

# **The Innovation Drive for Pension Funds: The Impact of Demographic Change on Strategic Asset Allocation**

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Peter Bänziger  
Head of Asset Management and Institutional Clients  
Swisscanto Asset Management Ltd.

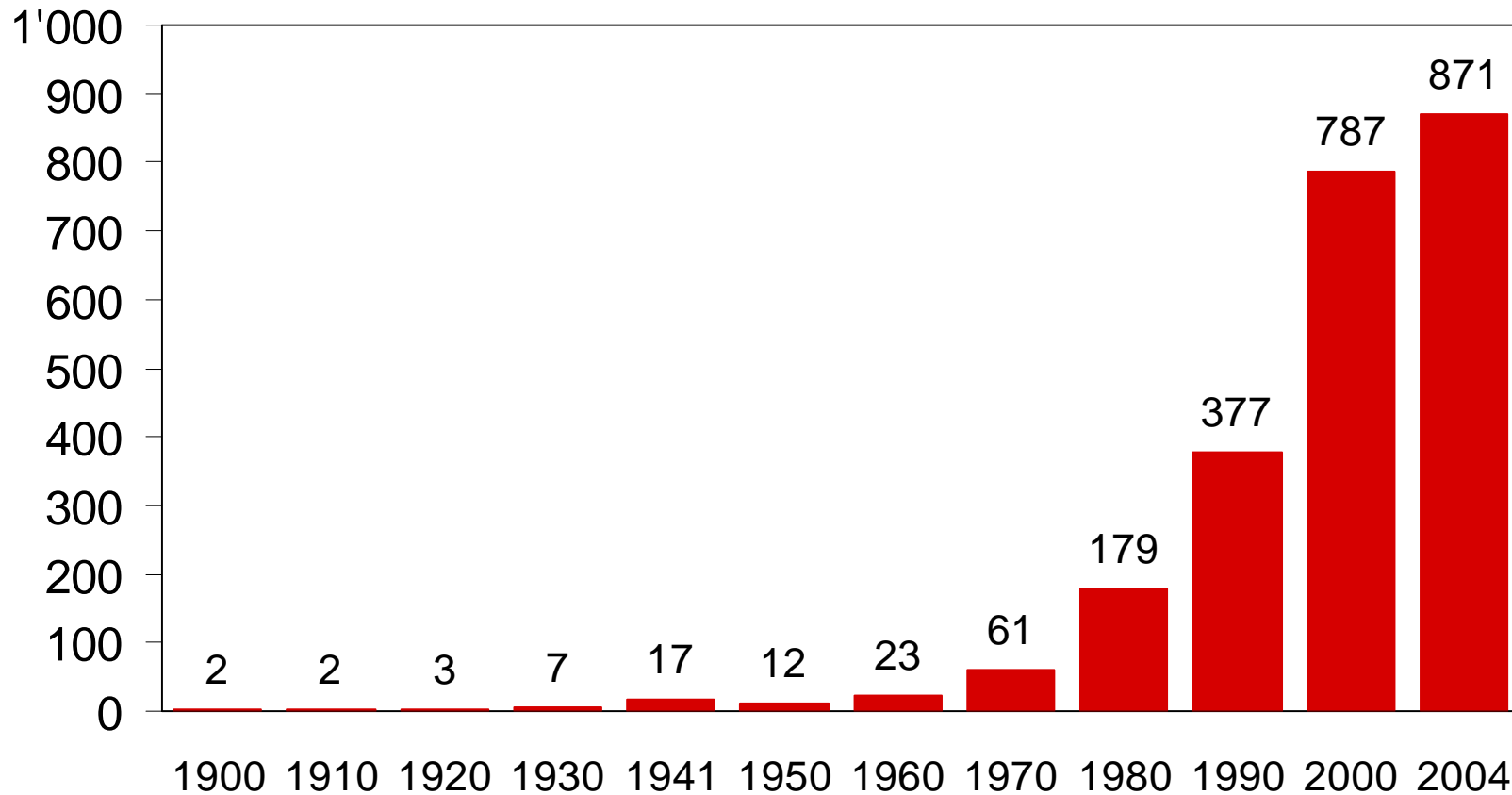
# Agenda

- **The impact of an ageing population on pension funds**
- Initial position illustrated using an example
- Consequences from the general conditions
- Possible investment concepts
- *One* possible solution
- Conclusions

Annex: Sources and Literature

# Population development

## Number of individuals in Switzerland aged 100 years or older



Source: Federal Statistical Office

# Causes of ageing (1)

## Increase in life expectancy (CH)

Life expectancy at age 65			Equivalent to age	
Year	Men	Women	Men	Women
1880	9.6	9.8	74.6	74.8
1910	10.2	10.9	75.2	75.9
1940	11.6	13.1	76.6	78.1
1970	13.3	16.3	78.3	81.3
1990	15.5	19.7	80.5	84.7
2005	18.1	21.6	83.1	86.6
2050 <sup>1</sup>	22.5	25.5	87.5	90.5

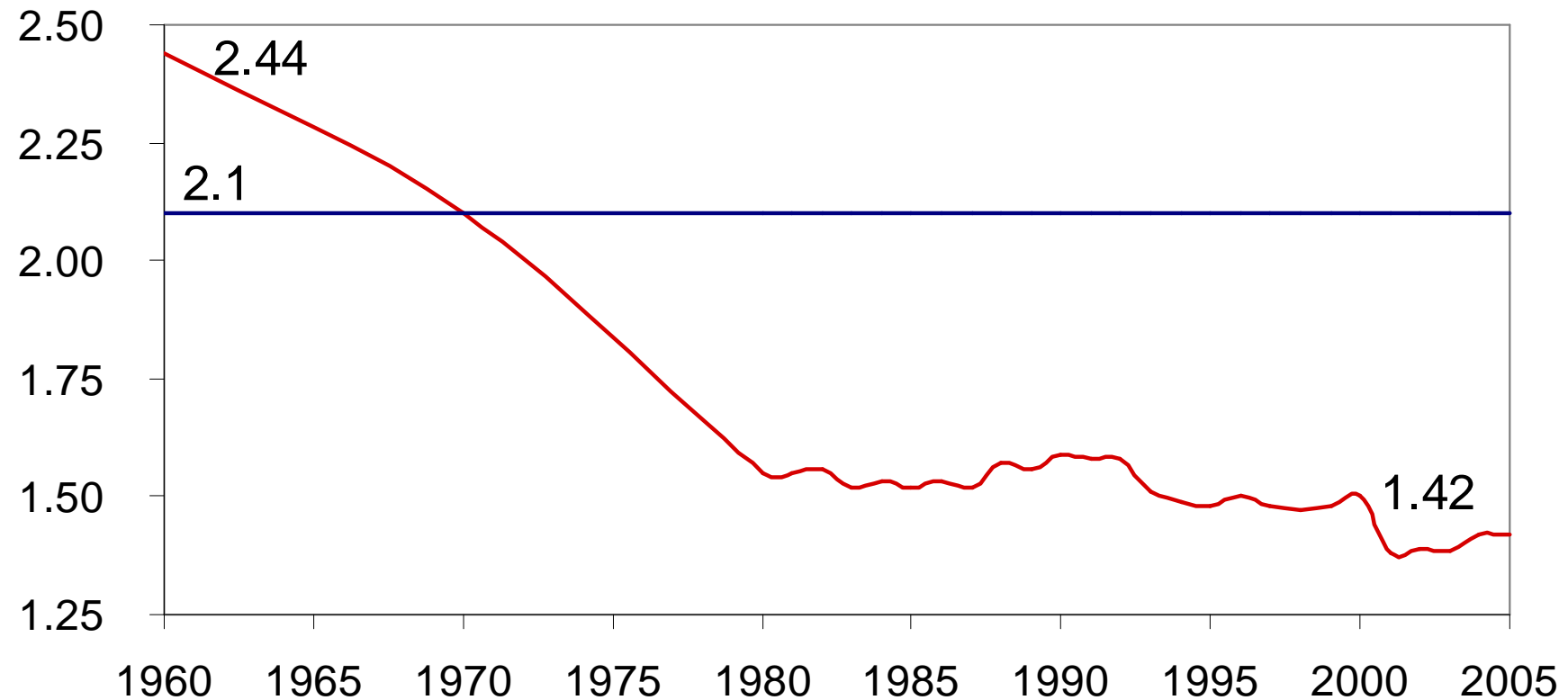
<sup>1</sup> Scenario "Trend" (A-00-2005), Federal Statistical Office

