity prices fall to S=95, the delta moves to -0.81: We need to sell CHF 8.1 mln short
- We came closer to put replication the more frequently we rebalance [B/S: continuous rebal.] => costs!

	1	2
Share price (S)	100.00	95.00
Exercise price (X)	100.00	100.00
Int rate-cont (r)	0.01	0.01
Dividend yield (q)	0.02	0.02
Option life (T, years)	1 M	1 M
Volatility (σ)	0.20	0.20
Put	2.36	5.67
Delta	-0.50	-0.81

Synthetic Replication of [Put] Options

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- Similar approaches are, for example, Rubinstein / Leland (1995), Tilley / Latainer (1985), Fong / Vasicek (1988), Bookstaber/Langsam (1988), Benninga / Blume (1985)

- Best rebalancing frequency?
- Transaction costs?
- Rebalancing requires attention and resources!
- Does option replication work in practice?
- Experience of 1987: Program trading & Black Monday [19 Oct 1987]: Dow Jones Index lost -23% [cf., for example, Furbush (1989)]

Trading Strategies with Option-Like Return Profiles

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- Trading Strategies generate option-like return profiles
- Example: CTAs [Fung / Hsieh (1997, 2001)
- Idea is based on Merton's Market Timer (1981). See also Huber (2005)

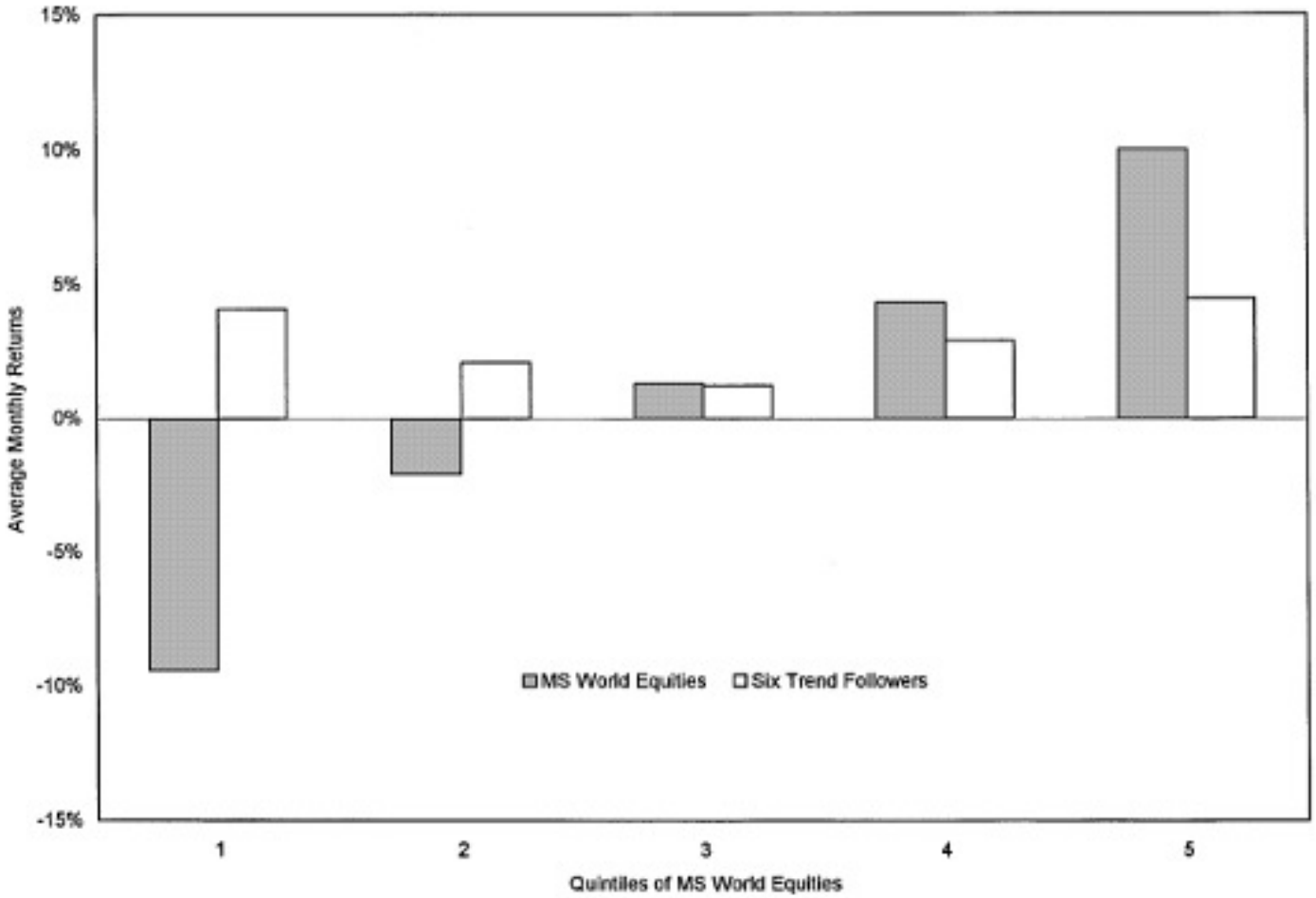

Figure 1
Average monthly returns of six large trend-following funds in five different MS world equity market states

