Financial Policy in Highly Volatile Economies

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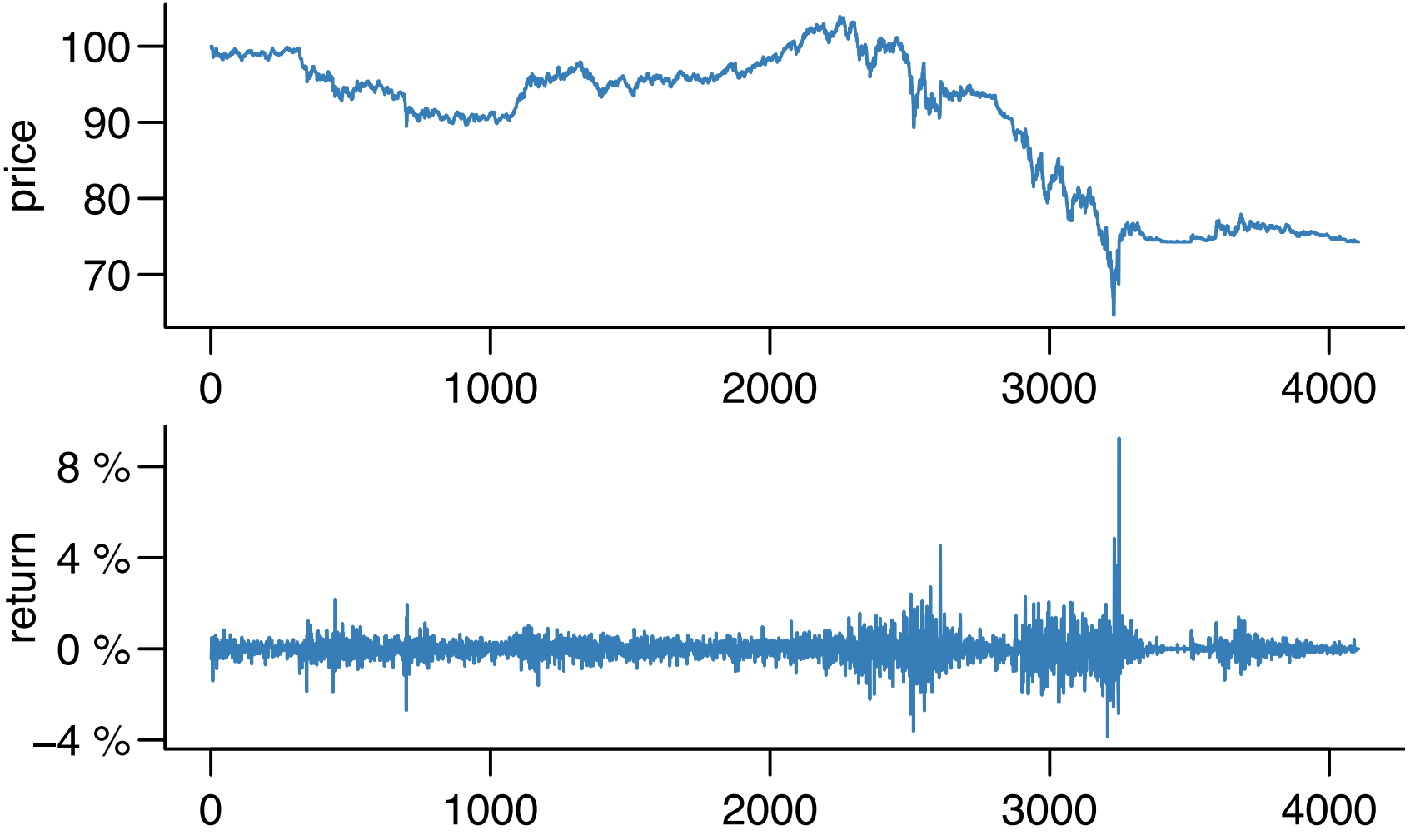
The presentation is based on

- "Model Risk of Risk Models", (2016) with Kevin James (PCA and LSE), Marcela Valenzuela (University of Chile) and Ilknur Zer (Federal Reserve), forthcoming Journal of Financial Stability
- "Why risk is so hard to measure" (2016) with Chen Zhou, Bank of Netherlands and Erasmus University, 2015
- "Learning from History: Volatility and Financial Crises" (2016) with Marcela Valenzuela (University of Chile) and Ilknur Zer (Federal Reserve)
- And several `VoxEU.org` blogs

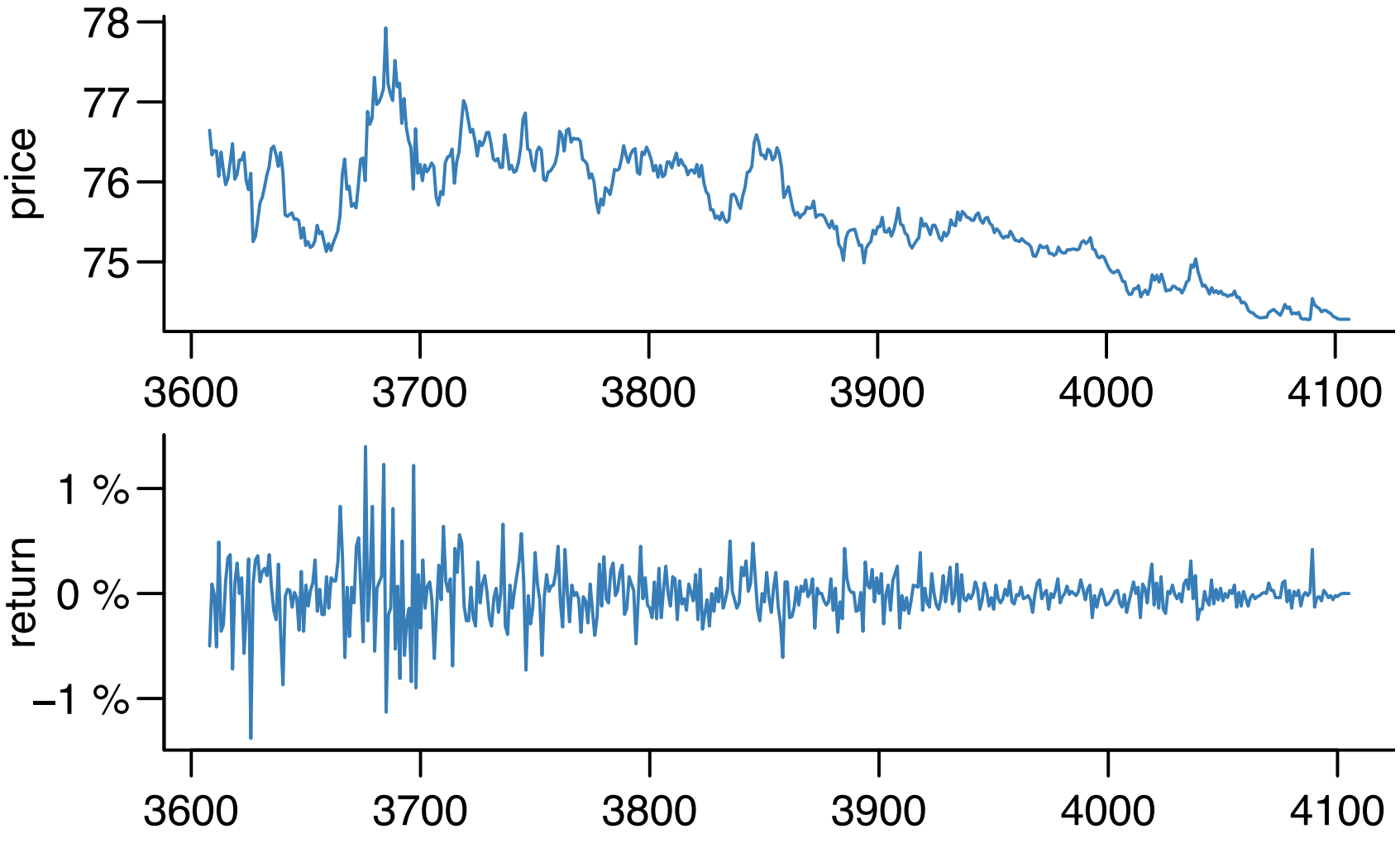
How often do systemic crises happen?

- Ask the IMF–WB systemic crises database (only OECD)
- Every 43 years (17 for UK)
- Best indication of the target probability for policymakers
- However, most indicators focus on much more frequent events
- Typically every month to every five months
  - Basel II/III, SES/MES/CoVaR/Sharpley/SRisk

Some actual price series



Some actual price series (Zoom in)



Lets forecast risk...

with "reputable" models generally accepted by authorities and industry

- Value–at–Risk (*VaR*) and Expected Shortfall (*ES*)
- Probability 1%
- Using as model

MA	moving average
EWMA	exponentially weighted moving average
GARCH	normal innovations
t–GARCH	student–t innovations
HS	historical simulation
EVT	extreme value theory