Sources: Swiss mortality tables, Federal Statistical Office

## Causes of ageing (2)

Decrease in number of children (CH)

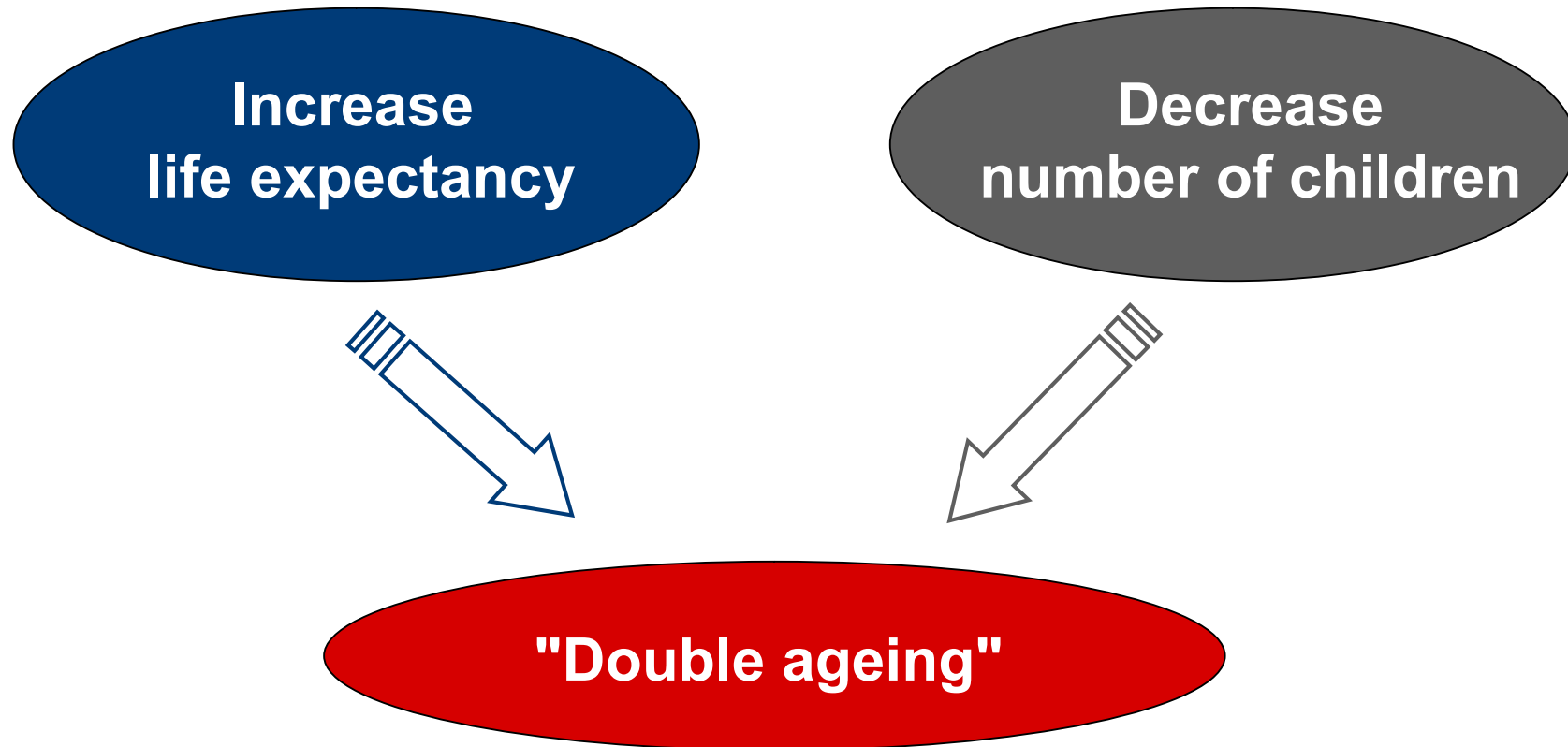
Birth rate (number of children per woman)



Source: Federal Statistical Office

# Causes of ageing (3)

## Conclusion



# Impacts on pension funds (1)

Financing according to funding principle

- Contributions of employer and employee, deposits
- Capital return as "third contributor"
- 2004: CHF 48 billion earnings (of which CHF 14 billion capital gains), CHF 35 billion payments

# Impacts on pension funds (2)

## Cashflow and investment policy

- **"Immature pension fund": Earnings > Payments**  
Contributions and deposits > Pension and capital payments  
⇒ longer investment horizon,  
liquidity is not a strategic objective
- **"Mature pension fund": Earnings < Payments**  
Contributions and deposits < Pension and capital payments  
⇒ Challenging cash management; shorter investment horizon;  
matching maturities (contentious)

# Impacts on pension funds (3)

## Risk carrier

Example: Balance sheet in case of underfunding (schematic, without provisions), cash ratio of 95%

*"Immature pension fund"*

PC employees	90
PC pensioners	10
Underfunding	-5

*"Mature pension fund"*

PC employees	10
PC pensioners	90
Underfunding	-5

# Impacts on pension funds (4)

Restructuring within one year

<i>Restructuring through returns</i>	"Immature PF"	"Mature PF"
Interest rate employees (0%)	0	0
Interest rate pensioners (4%)	0.4	3.6
Compensate underfunding	5.0	5.0
<b>Returns for restructuring</b>	<b>5.7%</b>	<b>9.1%</b>
	(5.4 / 95)	(8.6 / 95)

## *Restructuring through contributions*

Insured wages	45	5
<b>Required contributions</b>	<b>12%</b>	<b>172%</b>
	(5.4 / 45)	(8.6 / 5)

⇒ Restructuring a mature pension fund is problematic.

# Impacts on pension funds (5)

## Possible solutions

- Investment
  - Expanding scope of investments abroad
- Pension scheme
  - "Realistic" assumptions  
(conversion rate, actuarial interest rate, minimum provisions based on actuarial rather than political considerations)
  - Division of pension into a guaranteed pension and a bonus portion
- Pensioner as risk carrier
  - Participation of pensioners in investment success
  - Pensioners can be involved in the restructuring

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# Pension fund of company X: Initial position at end of 2006

- Partial liquidation on account of closures and sale of companies
- 200 employees (assumption: stable)
- 1200 pensioners
- Cash ratio 112%
- Expected return 4%
- Coincidental projection of pension fund commitments
- Analysis of actuarial cashflows