Source: Fung / Hsieh (1997), p. 289, Fung / Hsieh (2001), p. 316

Trading Strategies with Option-Like Return Profiles

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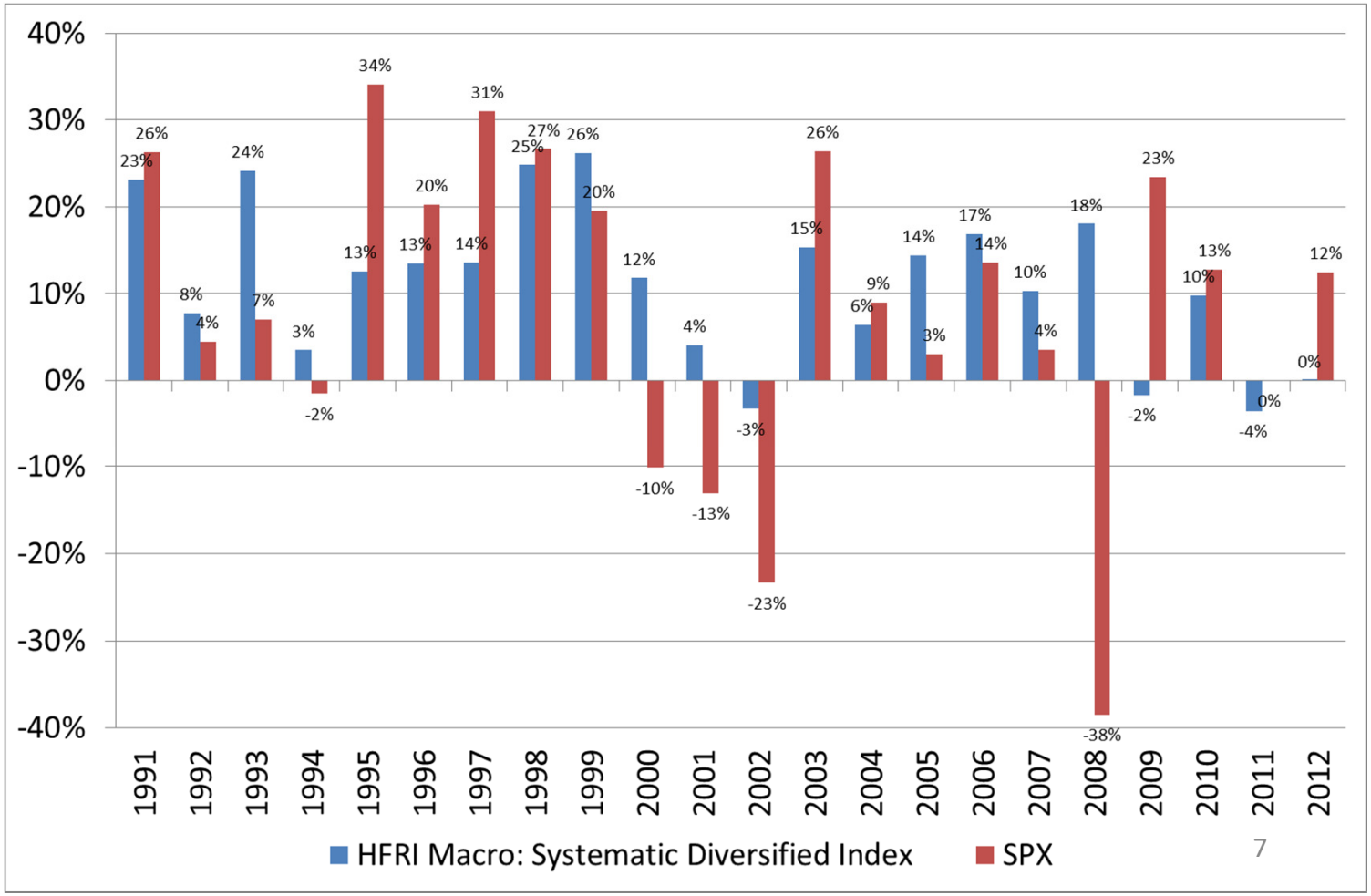
- Can the option-like return profile of systematic strategies be proved empirically?
- Example: HFRI Macro: Systematic Diversified Index vs. SPX, 1991-2012
- CTAs typically do not perform well in oscillating markets [e.g., 2011, 2012]



Source: www.hedgefundresearch.com, Reuters

How to Create Tail Risk Insurance (1)

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- Focus on mid- to longer-term tail risk events [e.g., 2008, horizon 3 – 12 months]
- NOT: Short-term sell-offs [Tsunami Japan 3/2011]
- We look for payouts as extreme as possible
- Technical trading rules [incl. long/short trend-following] tend to do better in more volatile times

→ Increase exposure when there is high volatility AND become more concentrated

→ Reduce exposure when there is low volatility AND become more diversified

- Simple implementation with as few assets as possible [two assets only: SPX and US Treasuries]
- Exchange-traded, liquid instruments
- Rebalancing only 1x per month
- No loss of an option premium

How to Create Tail Risk Insurance (2)