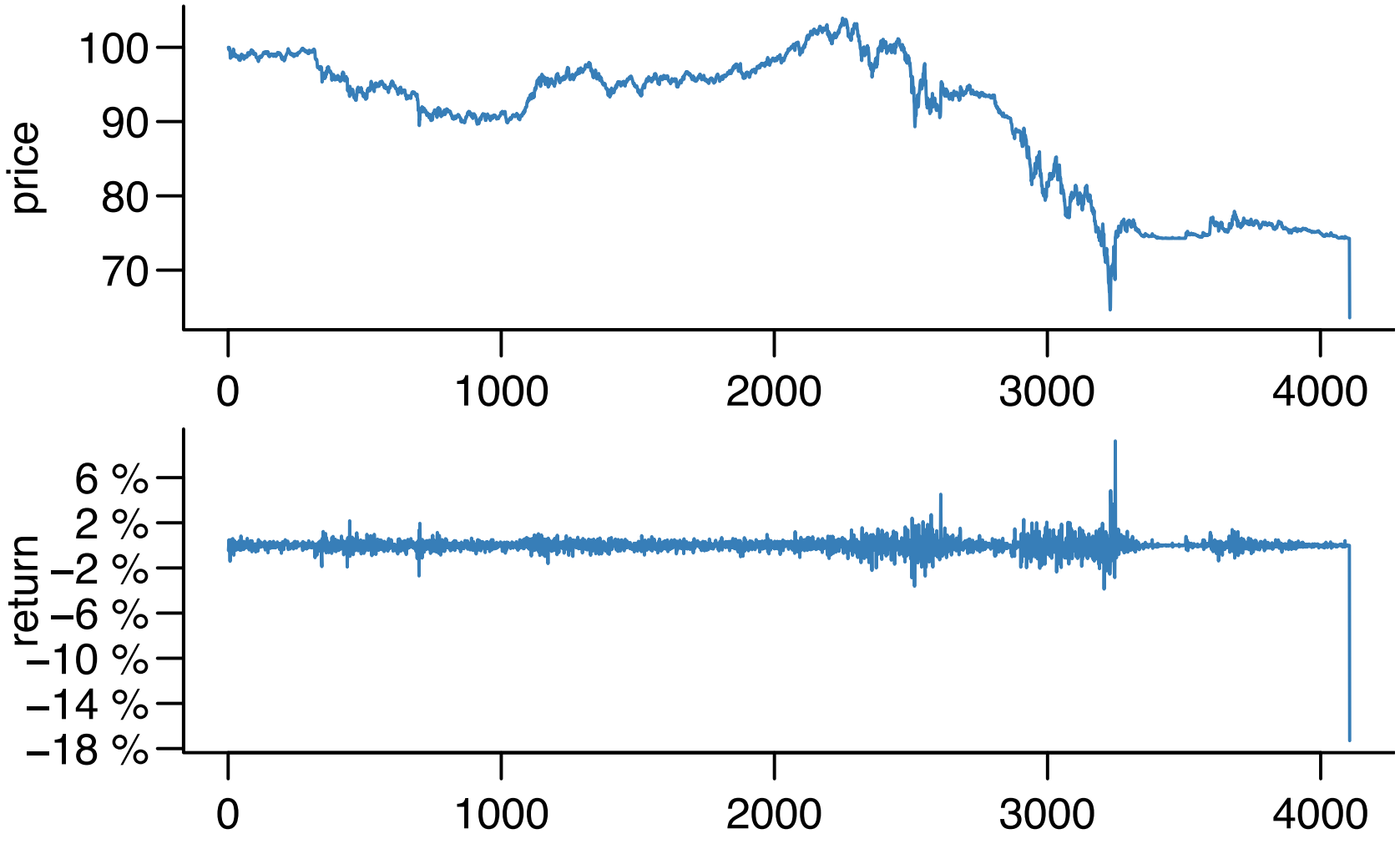
- Estimation period 1,000 days

Risk for the next day $(t+1)$

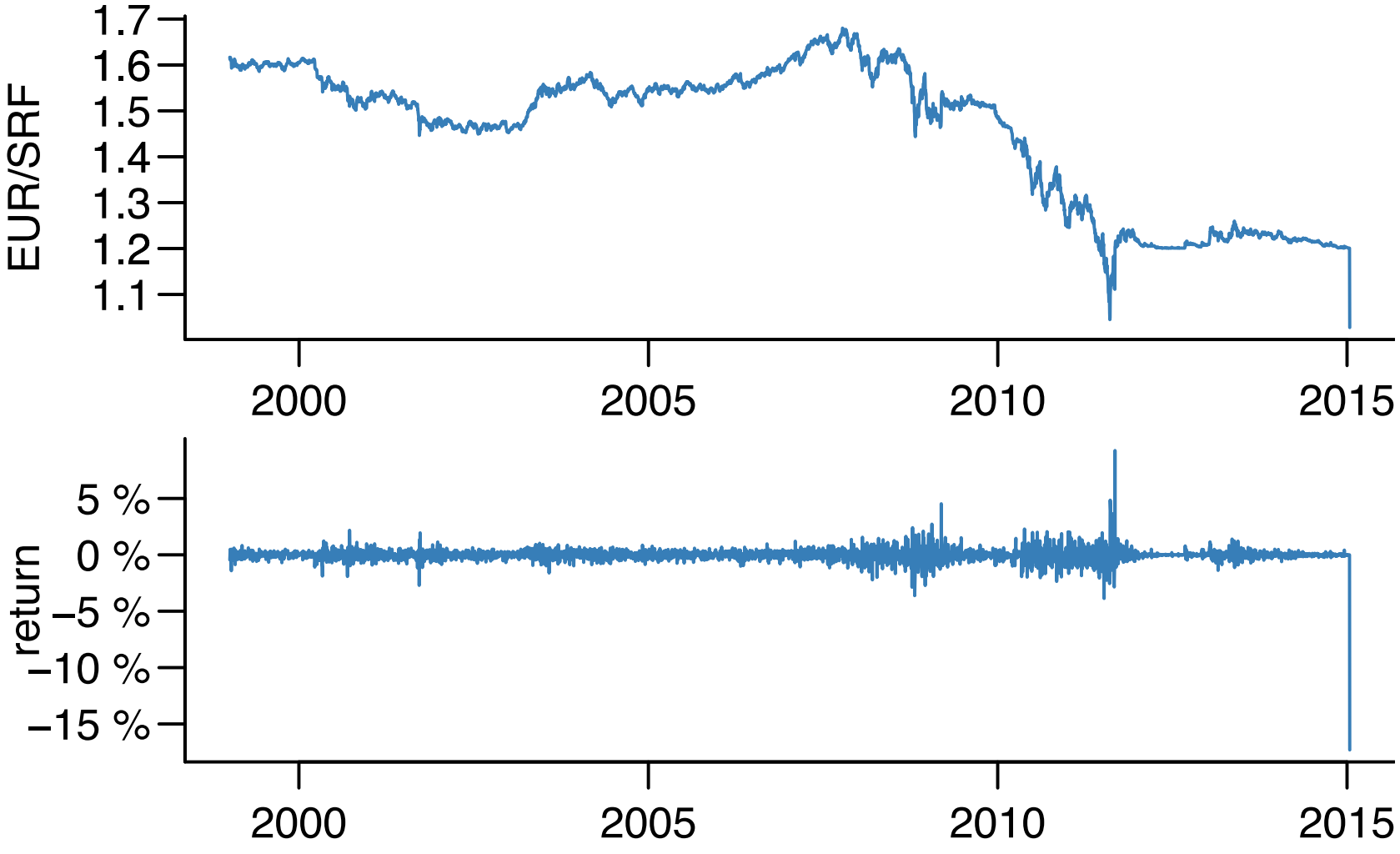
Portfolio value is 1,000

Model	VaR	ES
HS	*14.04*	20.33
MA	11.42	13.09
EWMA	*1.59*	1.82
GARCH	1.71	1.96
tGARCH	2.10	2.89
EVT	13.90	24.41
Model risk	*8.85*	13.43

Lets add one more day...



€/CHF


EUR/SRF
1.7
1.6
1.5
1.4
1.3
1.2
1.1
2000
2005
2010
2015
return
5 %
0 %
−5 %
−10 %
−15 %
2000
2005
2010
2015

How frequently do the Swiss appreciate by 15.5%?

measured in once every X years

Model	frequency

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MA	2.7×10^{217}	age of the universe is about 1.4×10^{10}

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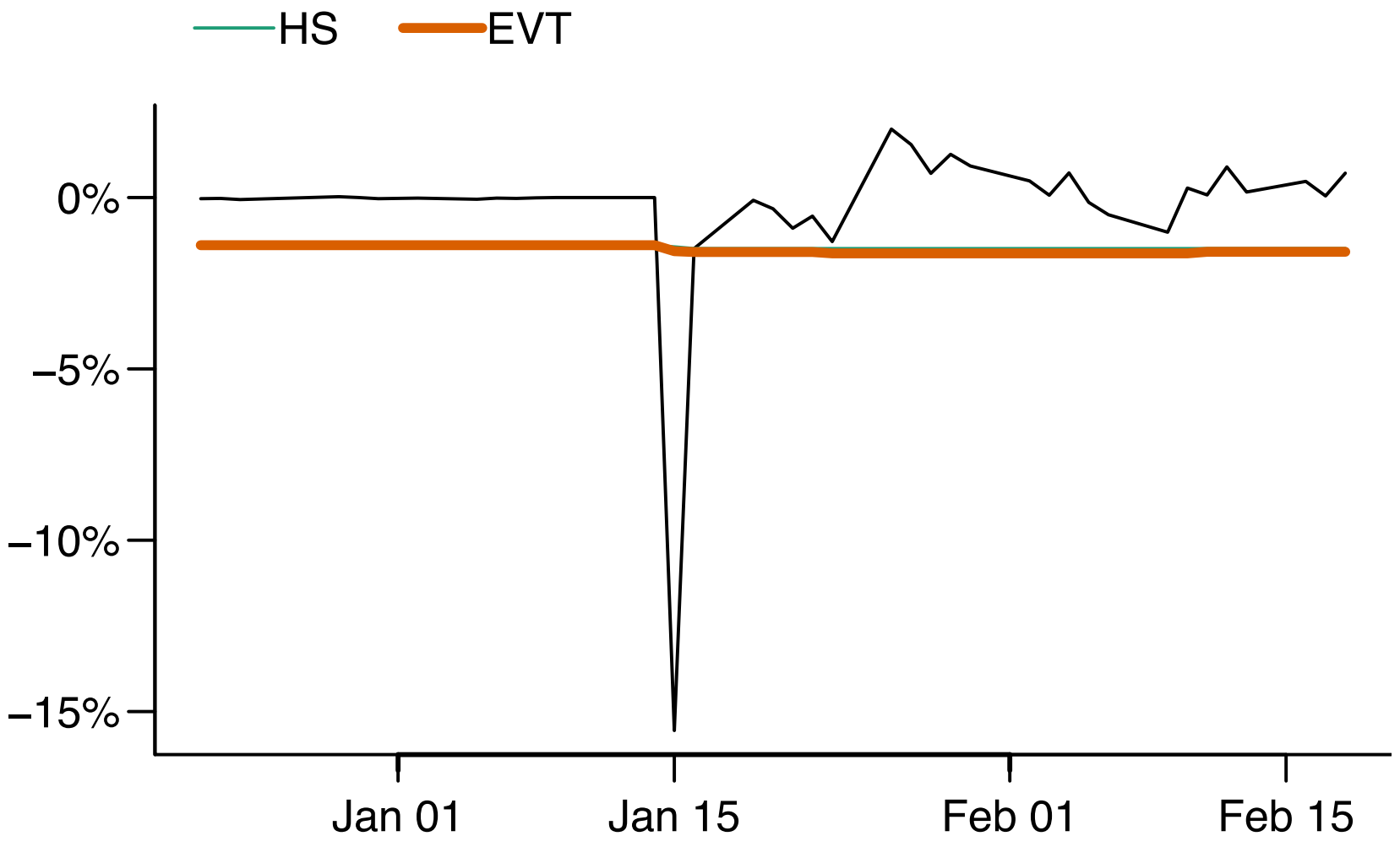
Even more interesting after the event



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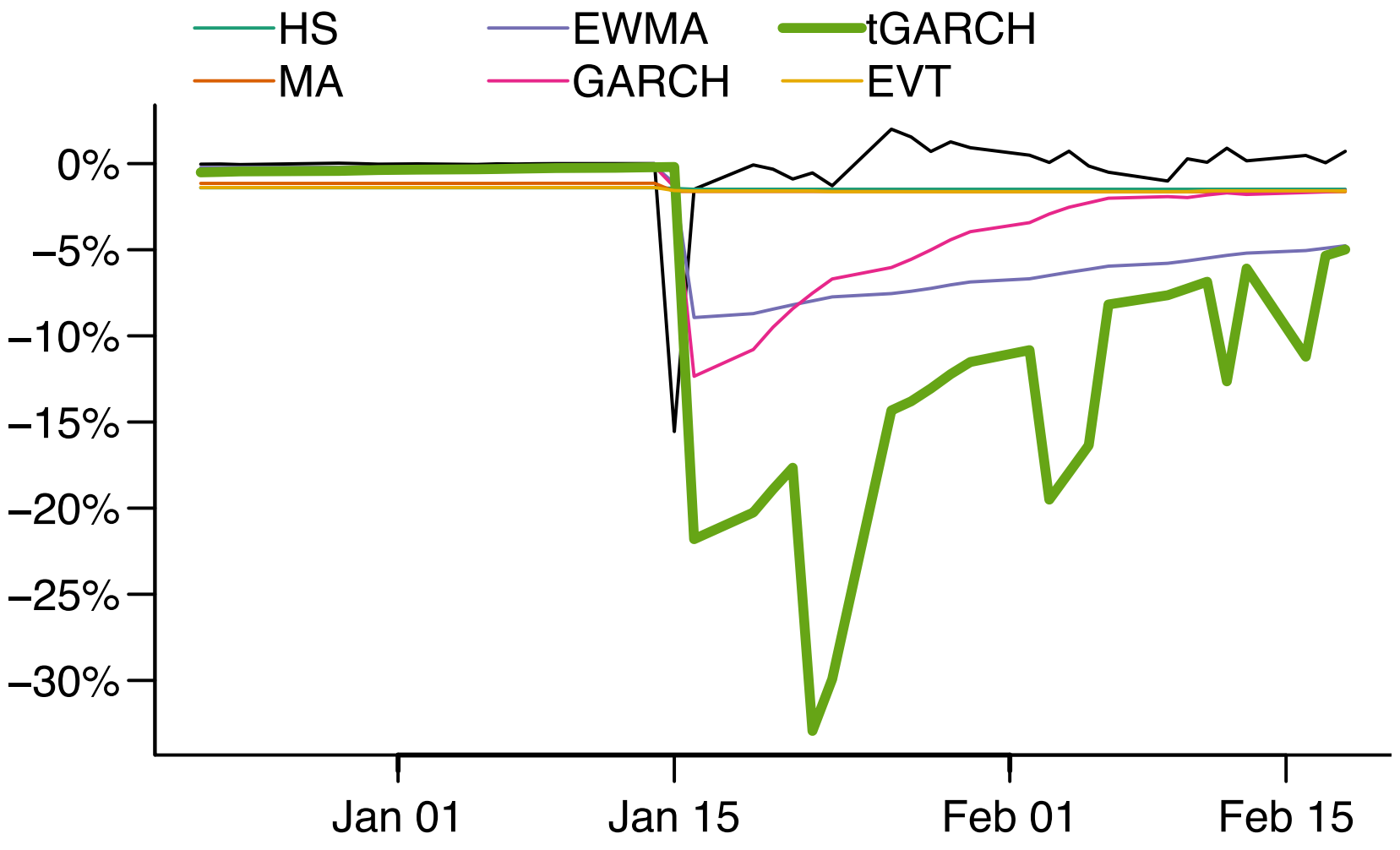