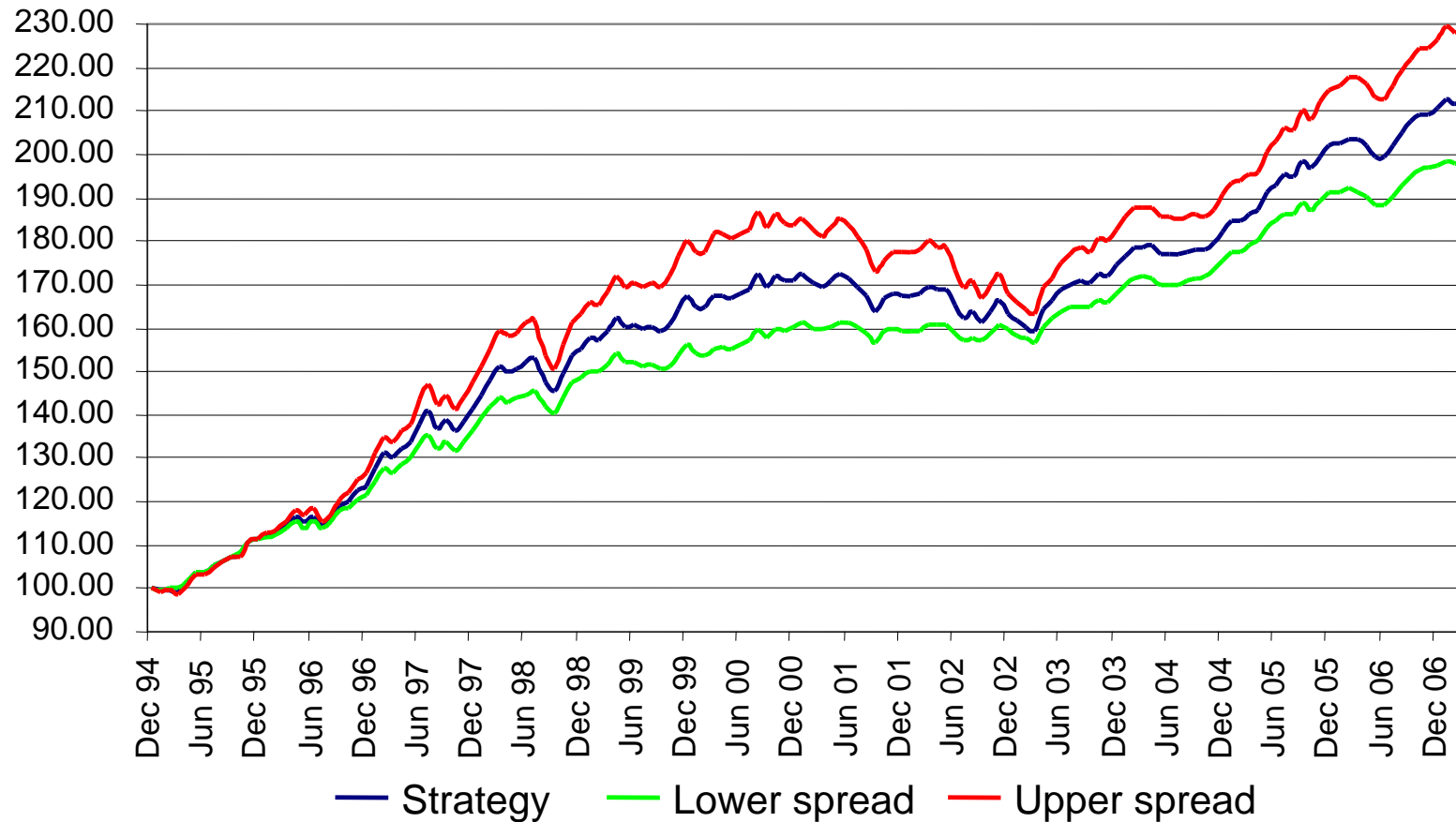
# Initial position of pension institution

Fluctuation reserves: 12%, expected return: 4%

	Weighting strategy	Lower spread	Upper spread
Liquidity / Time deposits	10%	15%	3%
Swiss bonds incl. loans	40%	50%	30%
Foreign bonds foreign currencies	9%	5%	13%
Equities, abroad	13%	10%	16%
Equities, Switzerland	13%	10%	16%
Real estate	15%	10%	18%
Alternative investments	0%	0%	4%
<b>Expected return</b>	<b>4.35%</b>	<b>3.92%</b>	<b>4.87%</b>
<b>Risk</b>	<b>5.35%</b>	<b>4.34%</b>	<b>6.52%</b>