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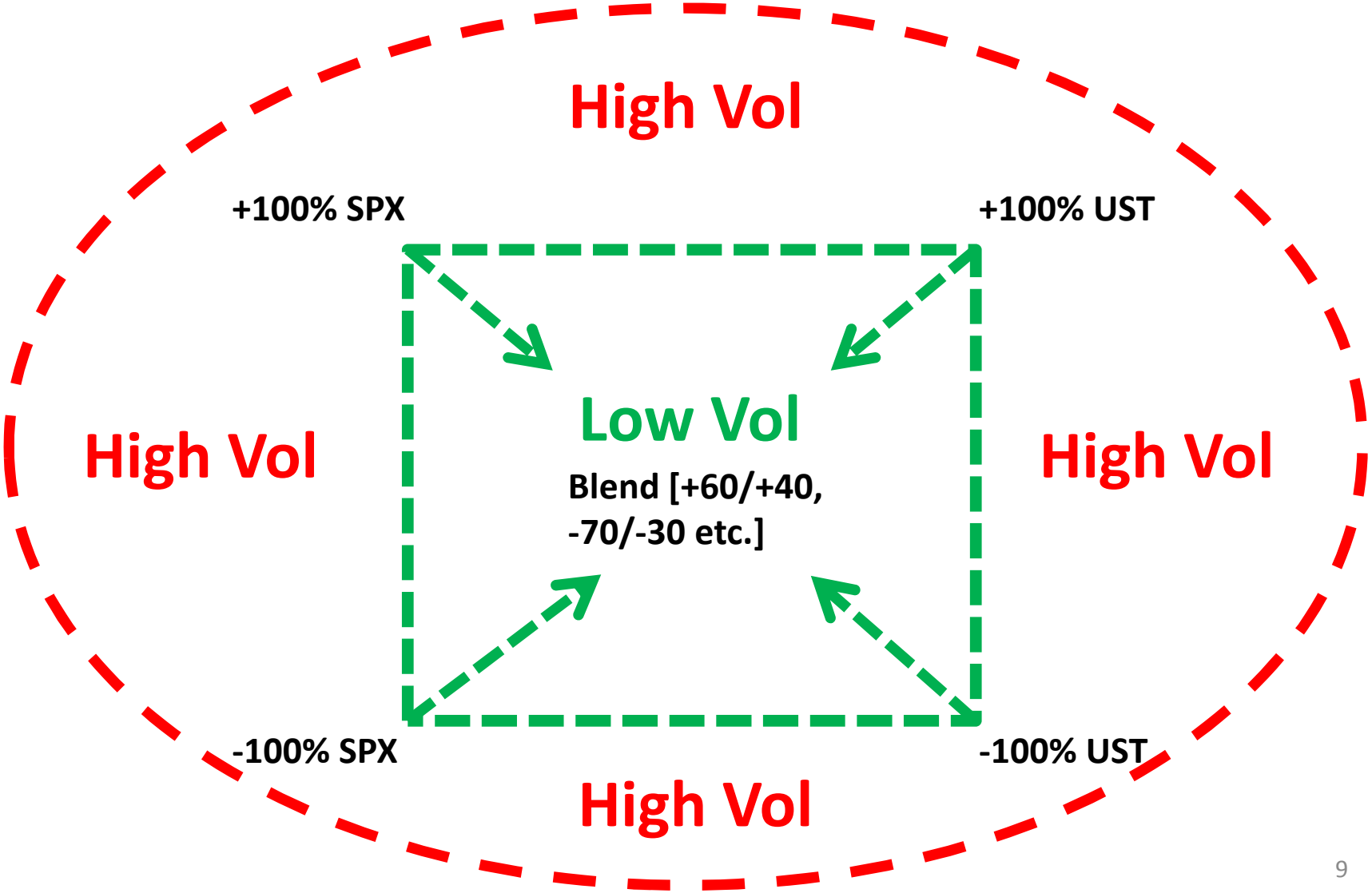

How to Create Tail Risk Insurance (3)

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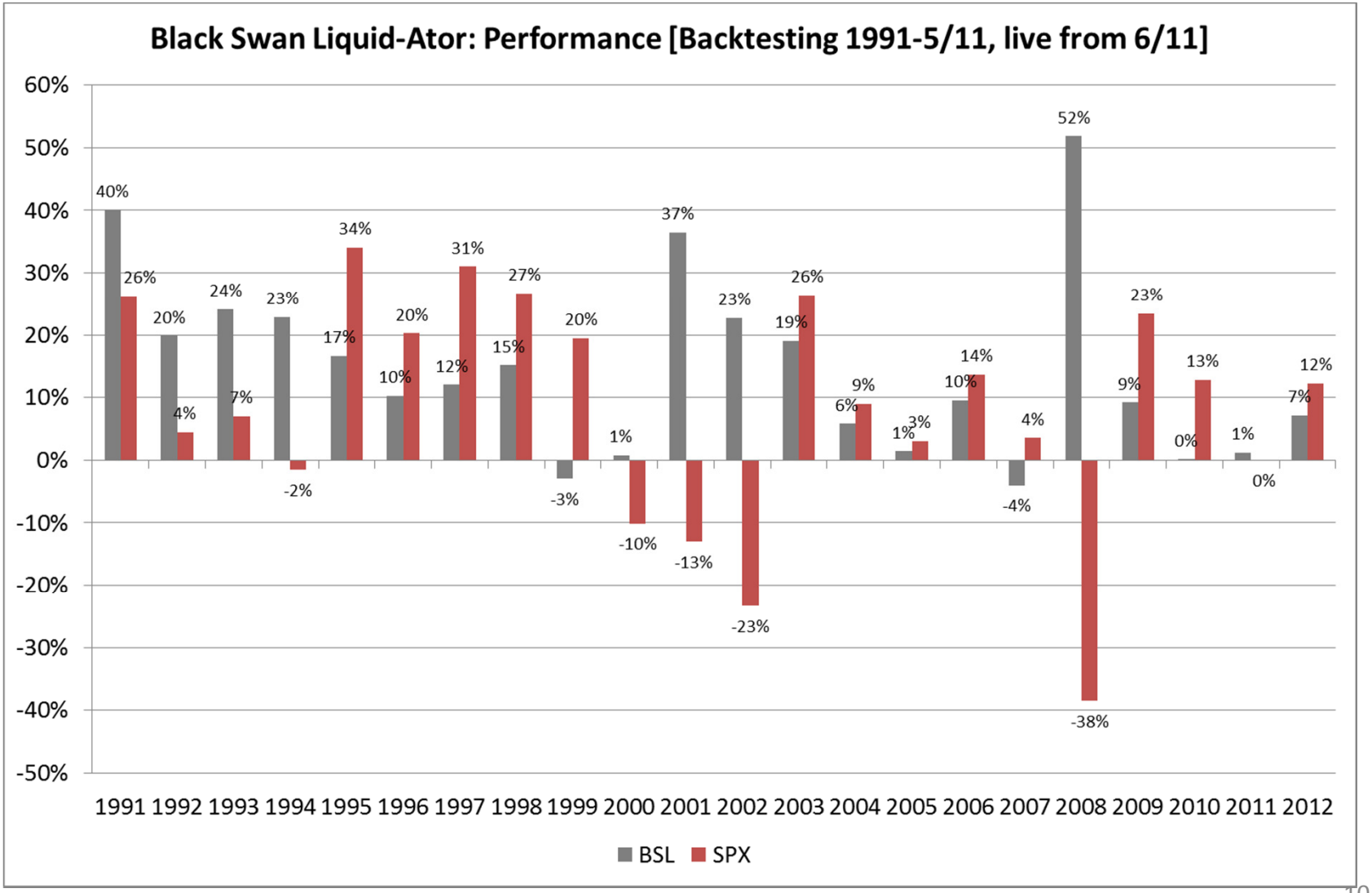