But is the event all that extraordinary?

just eyeballing it seems not that much

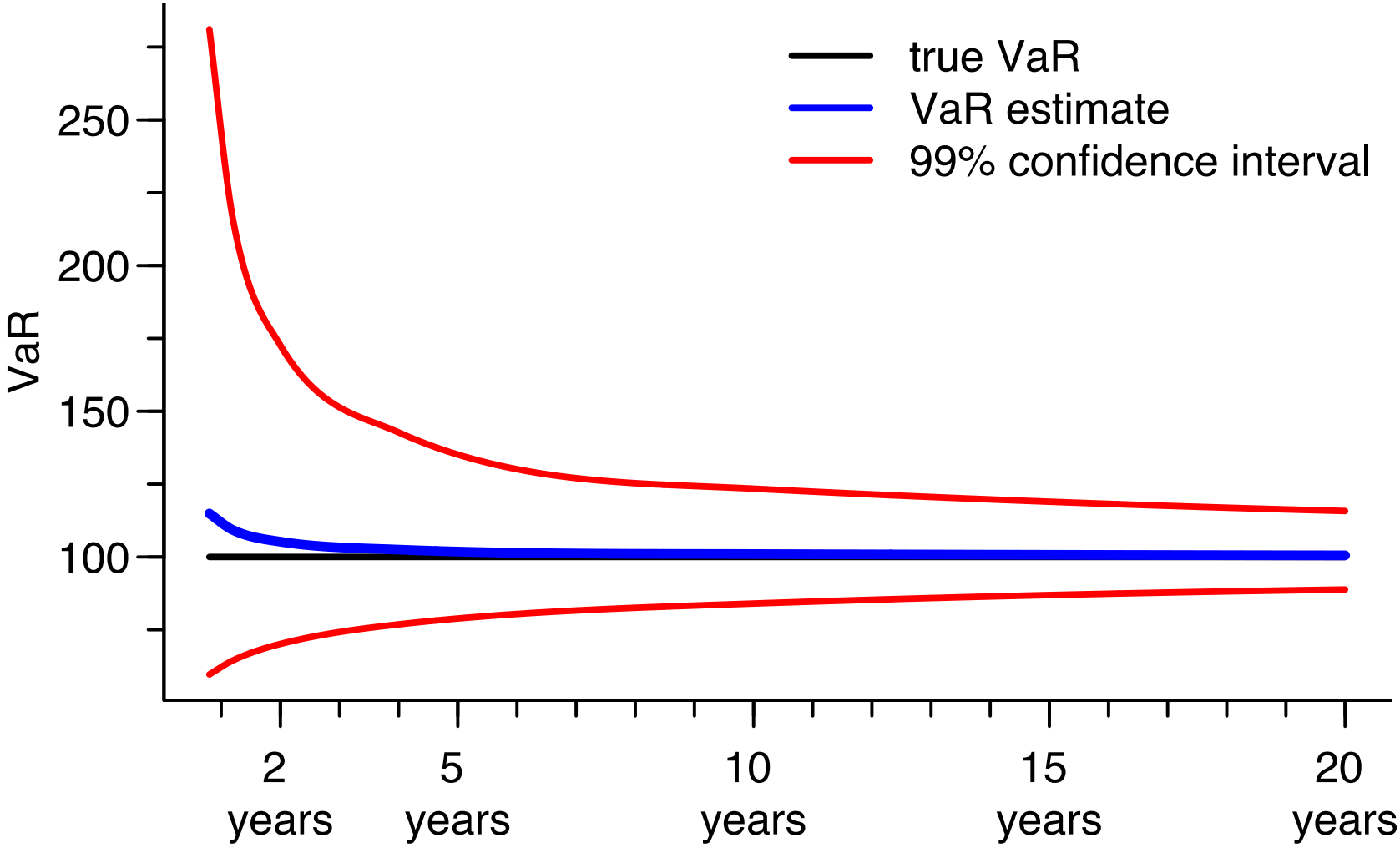
Could we do better?

- If one considers who owns the Swiss National Bank
- And some factors, perhaps
  - SNB dividend payments
  - Money supply
  - Reserves
  - Government bonds outstanding
- Yes, we can do much much better than the models used here
- But they are what is prescribed

example is from `www.voxeu.org/article/what-swiss-fx-shock-says-about-risk-models`

Finite sample properties of risk forecast

for various sample sizes



Forecasting a tail when we know the distribution

- Asymptotically everything might be fine but what are the *small sample properties?*
- With a properly specified model, a 99% confidence interval may be
  - 10,000 observations

$$Risk \in [0.9, 1.13]$$

  - 1,000 observations,

$$Risk \in [0.7, 1.6]$$

  - 500 observations

$$\texttt{Risk} = \texttt{runif}()$$

And in the real world

- Where returns follow an unknown stochastic process
- The uncertainty about the risk forecasts will be much higher
- This goes a long way to explain why different risk models, each plausible, can give such widely differing results

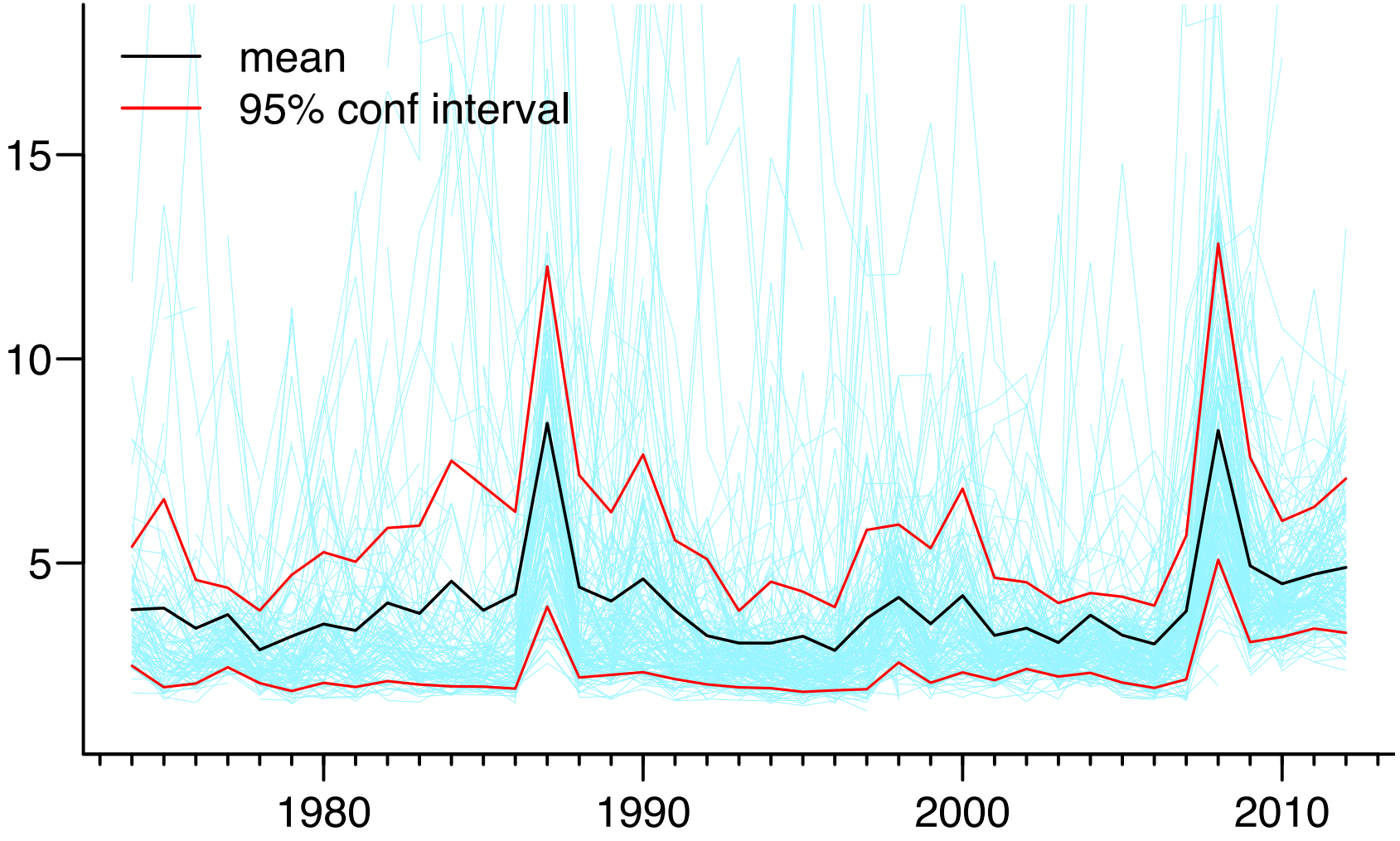
Model risk of risk forecast models

Every model is wrong — Some models are useful

The risk of loss, or other undesirable outcomes like financial crises arising from using risk models to make financial decisions

- Infinite number of candidate models
- Infinite number of different risk forecasts for the same event
- Infinite number of different decisions, many ex ante equally plausible
- Hard to discriminate

Model risk — US Financials



The signal sent by risk forecast models

- They tend to overestimate risk after a crisis happens
- And underestimate it before a crisis happens
- Getting it systematically wrong in all states of the world

Why models perform the way they perform

1. The statistical theory of the models
2. The nature of risk

Risk is endogenous

Danielsson–Shin (2002)

- We have classified risk as *exogenous* or *endogenous*

  exogenous Shocks to the financial system arrive from outside the system, like with an asteroid

  endogenous Financial risk is created by the interaction of market participants

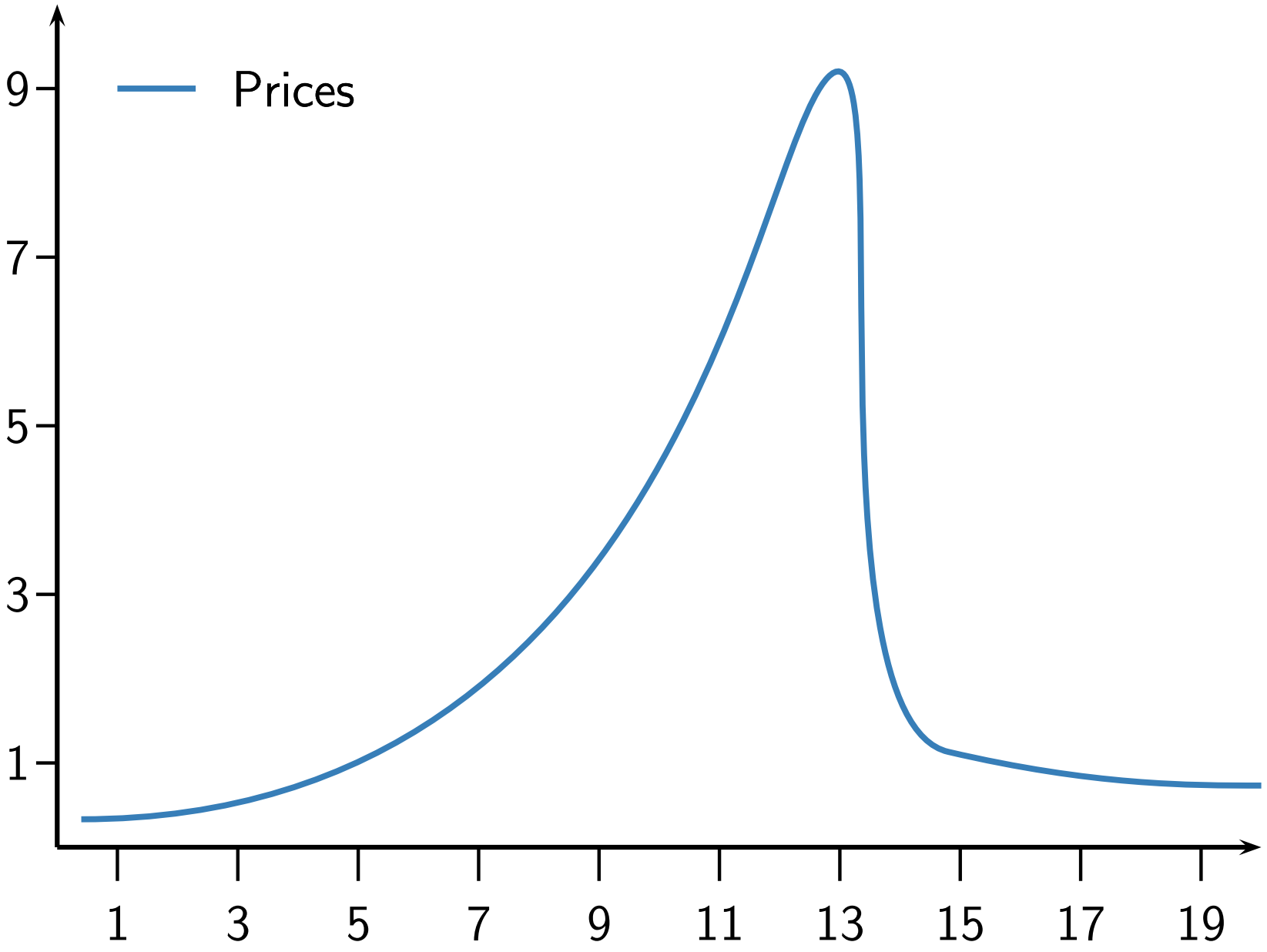
"The received wisdom is that risk increases in recessions and falls in booms. In contrast, it may be more helpful to think of risk as increasing during upswings, as financial imbalances build up, and materialising in recessions."
Andrew Crockett, then head of the BIS, 2000