# Strategy performance

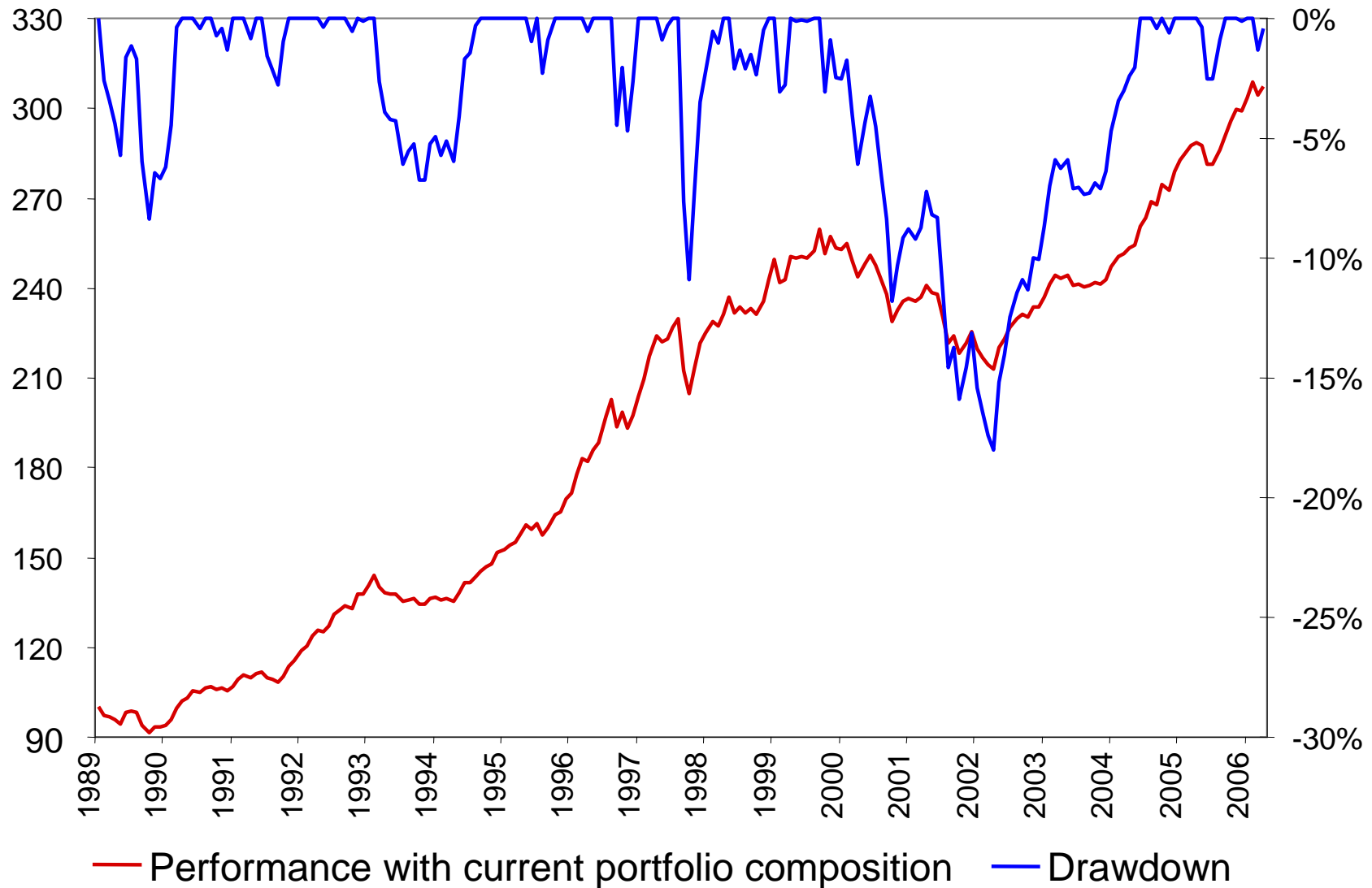
Current strategy in retrospect



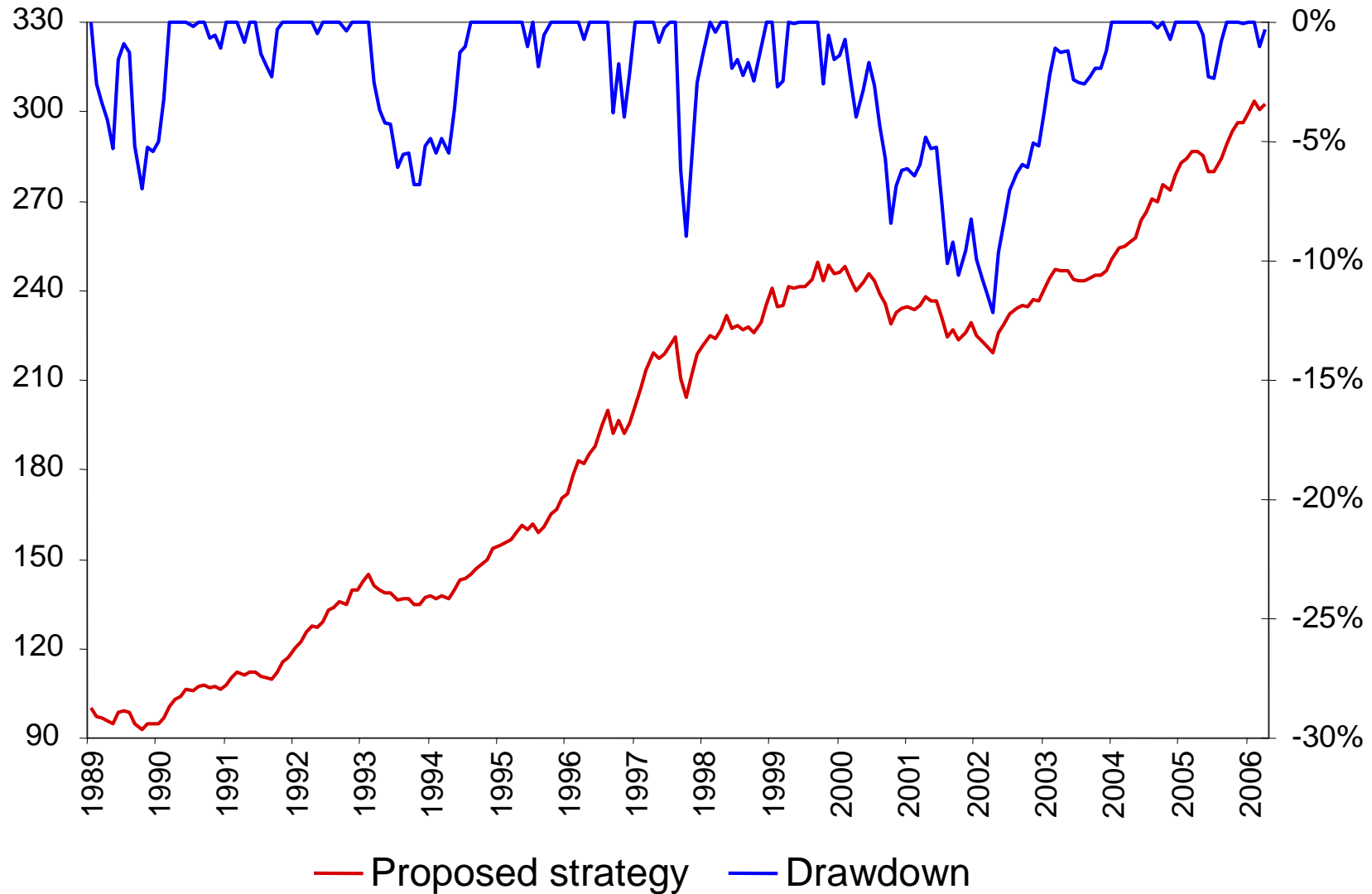
# Possible strategies

	<b>Strategy 1</b>	<b>Strategy 2</b>
	Weighting in %	
Liquidity	10	3
Bonds, CHF	40	42
Bonds, foreign currency	9	13
Equities, Switzerland	13	12
Equities, abroad	13	11
Real estate	15	15
Alternative investments	0	4
Total	100	100
Expected return	4.35%	4.43%
Risk	5.35%	5.17%