Performance figures start in 7/1991, are in USD and include 0.05% transaction costs, but no management fee

Inflation / Deflation Protection: Requirements

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1) We need a strategy that provides effective protection against **inflation** AND **deflation**: Insurance against the **tail risks** of inflation AND deflation => **long straddle on inflation**
2) In a low inflation / low deflation environment, it should aim to deliver **positive absolute returns**: no loss of option premium

- Implemented with **highly liquid** instruments [futures], **daily liquidity**
- Transparency
- Low-frequency trading: **Rebalancing and trading only 1x per month**
- Ideally, leveraged exposure to changes in inflation / deflation: A small allocation to the product can help to protect a larger part of a client's portfolio

→ Can we synthetically create a straddle on inflation?

Inflation / Deflation Protection: Requirements

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Simulated Scenarios (simplified)

Price Environment	Inflation p.a.	Estimated Return
Deflation	-5%	+
Price Stability	0%	0
Inflation	5%	+
Running Inflation	10%	++
Running Inflation	20%	++
Galloping Inflation	50%	+++

- **Option-like, convex return profile with respect to inflation and deflation**
- Strategy targets to address tail risks / a black swan event with respect to inflation and deflation
- If tail events strong inflation or strong deflation do not materialise, **still a neutral or positive absolute return is targeted**

Possible Solutions for Inflation Straddle

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1) Allocate long-only between commodities and government bonds
2) Long/short strategy trading a) in commodities only, b) in commodities and government bonds

- There is no explicit link between statistical measures, like CPI, and the strategies' performance.
- Use commodities with a high sensitivity to an increase in inflation or deflation expectations: For example, Crude Light Oil, Gold, Industrial Metals

CPIs in Switzerland and US 1970-1980

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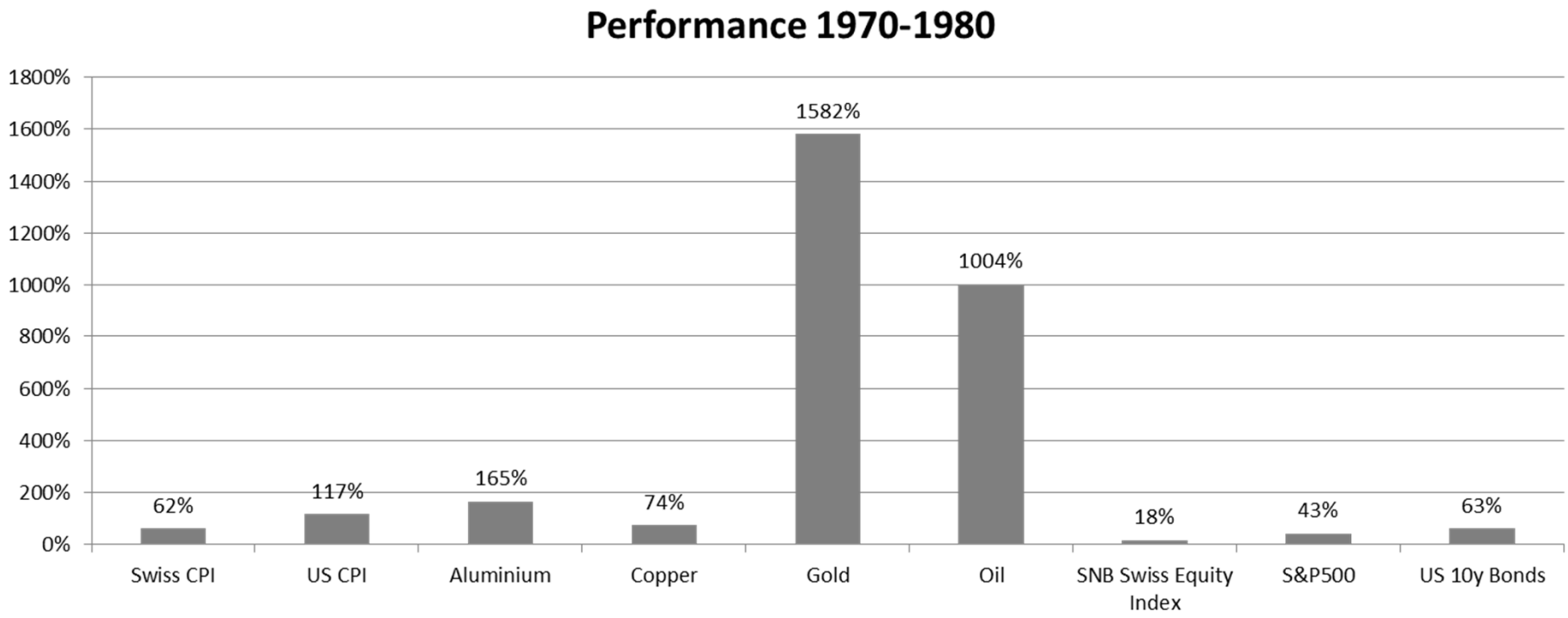
- The 1970s can be taken as an example for a high inflation period: Both Swiss and US CPI showed high inflation in this period
- Gold, Crude Oil, Aluminium and Copper with high gains