- Market participants are guided by a myriad of models and rules, many dictate myopia
- Prices are not Markovian in adverse states of nature

Two faces of risk

- When individuals observe *and* react — affecting their operating environment
- Financial system is not invariant under observation
- We cycle between virtuous and vicious feedbacks
  - risk reported by most risk forecast models — *perceived risk*
  - *actual risk* that is hidden but ever present

Endogenous bubble



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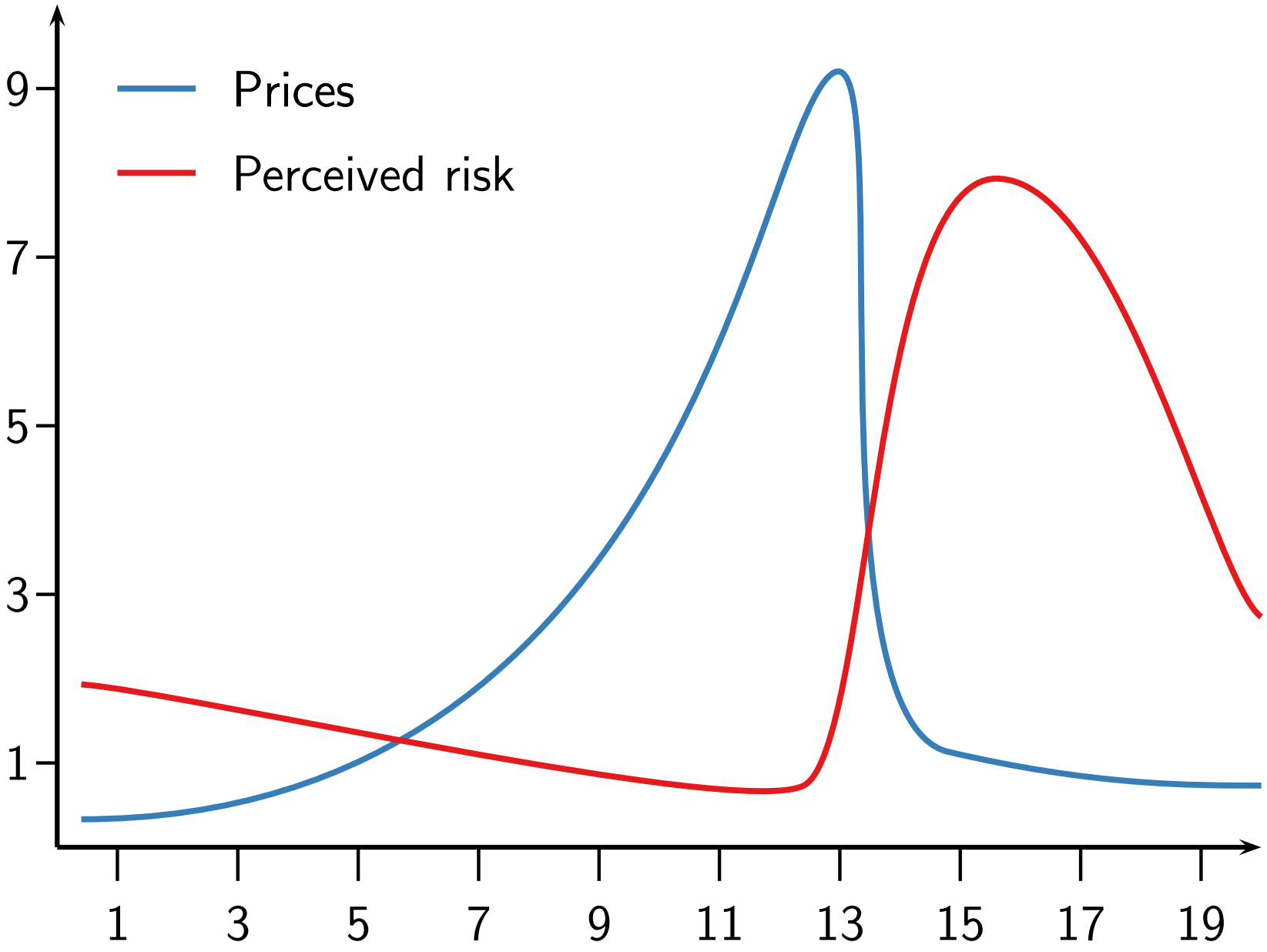
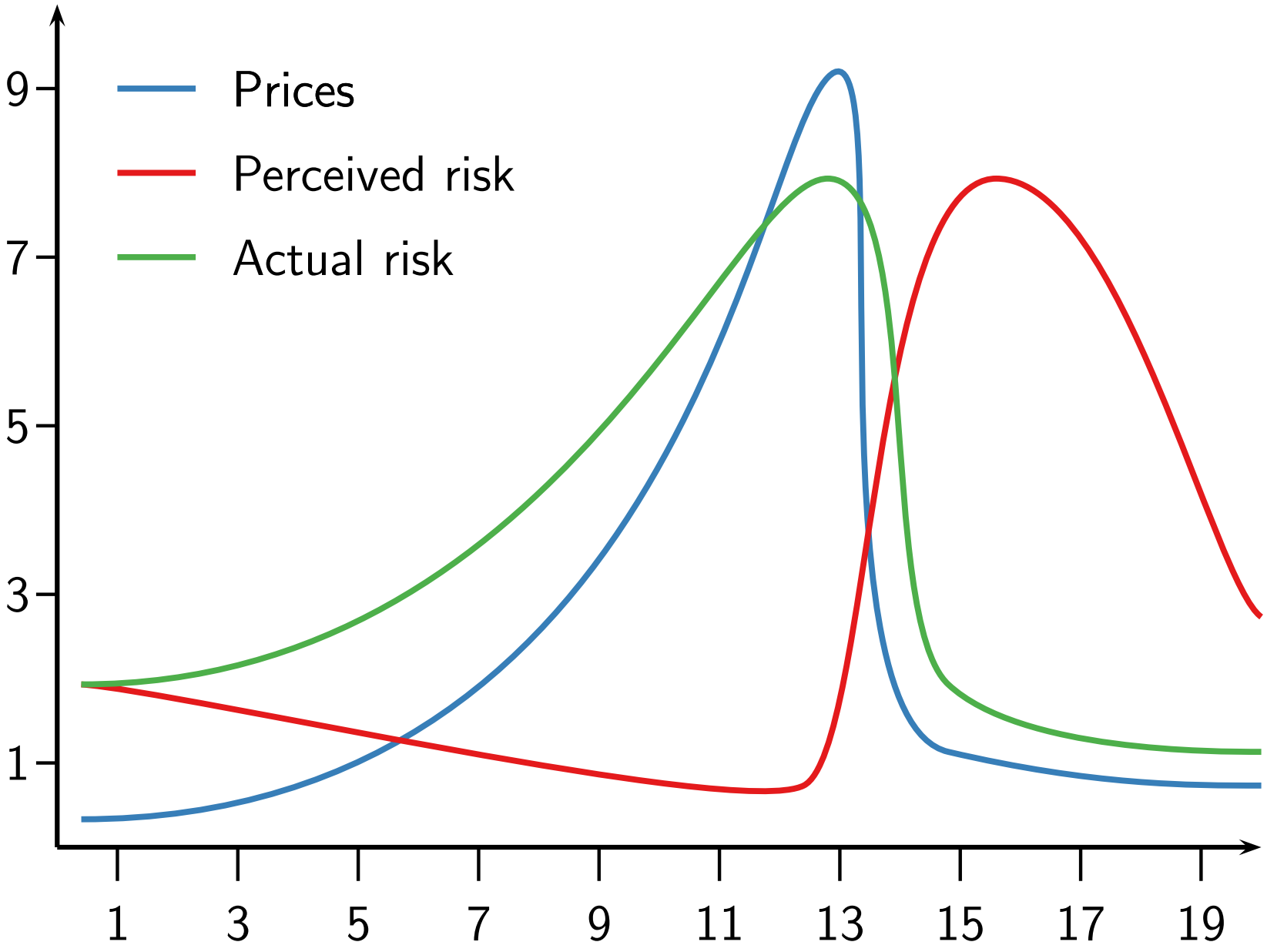
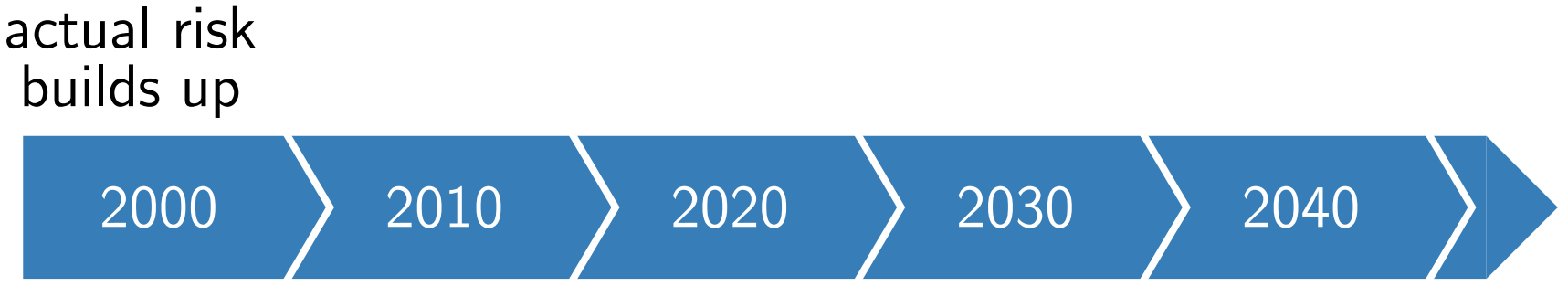