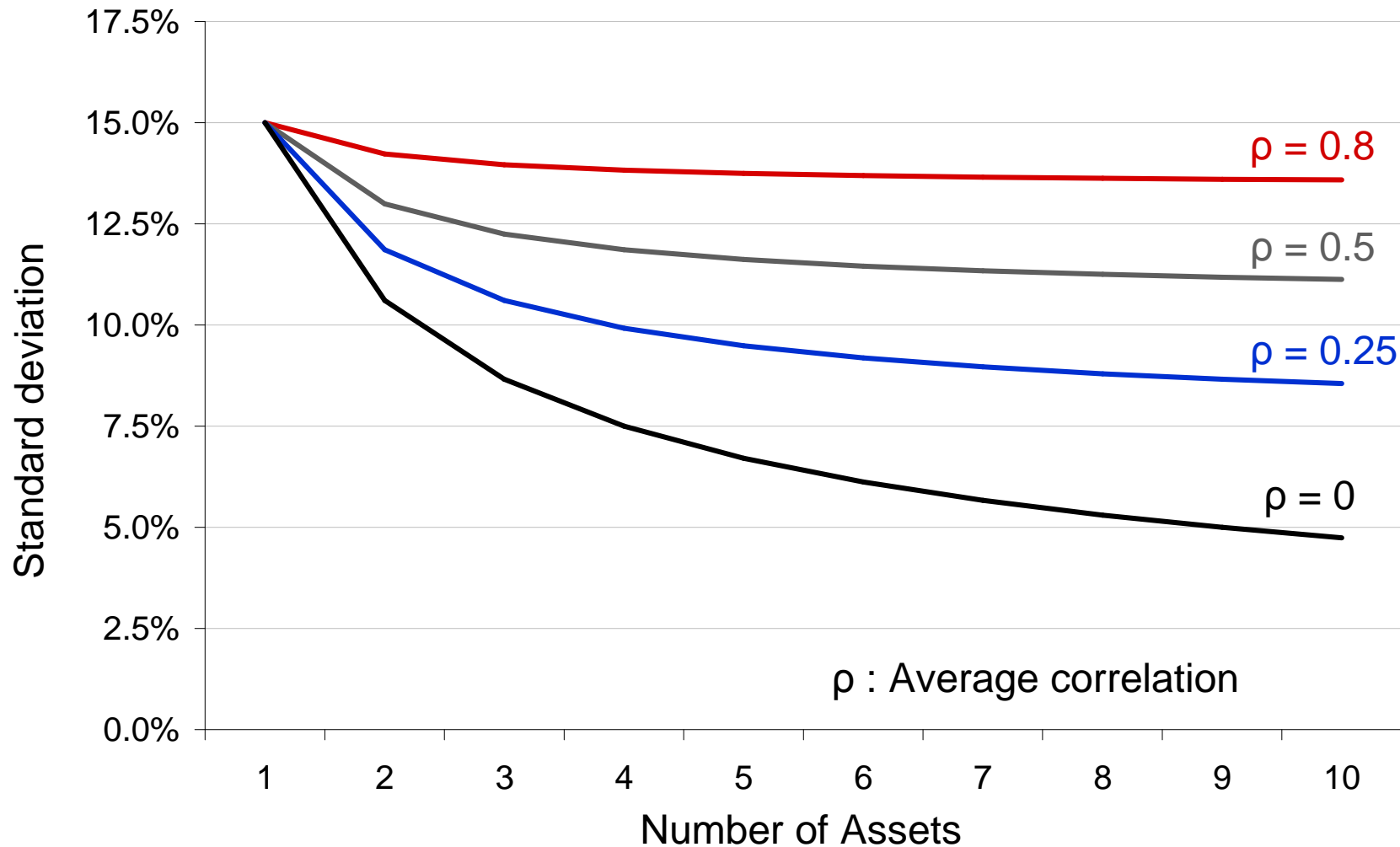
# Maximum setback risk – strategy 1



# Maximum setback risk – strategy 2

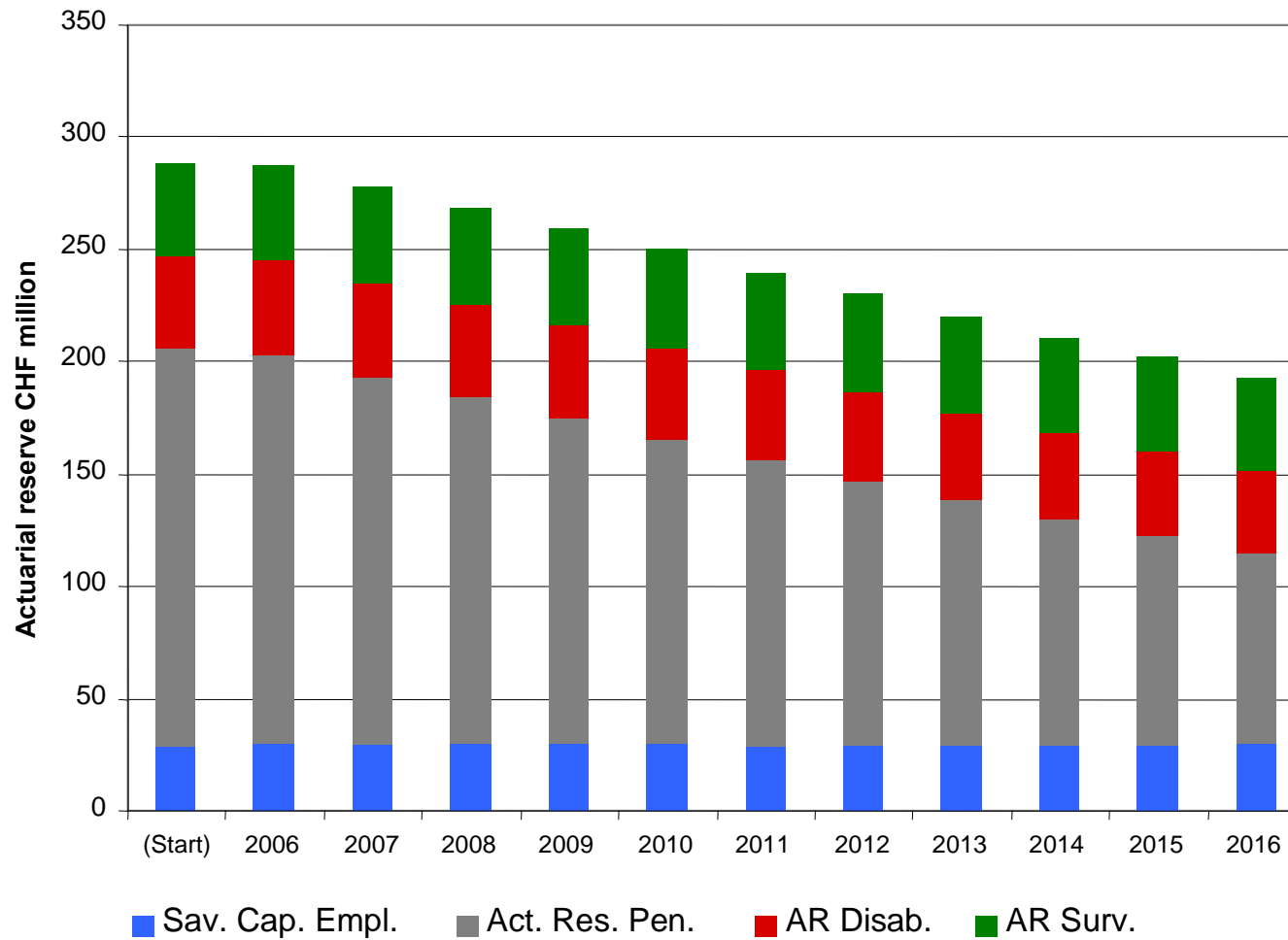


# Risk reduction is a function of number of assets and average correlation



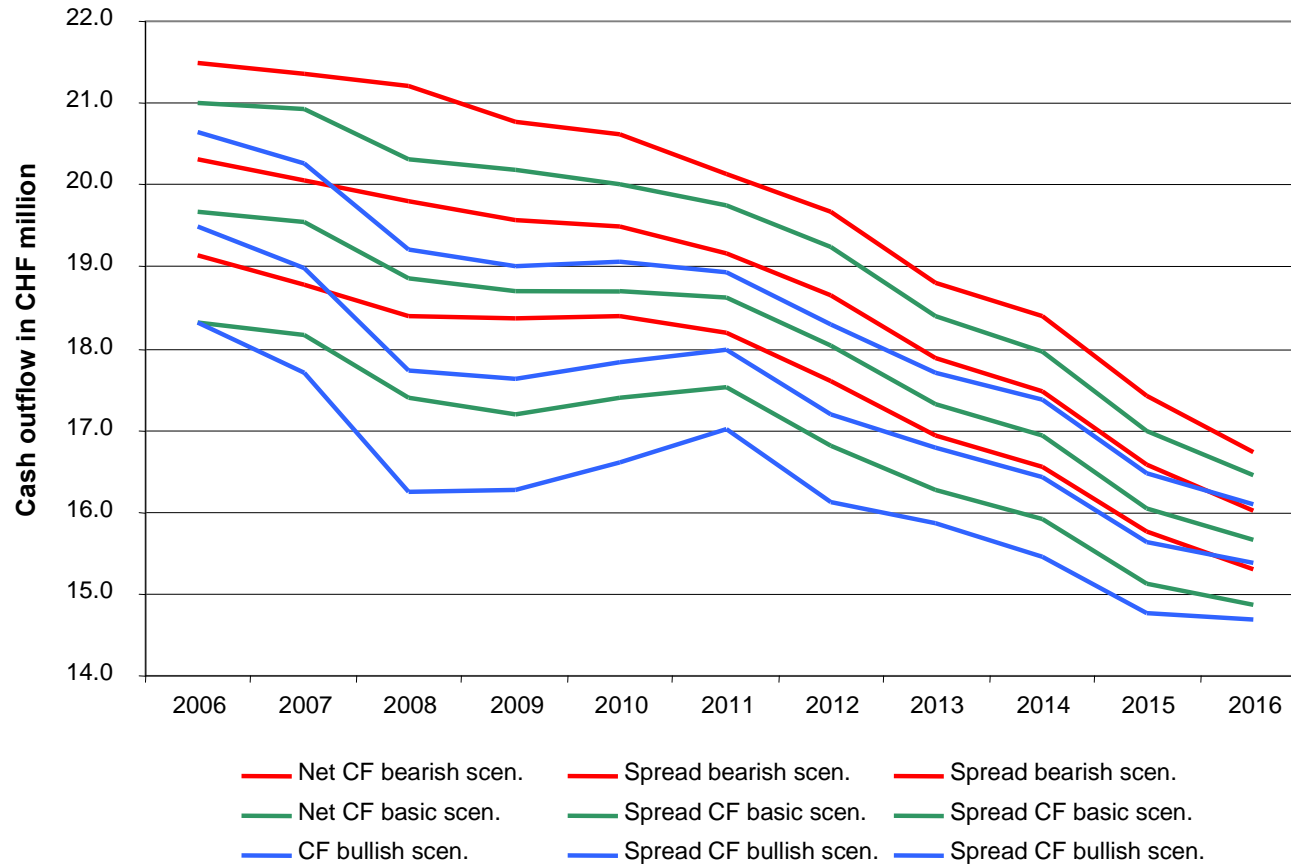
# Actuarial reserve progression

## Actuarial reserve progression



# Cashflow simulations until 2016

Comparison of net cashflow distribution  
Scenarios and spreads



Good basis for  
portfolio  
construction

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# Findings

- Long investment horizon ( $\geq 10$  years)
- A 10-year investment horizon can be used to calculate default probability
- Liquidity requirements necessitate active reduction of assets
- Restructuring of a mature pension fund is very difficult
- Scope of action with regard to investment strategy is essential
- Negative "fat tail" events must be avoided
- A zero-risk strategy is not possible