Synthetic Straddle on Inflation

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- We propose a solution for 1): A Simple Trend-Follower allocates long-only between commodities and government bonds
- Two baskets of assets:
  1) US Treasuries 5Y
  2) Commodity basket: 1/3 Crude Light Oil, 1/3 Industrial Metals [Aluminium, Copper, Nickel, Zinc], 1/3 Gold

- Trading Rule:

  If Comdty[3M Moving Average] > UST[3M Moving Average] then

  +100% Comdty, 0% UST

  Else

  0% Comdty, +100% UST

- Desired: Convex Inflation Beta!

Inflation Quintiles

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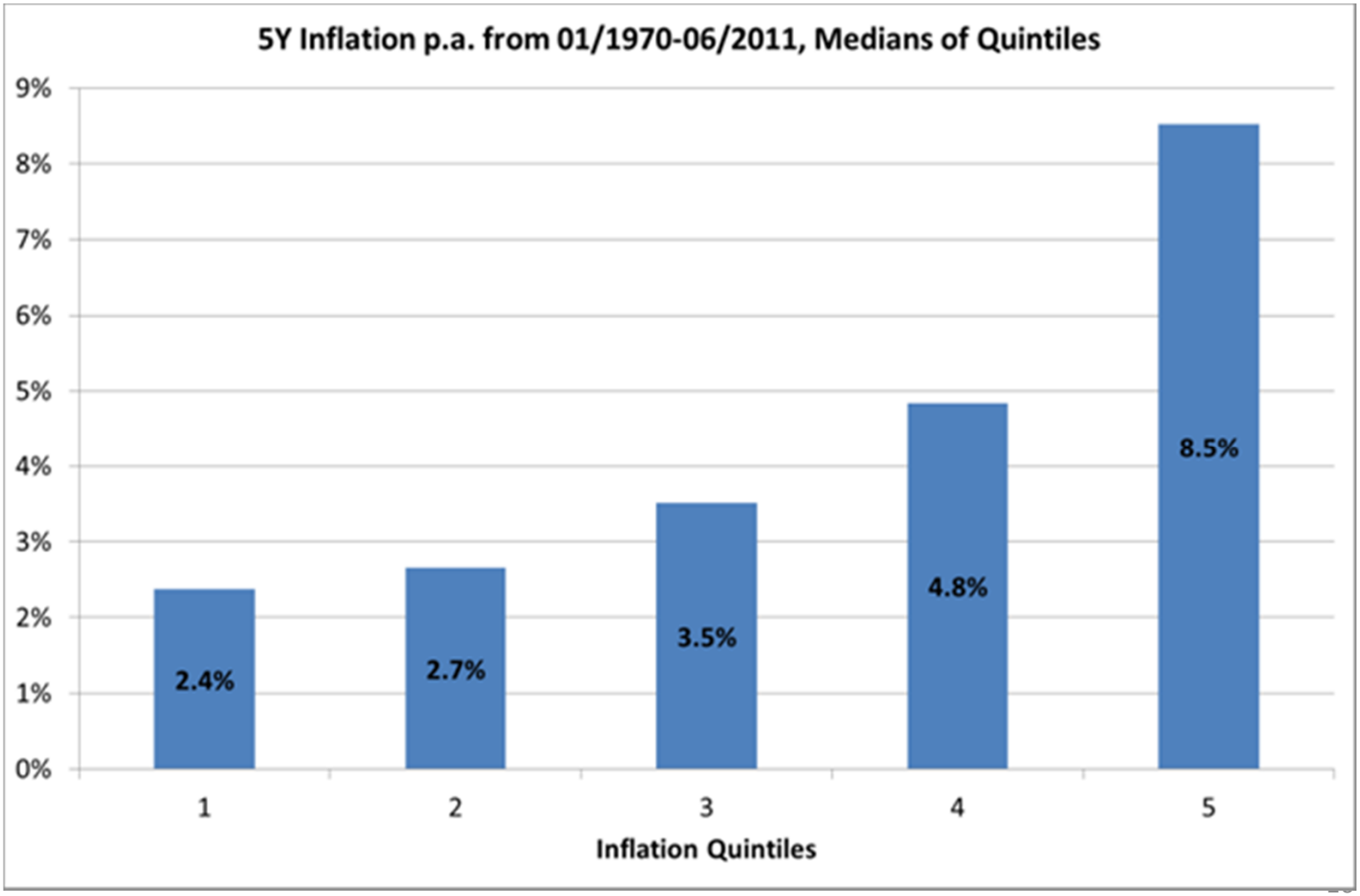
- US inflation, based on the US CPI