Endogenous bubble



The 42 year cycle of systemic risk



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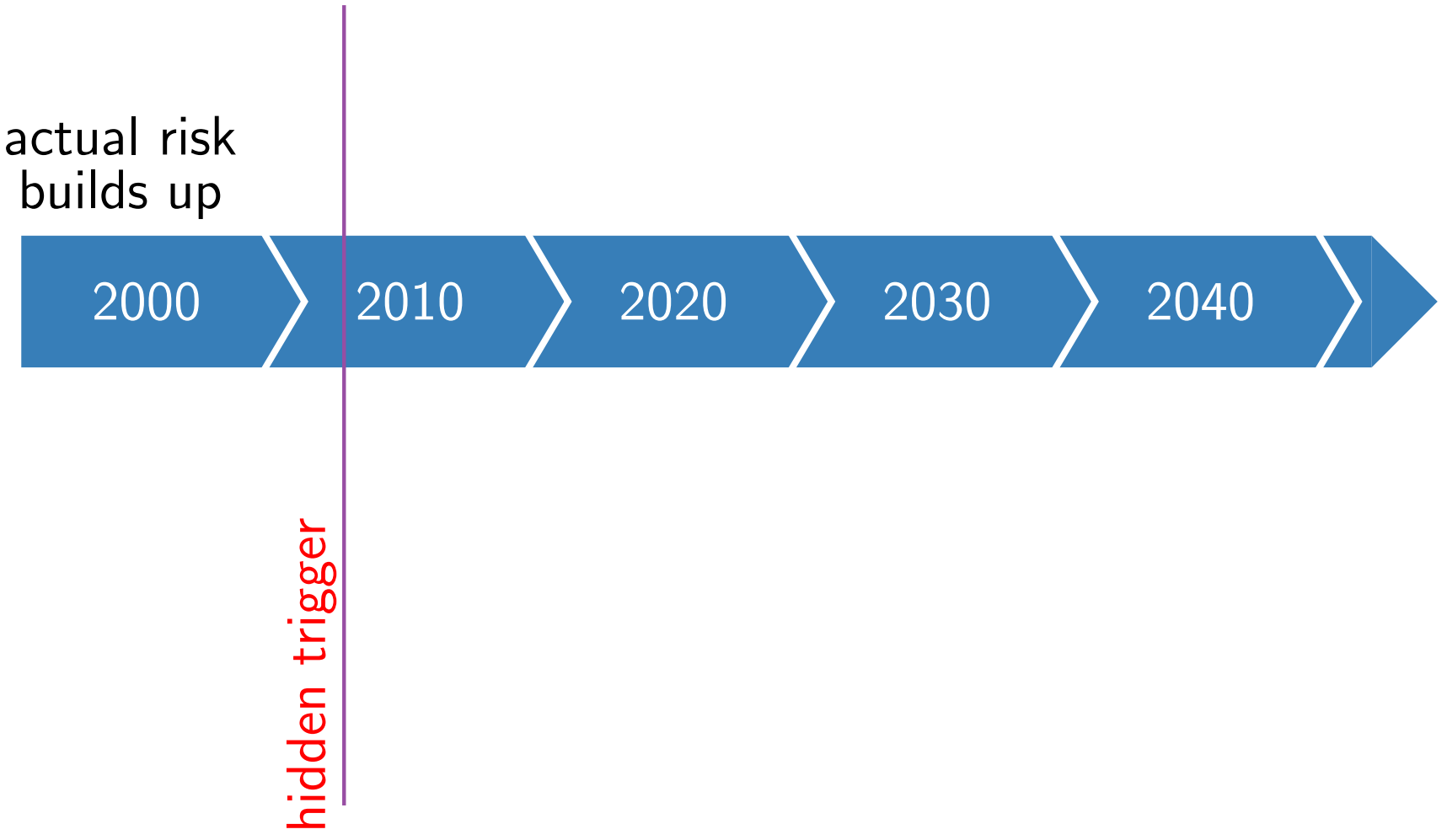

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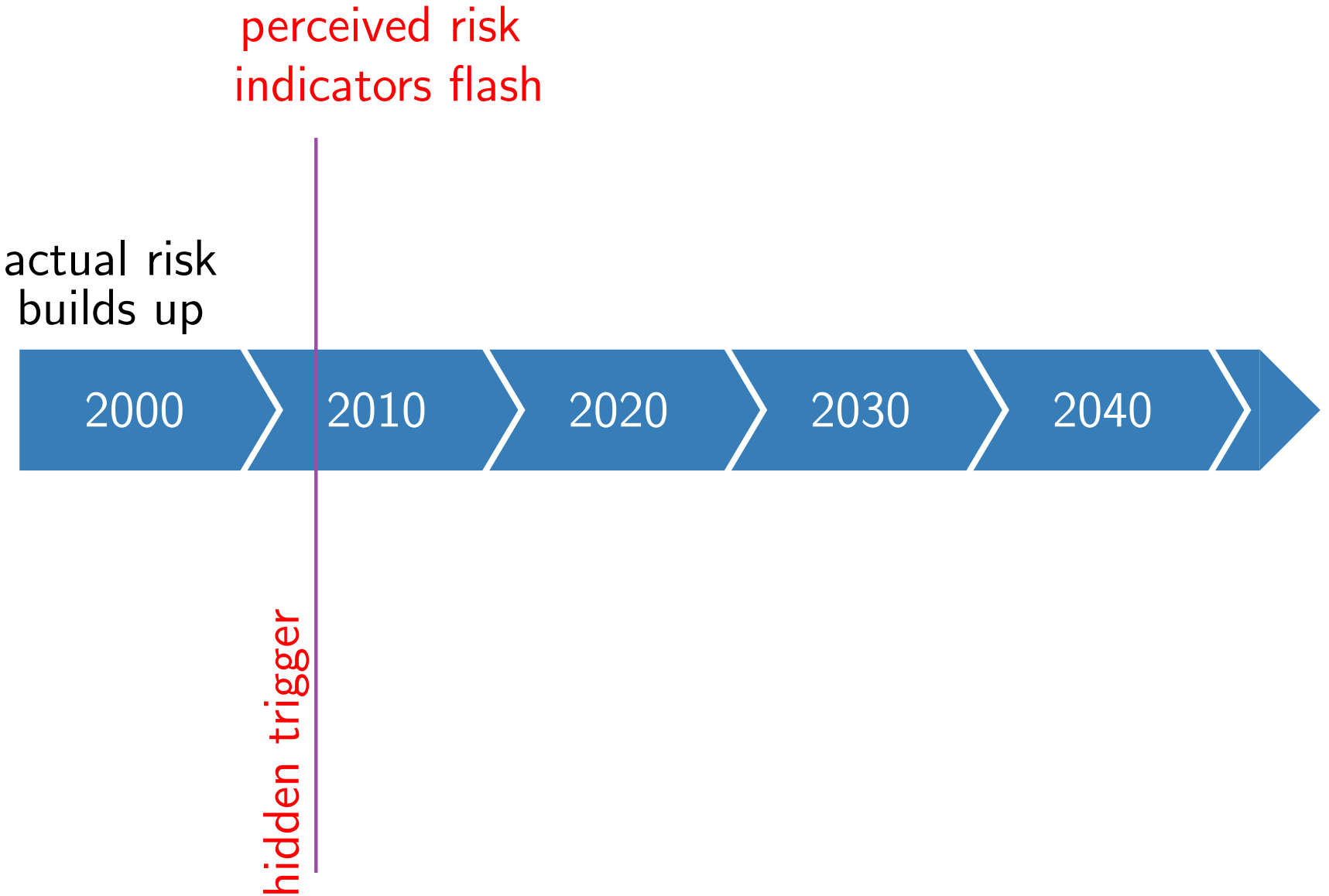

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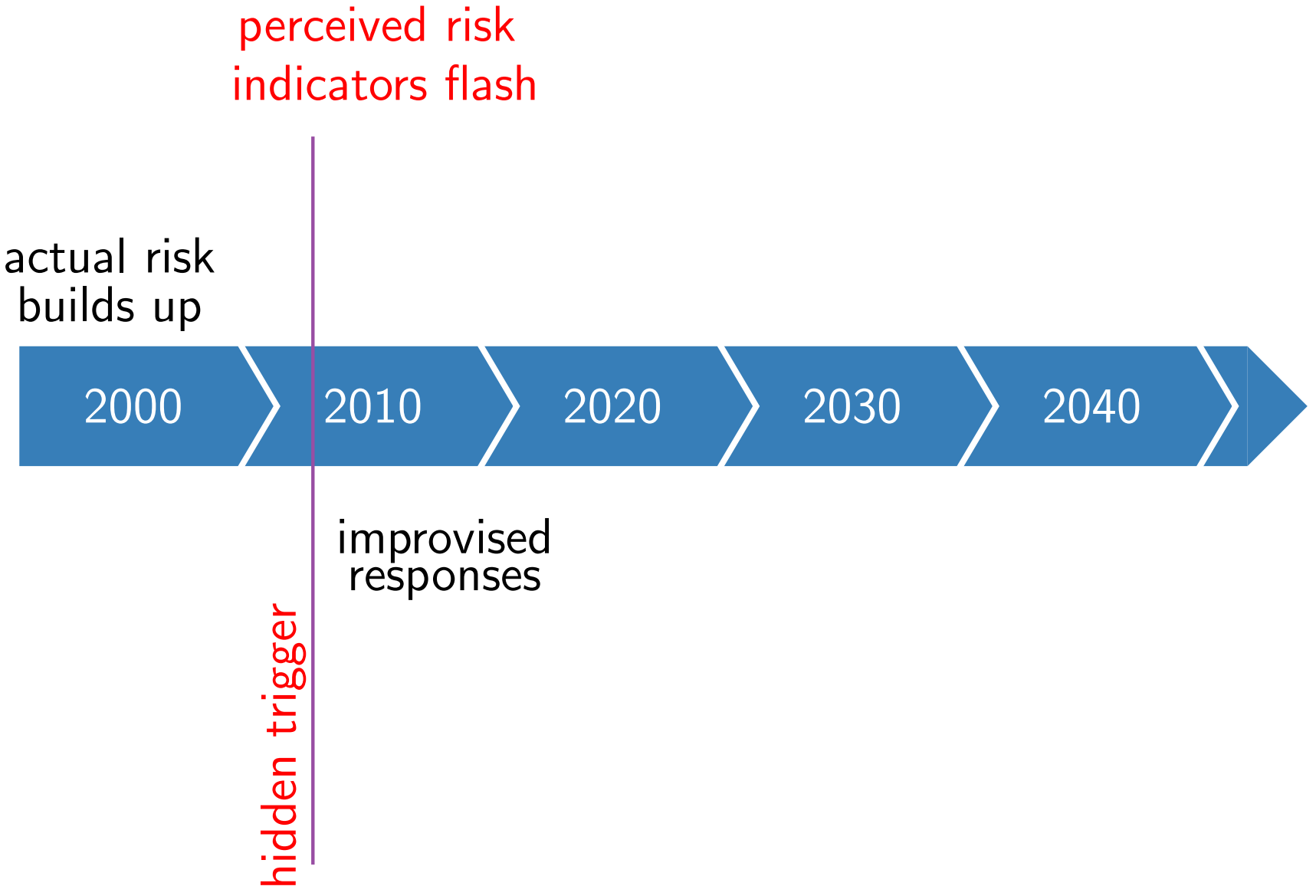