# Consequences

- Estimates for returns on the basis of historical figures are unacceptable
- Pure return/risk view is not enough
- Definition of floor for cash ratio (VaR for one year)
- Optimisation of drawdown risk
- Strategy returns should not be normally distributed and should not include fat tails

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# Possible investment concepts

Mandatory integration into all concepts: liquidity planning

- Liability-driven investments
  - Cashflow matching
  - Duration matching
- Dynamic investment strategies (portfolio insurance)
  - Model-based and flexible asset allocation
  - CPPI concepts
- Use of derivatives
- Optimisation of maximum setback risks

# Liability-driven investments

- Gaining in importance
  - Change in accounting (mark to market valuations – assets and liabilities)
  - Objective: Elimination of risks that originate from the pension fund
- Implementation depends on
  - Risk preference of the board of trustees
  - Cash ratio (financial power of the "sponsor")
  - Competence of in-house/external managers
  - Commitment profile and possible investment strategies
- Duration or cashflow matching is only possible with very high cash ratio
  - Risk-free interest rate: approx. 3%
  - Actuarial interest rate: 3.5-4%

# Dynamic investment strategies

- Stop-loss strategies
- **Constant proportion portfolio insurance concepts**

	Investment horizon		
Cash ratio	10 years	5 years	1 year
95%	4%	-	-
100%	14%	3%	-
105%	22%	15%	19%
110%	29%	26%	43%

Source: AMMANN, 2003 and presentation at Swisscanto, November 2006

# Use of derivatives (Harry M. Kat, Cass Business School, London)

- **Option strategies for equity holdings**
- **Use of swaps**
  - Interest rate sensitivity bonds + swap = Interest rate sensitivity of commitments (duration matching)
- **Use of swaptions**
  - “Smart swaption”
  - Annual choice between swap and swaption, dependent on interest rate expectations
  - Low interest rates: swaption
  - High interest rates: swap
- **Combination of interest rate and equity derivatives**
- **"Old-fashioned" diversification using hedge funds**
- **Combination making use of all instruments**

# Use of derivatives

## (Harry M. Kat, Cass Business School, London)

- Underlying concept: hedging against loss while simultaneously selling part of the upside through options
- Example (as at 04.06.2007)
  - Purchase of 1-year at-the-money puts on 50% of equities and sale of 1-year out-of-the-money calls on the entire equity holding
  - SMI level 9540
  - SMI puts March 2008 Strike 9500: CHF 421
  - SMI calls March 2008 Strike 9950: CHF 360

Further details and free working papers:  
Alternative Investment Research Centre website at [www.cass.city.ac.uk/AIRC](http://www.cass.city.ac.uk/AIRC)  
Cardano Risk Management website at [www.cardano.nl](http://www.cardano.nl)

# Use of derivatives (Harry M. Kat, Cass Business School, London)

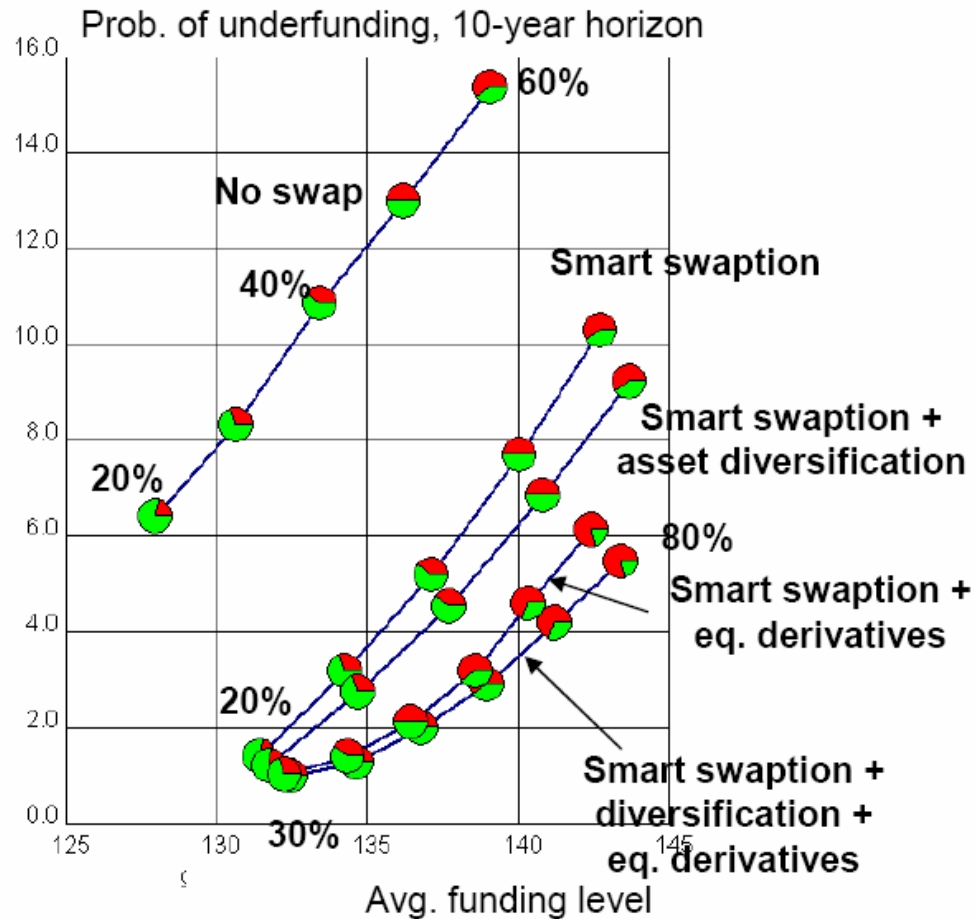
Example (as at 29.08.07)

- Purchase of 1-year at-the-money puts on 50% of equities
- Sale of 1-year out-of-the-money calls on the entire equity holding
  - SMI level 8706
  - SMI puts June 2008 Strike 8700: CHF 575
  - SMI calls March 2008 Strike 9100: CHF 390
- Long puts:  $575/2 = \text{CHF } 290$  ) Net income CHF 100
- Short calls = CHF 390 )

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# Optimisation of maximum setback risks

- Define possible investment categories
- Examine historical return/risk characteristics and correlation development
- Estimate future, long-term returns on the basis of current bond yields and historical risk premiums
- Investigate the historical drawdown behaviour
- Search for portfolio composition with minimum drawdown, taking into account earning opportunities
- "Fine tuning" based on further criteria (law, liquidity, implementation, etc.)