Source: Huber (2011), p. 6

CPIs in Switzerland and US 1970-2010

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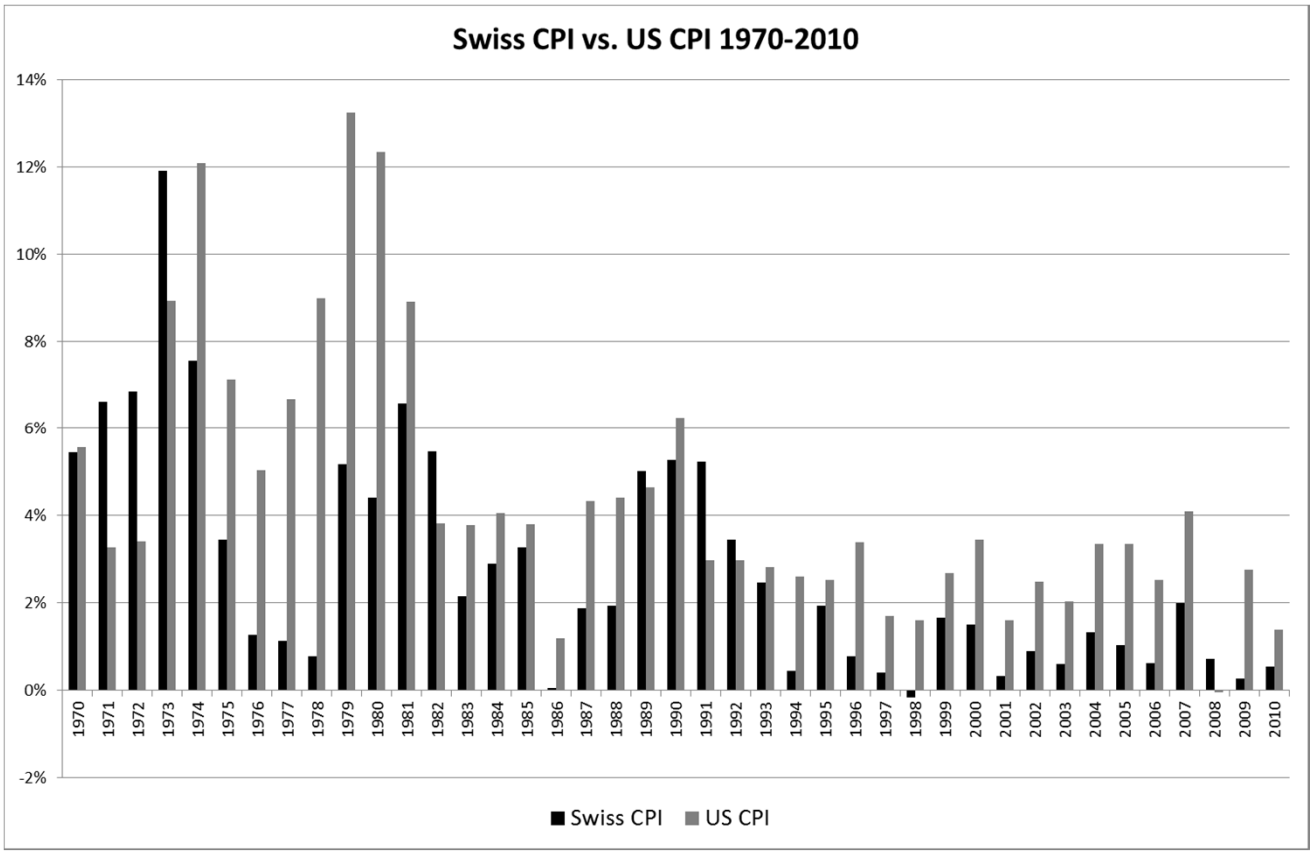
- From 1970 to 2010, there is a positive relationship between the US CPI and the Swiss CPI: Switzerland is not isolated from the US
- Correlation coefficient between US CPI and Swiss CPI [1970-2010] = 0.58
- If inflation / deflation picks up in the US, it is likely that Switzerland will be affected as well



Defining Inflation Beta

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- Inflation Beta is calculated as elasticity over five-year horizons:

$$inflation\ beta = \frac{\frac{p_{i,t+5Y}}{p_{i,t}} - 1}{\frac{CPI_{t+5Y}}{CPI_t} - 1}$$

- An inflation beta of 1 means that an asset's price increases at the same rate as inflation over a five-year horizon

Database for Inflation Straddle

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- Historical quarterly data from 12/1969 to 06/2011 [Source: UnctadStat, Bloomberg, US Census Bureau]
- All assets in USD [for a detailed description see Huber (2011)]:
  - MSCI USA equities
  - 5 Y US treasury notes [5Y_TR], 3M T-Bills [TB3M]
  - industrial metals [copper, lead, aluminium, zinc, tin], equal weighted [INDM]
  - soft commodities [rice, sugar, soybeans, coffee, cotton, wheat], equal weighted [SOFT]
  - Inflation-linked bonds [historical time series generated according to method documented by Kothari / Shanken (2004)], [ZCIP]
  - Gold, Silver [GOLD, SILV]
  - Crude Oil [CRUD]
  - US New Home Sales Prices [NHSP]