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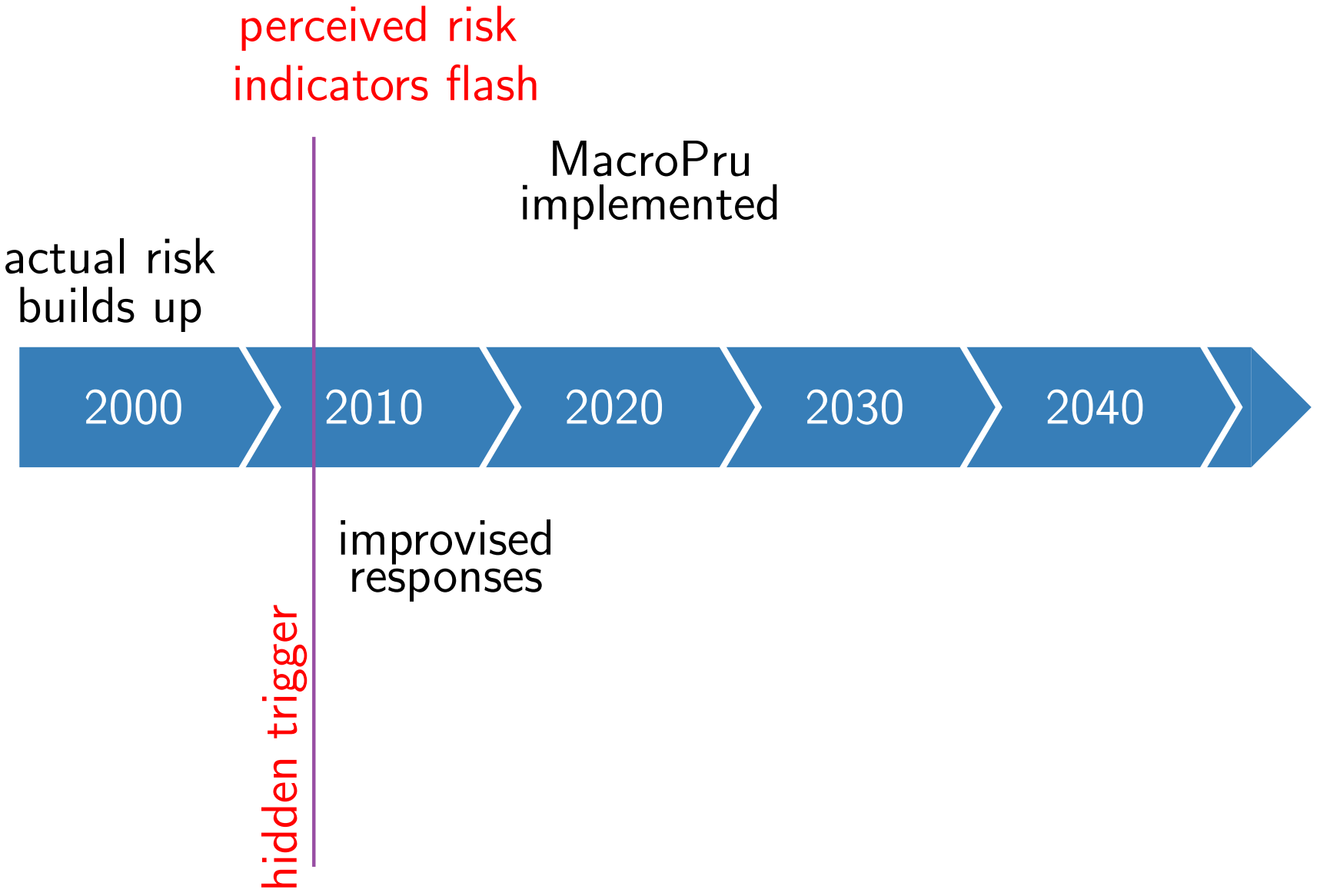

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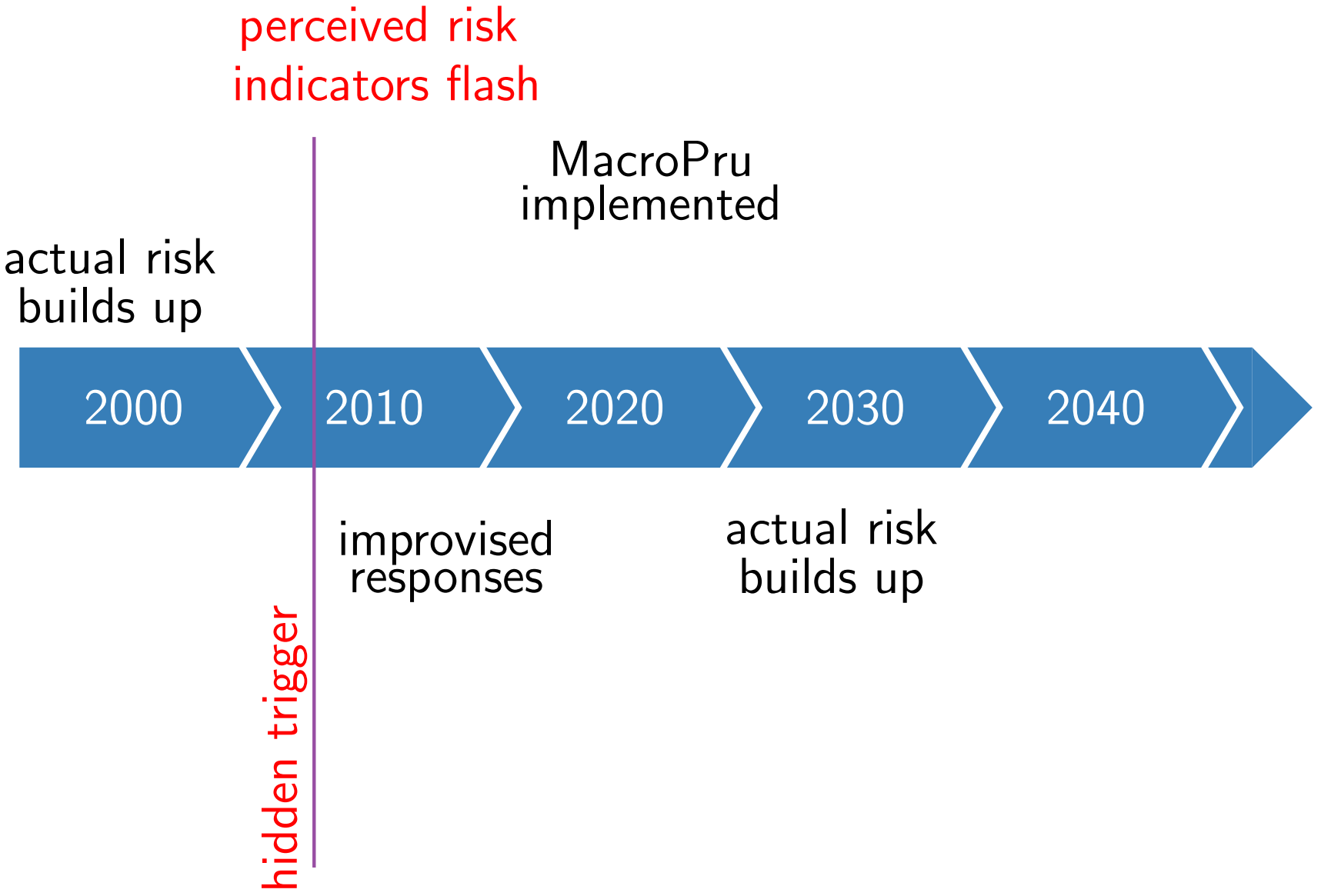

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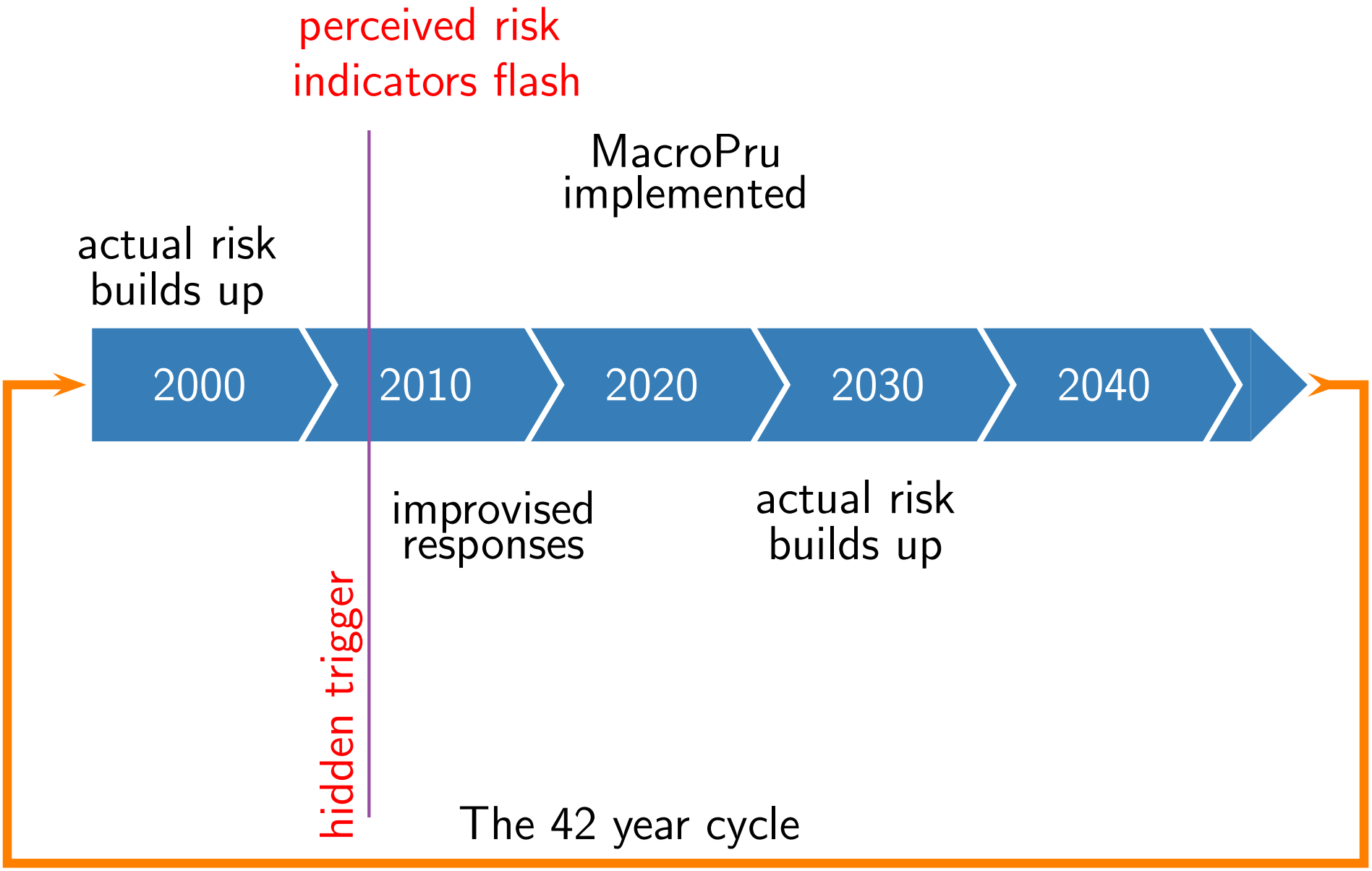

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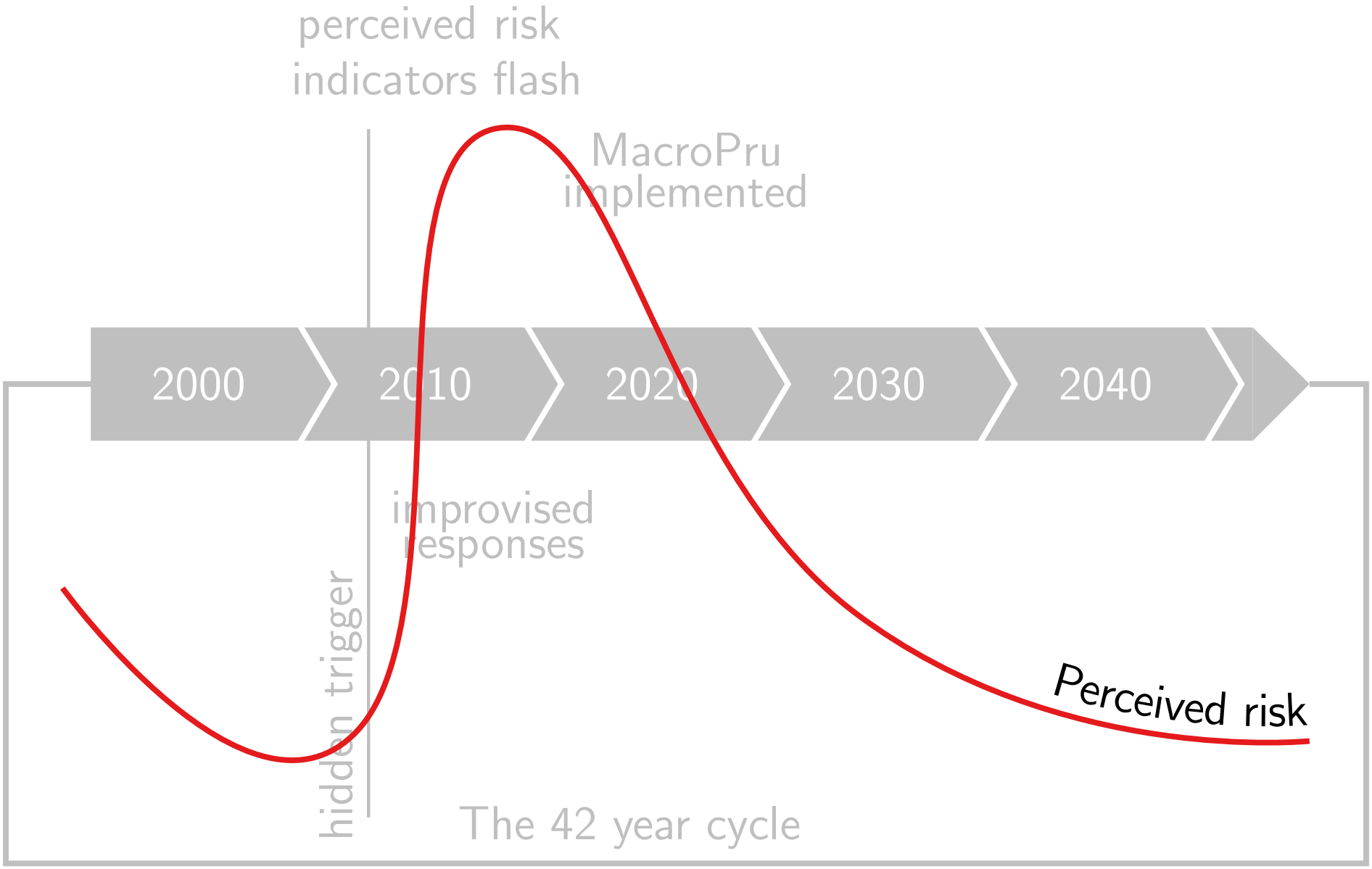