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# Investment categories

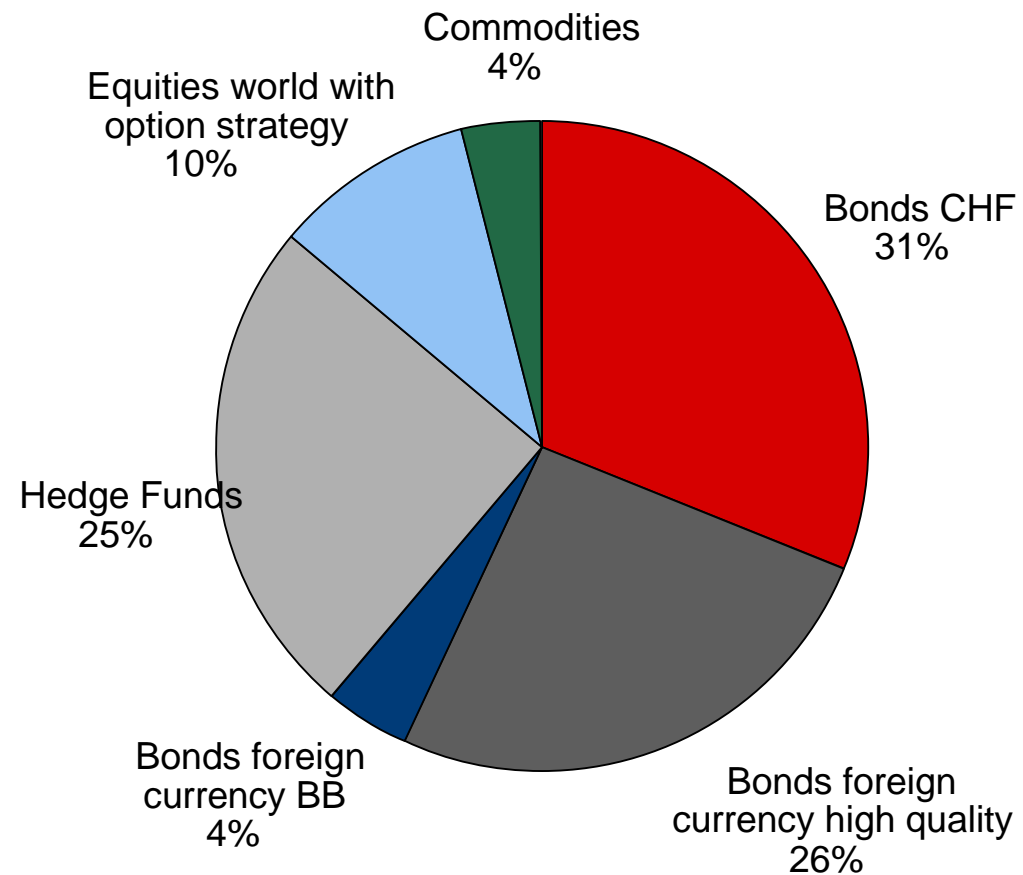
- Liquidity
- Government bonds
- Corporate bonds investment grade
- High-yield bonds
- Global equities
- Alpha portfolio (hedge funds)
- Beta portfolio (hedge funds)
- Commodities
- Real estate
- Private equity

# Long-term return/risk estimate

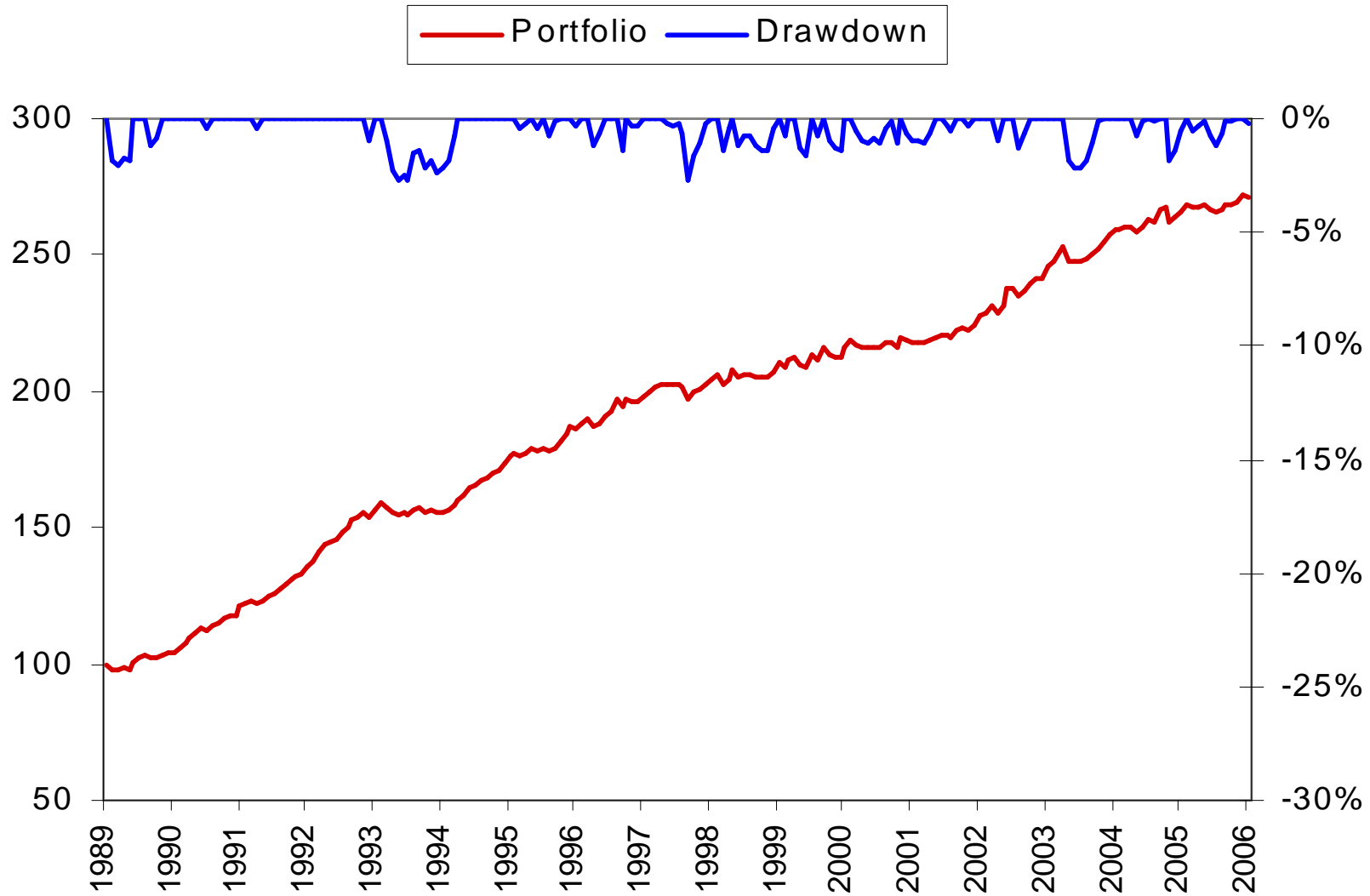
Investment category	Expected return p.a.	Risk (stand. dev.) p.a.
Money market	2.0%	0.8%
Bonds CHF	3.0%	3.8%
Bonds foreign curr. (part. hedged)	3.5%	7.8%
Bonds BB (partially hedged)	5.0%	8.8%
Equities with option strategy	7.0%	10.4%
Real estate Switzerland	4.0%	8.7%
Hedge Fund Alpha	4.0%	2.7%
Hedge Fund Beta	5.8%	6.1%
Commodities hedged	5.8%	20.4%