Synthetic Straddle on Inflation: Results (1)

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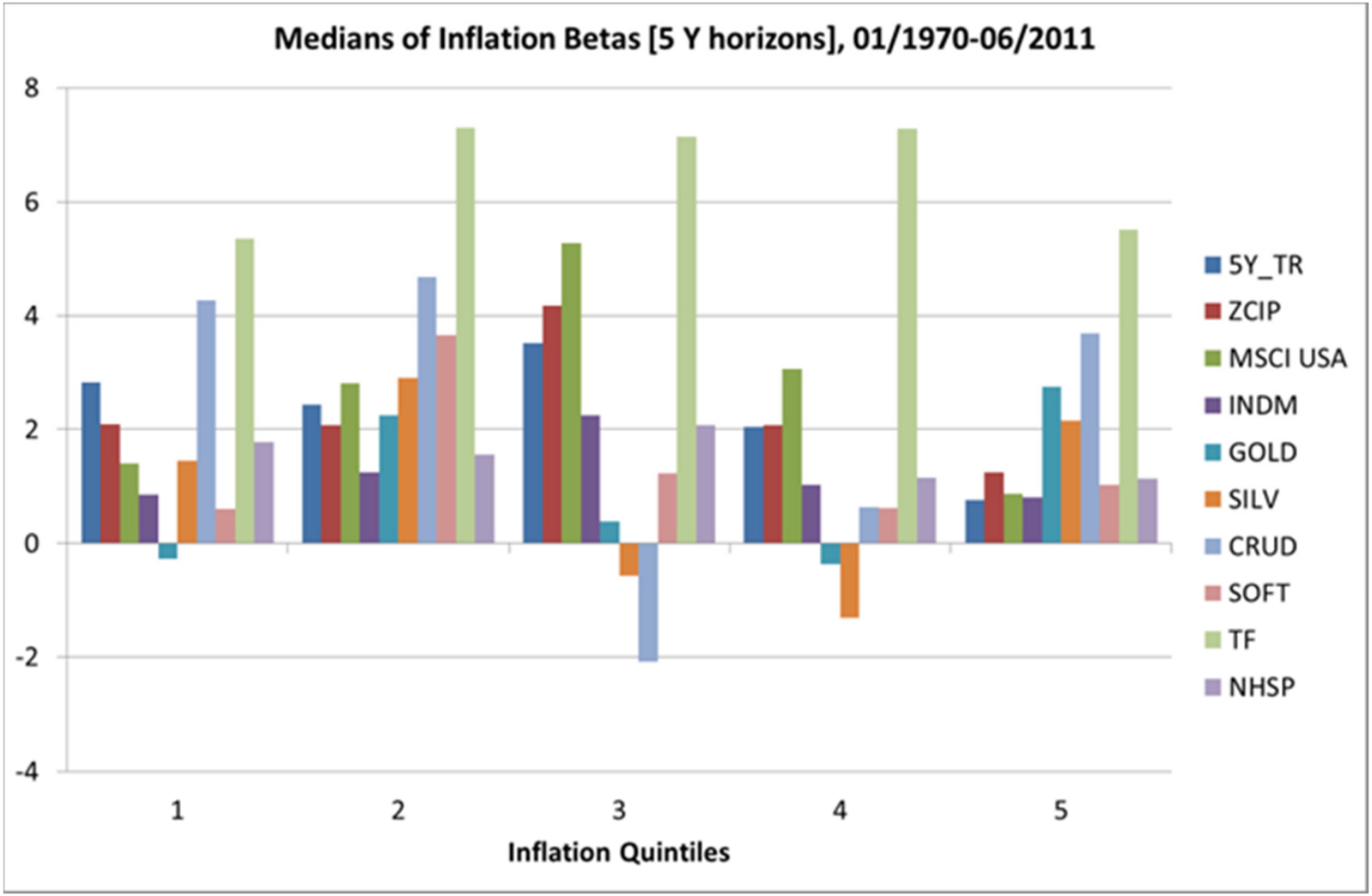
- Does our simple Trend-Follower exhibit convex inflation beta?



Source: Huber (2011), p. 8

Synthetic Straddle on Inflation: Results (2)

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- Equities [MSCI USA] with lower inflation beta when inflation rises
- Gold with unstable inflation beta between -0.4 and 2.8. Higher inflation beta with higher inflation
- Real Estate inflation betas 1.2 – 2.1 in all environments
- Trend-follower with high inflation beta in all environments [5.4 – 7.3]

Summary

- Typically, buying insurance is expensive [insurance premium = option premium]
- Trend-Following produces convexity for longer-term horizons!

- Even simple trend-following strategies can add value
- Basis risk remains

- How do synthetic insurance strategies work in portfolio context [for tail risk insurance / inflation protection]?