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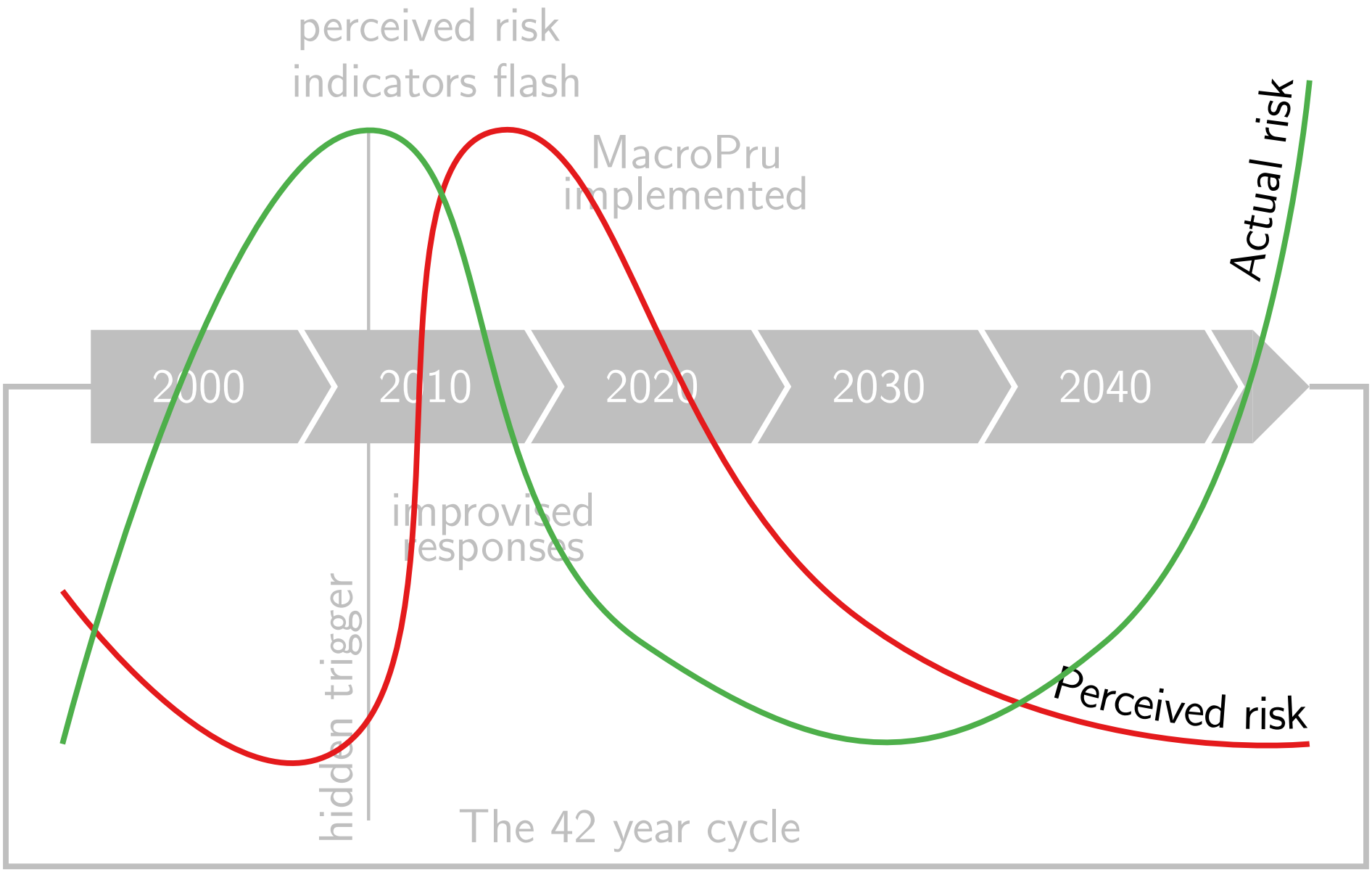
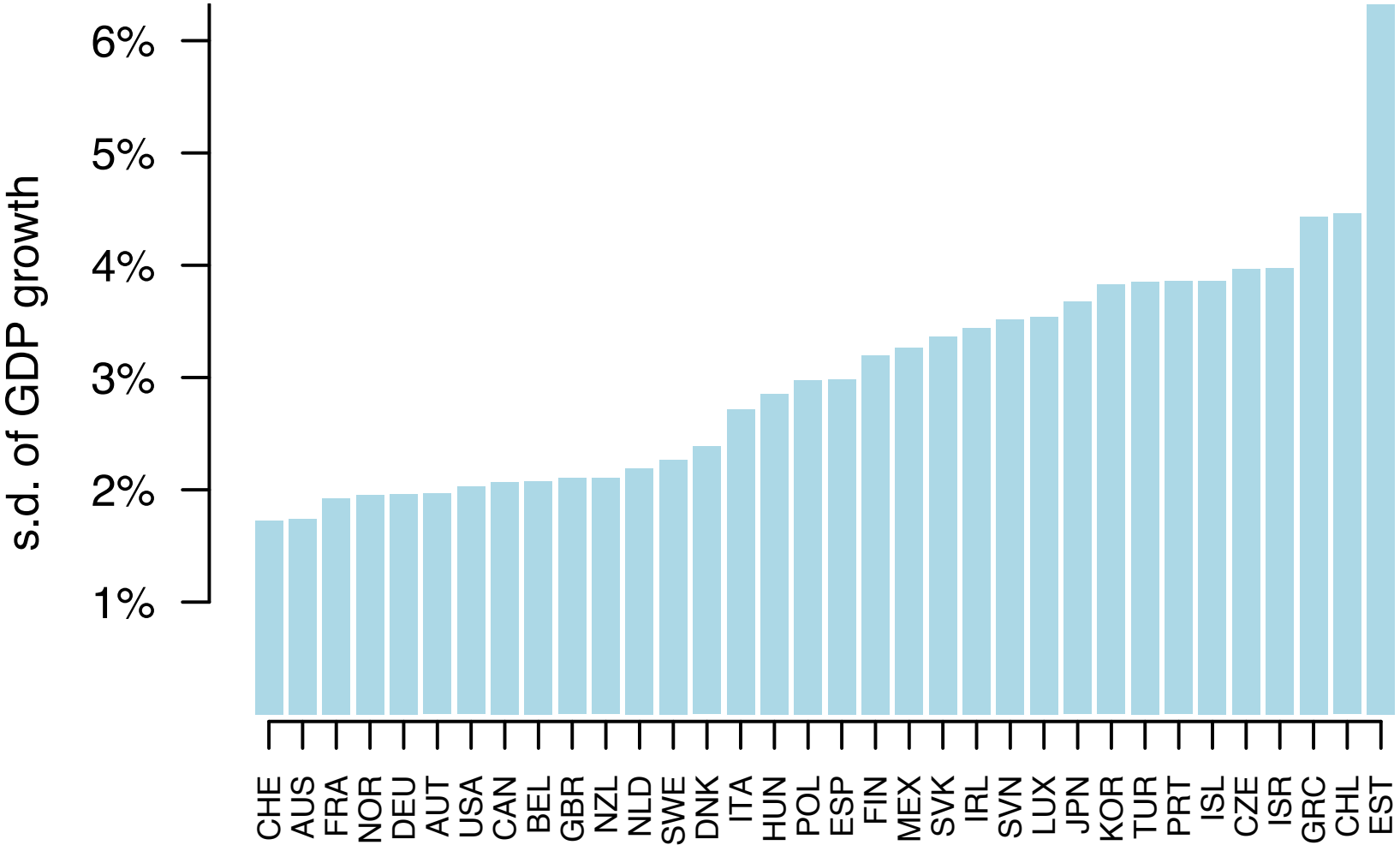


- Can one entertain the thought that in some forms MacroPru could be pro–cyclical?

Macroeconomic Volatility

http://modelsandrisk.org/Iceland



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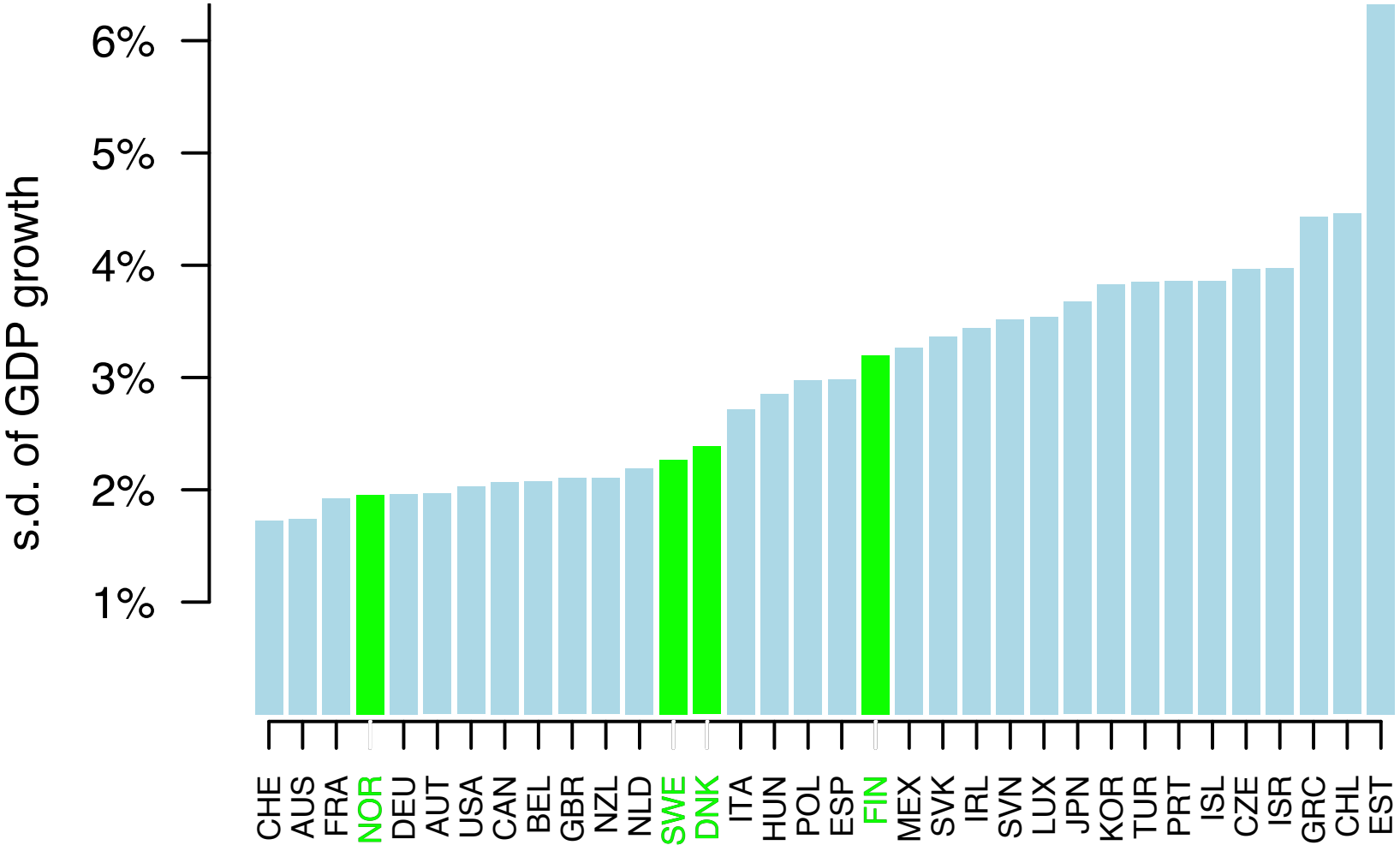