# Strategic allocation pension fund X

## Strategy 10% equities



# Asset development Strategy 10% equities



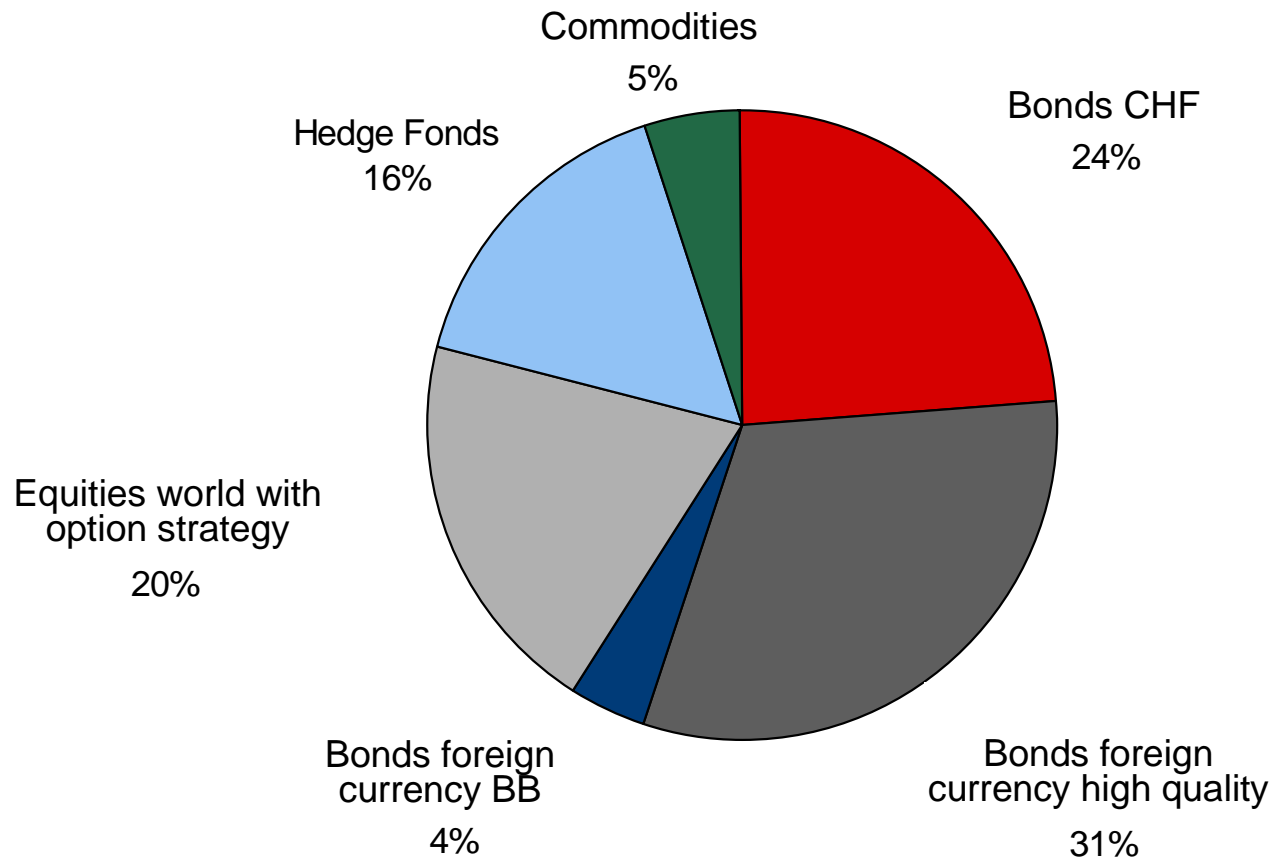
# Return/risk characteristics

## Strategy 10% equities 31.12.1989 – 31.12.2006

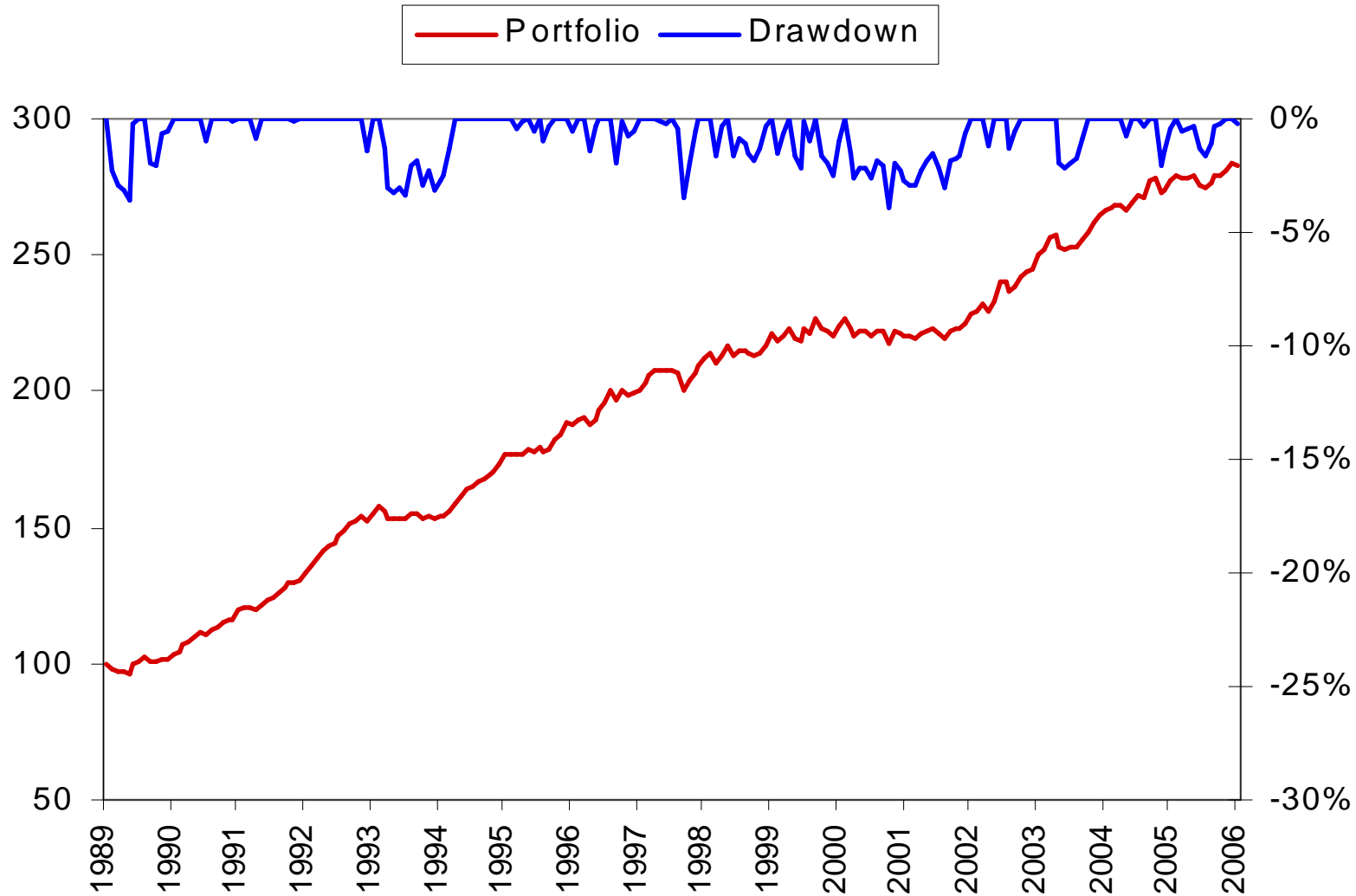
Total return	171.1%
Return p.a.	6.04%
Max. drawdown (hedge fund crisis, August 1998)	-2.71%
Longest drawdown (February 1994 to March 1995)	-2.68%
Expected return p.a. Swisscanto (before costs)	4.22%
Min. return over 1 year (97.5% probability)	-1.70%

# Strategic allocation pension fund X

## Strategy 20% equities



# Asset development Strategy 20% equities



# Return/risk characteristics

## Strategy 20% equities 31.12.1989 – 31.12.2006

Total return	183.1%
Return p.a.	6.31%
Max. drawdown (11 September 2001)	-3.92%
Longest drawdown (February 2001 to December 2002)	-3.92%
Expected return p.a. Swisscanto (before costs)	4.56%
Min. return over 1 year (97.5% probability)	-3.05%

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# There is (unfortunately) no standard solution ...

- Tailored to the individual situation of a pension fund
- Inclusion of liquidity planning in both investment strategy and portfolio construction
- Reduction of maximum setback risks
- Hedging against excess losses
- Maintaining scope of action
- Closer co-operation required between pension fund experts and investment experts

# Sources and Literature

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Harry M. Kat

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Sir John Cass Business School, City University, London

E-mail: [Harry@AIRC.info](mailto:Harry@AIRC.info)

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Dr. Amlan Roy, Demographics and Pensions Research, CREDIT SUISSE, November 2006

[Amlan.roy@credit-suisse.com](mailto:Amlan.roy@credit-suisse.com)

## *Dynamic strategies for Swiss pension funds*

Presentation by Prof. Dr. Manuel Ammann, University of St. Gallen, November 2006

Swisscanto: Own calculations

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