References

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- Benninga, S., Blume, M. (1985): On the Optimality of Portfolio Insurance, in: Journal of Finance, Vol. 40, Iss. 5, pp. 1341-1352.
- Bookstaber, R., Langsam, J. A. (1988): Portfolio insurance trading rules, in: Journal of Futures Markets, Vol. 8, pp. 15-31.
- Childers, V. (2011): Inflation: An Ounce of Protection, in: CFA Institute Conference Proceedings Quarterly, June 2011, pp. 1-10.
- Fong, H.G., Vasicek, O. (1988): Achieving the best return in asset allocation without Forecasting, in: Arnott, C., Fabozzi, F.J.: Asset Allocation: A Handbook of Policy Choices.
- Furbush, D. (1989): Program Trading and Price Movement: Evidence from the October 1987 Market Crash, in: Financial Management, Vol. 18, No. 3 (Autumn, 1989), pp. 68-83.
- Huber, C. (2005): Konstruktion stressresistenter Portfolios aus Hedge Funds-Strategien mit optionsähnlichen Renditestrukturen, in: Dichtl, H., Kleeberg, J., Schlenger, C. (Eds.): Handbuch Hedge Funds, Uhlenbruch Verlag, Bad Soden/Ts., pp. 321-361.

References

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- Huber, C. (2011): Purchasing Power Protection with a Simple Trend-Following Strategy in Different Inflation Regimes, Working Paper, www.rodexrisk.com.
- Kothari, S., Shanken, J. (2004): Asset Allocation with Inflation-Protected Bonds, in: Financial Analysts Journal, Vol. 60, pp. 54-70.
- Merton, R. (1981): On Market Timing and Investment Performance. I. An Equilibrium Theory of Value for Market Forecasts, in: Journal of Business, Vol. 54, No. 3, pp. 363-406.
- Rubinstein, M., Leland, H. (1995): Replicating Options with Positions in Stock and Cash, in: Financial Analysts Journal, Vol. 51, No. 1, Jan/Feb, pp. 113-121.
- Tilley, J.T., Latainer, G.D. (1985): A Synthetic Option Framework for Asset Allocation, in: Financial Analysts Journal, Vol. 41, No. 3, Jun./Jul., pp. 32-43.

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Appendix: Inflation Betas

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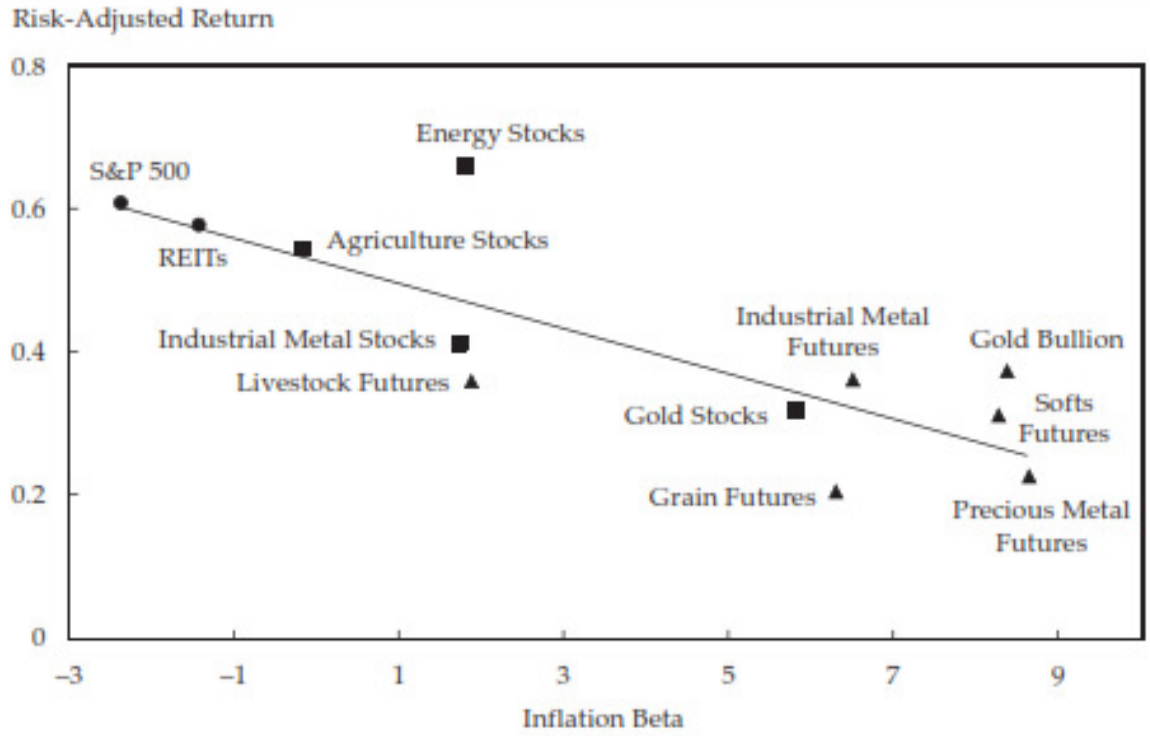
- Trade-off between inflation beta and risk-adjusted returns
- Interesting area: Inflation betas of 3 and more

Figure 4. Inflation Beta and Risk-Adjusted Returns for 12 Asset Classes, 1965–2009



Notes: Commodity futures prior to 1990 are on a U.S. consumption–weighted basis. Futures data are from the AllianceBernstein series prior to 1970, the MJK Commodity Futures Database for 1970–1990, and Dow Jones–UBS thereafter. Commodity-related stock data are from the Kenneth R. French Data Library. Gold bullion is sourced from the London Bullion Exchange. REITs are represented by the NAREIT U.S. Equity REIT Index.

Sources: Based on data from the U.S. Bureau of Labor Statistics, Kenneth R. French Data Library, Global Financial Data, London Bullion Exchange, *London Times*, NAREIT, *New York Times*, *Wall Street Journal*, and AllianceBernstein.

Source: Childers, V. (2011), p. 6.