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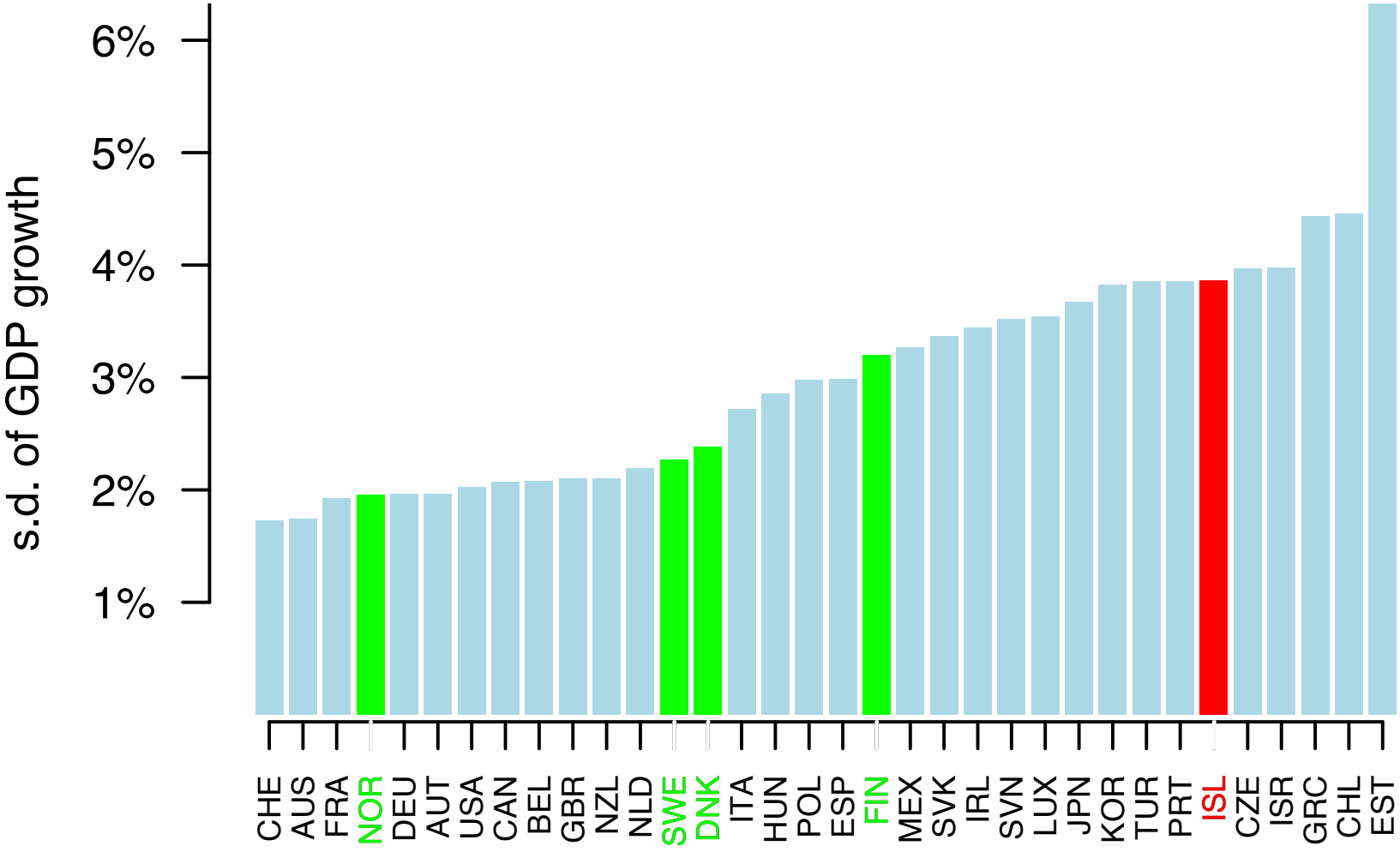

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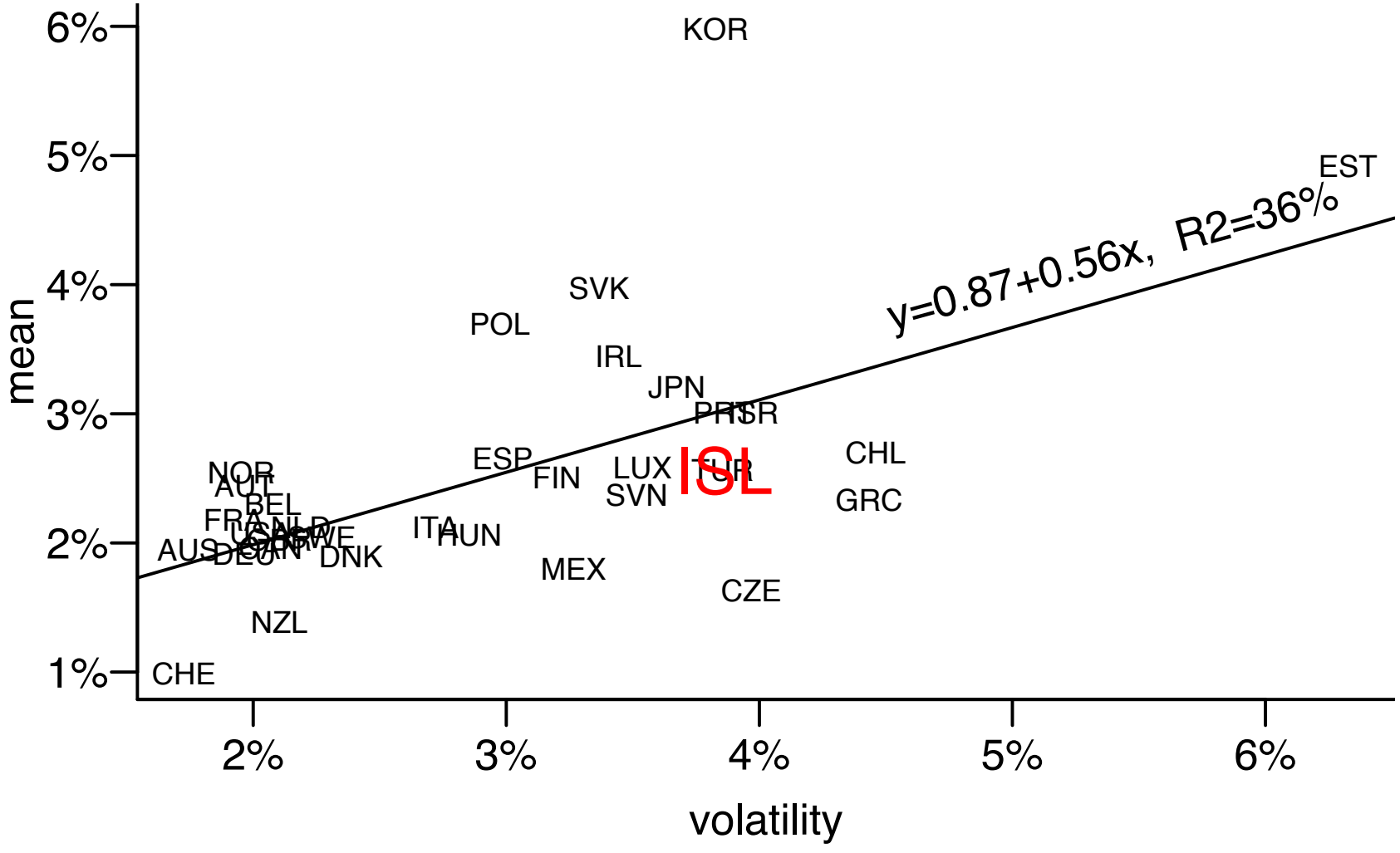

Economic challenges

- High inflation (now unusually 1.6%)
  - widespread indexation (here positive)
- Tight, homogeneous, low skilled and pro–cyclical labor market
  - Salaries now growing at double digit rates
- Economic growth comes from natural resource level effects
- Carry trades
  - Before 2008, 40% of GDP
  - Now growing rapidly again
- Fiscal policy countercyclical (e.g. large surplus now)

Monetary policy

- Inflation targeting (2.5%)
- Taylor equation, discount rate 5.75%
- Attracts hot money inflows
  - Increases money supply
  - positive wealth effects
- Rate increases stimulate

Plan for stability

http://modelsandrisk.org/Iceland

- Stop worrying about inflation so much — continue with indexation
- Keep interest rates at same level as in northern Europe
- Establish a sovereign wealth fund
- Non–sterilized FX interventions (to further disincentivice carry traders)

"Learning from History: Volatility and Financial Crises" (2015)

with Marcela Valenzuela (University of Chile)

Ilknur Zer (Federal Reserve)

Minsky and volatility

- Economic agents perceive a low risk environment as a signal to increase risk-taking
- Which eventually leads to a crisis

"Stability is destabilizing"

"Volatility in markets is at low levels, both actual and expected, ... to the extent that low levels of volatility may induce risk-taking behavior ... is a concern to me and to the Committee."
Federal Reserve Chair Janet Yellen, 2014.

Learning from History: Volatility and Financial Crises

- No extant empirical literature documenting such a relationship between financial market volatility, the real economy and crises
- We construct a comprehensive database on historical volatilities from primary sources (1800 to 2010, 60 countries
- Volatility *does not* predict crises
- but

- Decomposing volatility into unexpectedly low and high volatilities
- Strong and significant relationship between unexpected volatilities and the likelihood of financial crises
- Unexpectedly low volatility increases the probability of both banking and stock market crises
- Especially strong if low volatility persists half a decade or longer.
- Low volatility significantly increases risk-taking (credit-to-GDP)
- For stock market crises, but not banking crises, high volatility also increases the likelihood of a crisis, but only with much shorter lags, up to two or three years.

Conclusion

The lessons are...

- Risk is created out of sight in a way that is not detectable
- Attempts to measure risk — especially extreme risk — are likely to fail
  - Systemic risk measures like CoVaR, SES/MES, Sharpley, SRisk do not remotely capture systemic risk
  - Neither do the Basel II/III VaR and ES (nor are they supposed to)

The use of market data

- Most systemic risk measures are based on publicly available data that usually are market based
  - stock prices, CDS spreads, bid–ask spreads and the like
- Problem with market based indicators is that they react only after a crisis event is underway
- Might be cheaper to replace systematic risk measures based on market data with a Financial Times subscription
- Both react at the same time

It matters what models are used for and how they are used

- Risk models are

  most useful for risk controlling traders
  less useful in internal risk capital allocation
    - e.g. invest in European equities or JPG

  often useless for financial regulations
    - Traders read things like Basel III as manual for where to take risk

  dangerous when used for macro–prudential policy

one better not fall into the trap of doing probability shifting

Harmonization

- If we regulate by models we must believe there is one true model
- Therefore, banks should not report different risk readings for the same portfolio
- However, forcing model harmonization across banks is pro–cyclical
- And forcing the same models to be used for everything internally is also pro–cyclical
- And pro–cyclicality negatively affects economic growth and increases financial instability

model harmonization cannot be recommended for macro–prudential reasons

Best way to make the system stable is heterogeneity, not MacroPru

- Encourage different models to be used internally and across industry
- Have different regulations for different parts of the industry
  - Regulate banks differently from insurance companies and those differently from asset managers
- Encourage new entrants
- Encourage new forms of intermediation
  - just make sure to not regulate them with banking regulators

So

- Risk models are subject to considerable model risk, but the signal is often useful
- If one understands the model risk of risk models, they can provide a useful guidance
- Concern that important policy decisions are based on such poor numbers
- Basic compliance suggests that risk models outcomes should contain *confidence bounds*

The cost of a type I or type II error is significant

The minimum acceptable criteria for a risk model should not be to weakly beat noise