ACTUARIAL ASSOCIATION OF EUROPE

Professional judgment required
Example of challenges

Siegbert Baldauf

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Warning from history for actuaries

Example: Near-failure of Equitable Life in 2000.

First UK life insurer, founded in 1762. Second largest life insurer and largest mutual insurance company.

Background: Equitable life had sold policies with a Guaranteed Annuity Rate, offering a minimum annual annuity at maturity date of e.g. 10£ for 100£ in pension savings (stopped in 1988).

Product was developed in the 1970s, a time with high inflation rates.

Decrease of inflation made it impossible to finance this conversion rate

All attempts to renege on these contractual obligations failed.

Undertaking closed for new business in 2000

CEO was Appointed Actuary in personal union

Inquiry of this failure headed by Lord Penrose started 2001

Penrose Report: "*Equitable used a range of "**dubious" actuarial techniques** - also employed by other life insurers - to make it look like it had made a surplus when in fact it had made a loss*"

Warning from history for actuaries

The Penrose Report: A Discussion Meeting

held by the Institute of Actuaries, in Birmingham, 24 May 2004:

"…. there is always a difficult balance required in setting guidance notes between those actuaries who want a great deal of professional freedom and **an ability to exercise judgment**, and so want the **guidance** to be as **vague** as possible, and those actuaries who want to be told **exactly** how they must **carry out** their work.

(Source: B.A.J. 10, V, 1047-1070 (2004))

Significant changes on the role of the Appointed Actuary followed in 2004:

- Role of Appointed Actuary not continued
- New roles created: Actuarial Function Holder and With-Profits Actuary

“Cradle of the profession”

Paul Embrechts; ASTIN/AFIR, Panama 21/8/2017

A Darwinian View on Internal Models … and beyond!

*Modern society will no doubt need **tomorrow’s actuary** (whether life or non-life) to go back to this early cradle of our profession, that is as a data driven and model guided financial decision maker in a world governed by uncertainty.*

The following examples deal with

- Data,
- Modelling,
- Decision making and
- Relevance of the code of professional conduct

Solvency II requires professional judgment

Throughout the framework, expert judgment needed and explicitly required in relation to data and modelling.

- Solvency II changed the governance of undertakings.
- The actuarial function required as one of four key function.
- Holder of the Actuarial Function not necessarily an actuary.
- Instead of that: Fit and proper – requirement.

EIOPA could not refer to actuarial standards.

Detailed description of tasks required, comparable to those resulting directly from actuaries code of professional conduct.

Our questionnaire can be beneficial.

Example: Tasks of the Actuarial Function (1)

Directive Art. 48
a) coordinate the calculation of technical provisions

Delegated Acts Art. 272

<u>In coordinating the calculation of the technical provisions, the actuarial function shall include all of the following tasks:</u>

(a) assess the sufficiency of technical provisions and ensure consistency of calculation with Articles 75 to 86 of Directive
(b) assess the uncertainty resulting from the estimates made
(c) Proper treatment of limitations of data
(d) ensure that the most appropriate approximations are used
(e) ensure that homogeneous risk groups are identified
(f) Integration of relevant information from financial markets and available data on underwriting risks
(g) Year to year comparison of differences in the calculation
(h) Ensure that Options and guarantees are appropriately assessed

Example: Tasks of the Actuarial Function (2)

Delegated Acts Art. 272
c) Proper treatment of limitations of data

Valuation of technical provisions Guidelines 9-14

Material limitations of data

GL 9: Identification of the source of material limitations

GL10: Impact of shortcomings

GL 11: Data adjustments

GL 12: Recommendations of the actuarial function

GL 13: Application of expert judgment upon material limitations

GL 14: Documentation of data limitations

EIOPA-BoS-14/166 EN **Guidelines on the valuation of technical provisions**

Example: Tariffing (1)

Tariffing is a core business of actuaries. It requires a deep knowledge of the risk and a comprehensive overview of all relevant influencing values.

This is especially challenging for long-term products, if an adaptation of the premium is not possible.

While dependency on age and sex are well known, other parameter also have to be considered.

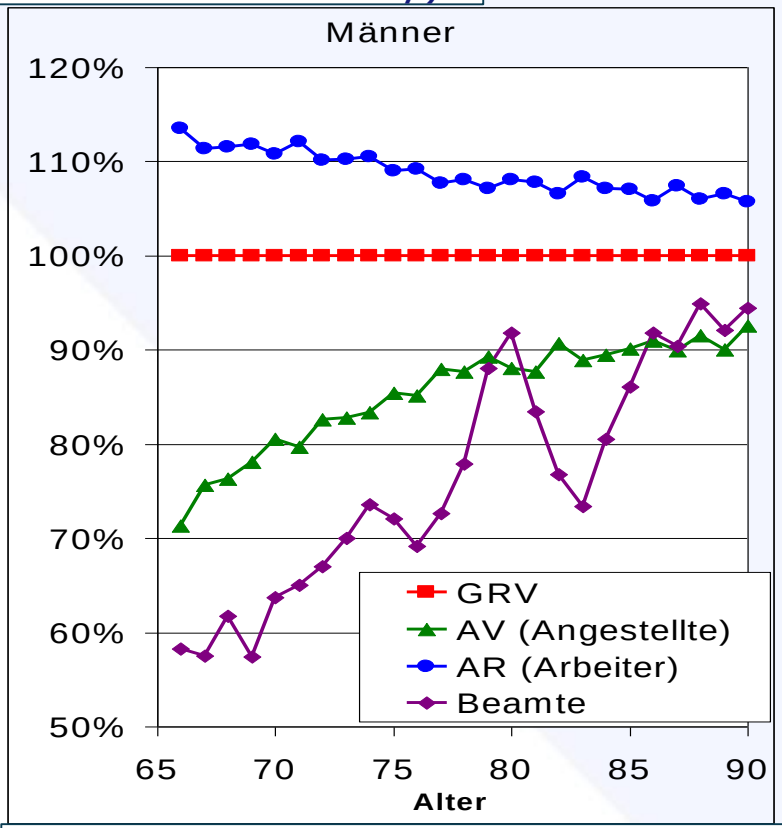
Example: Deferred annuity with lump-sum option at the end of deferment period.

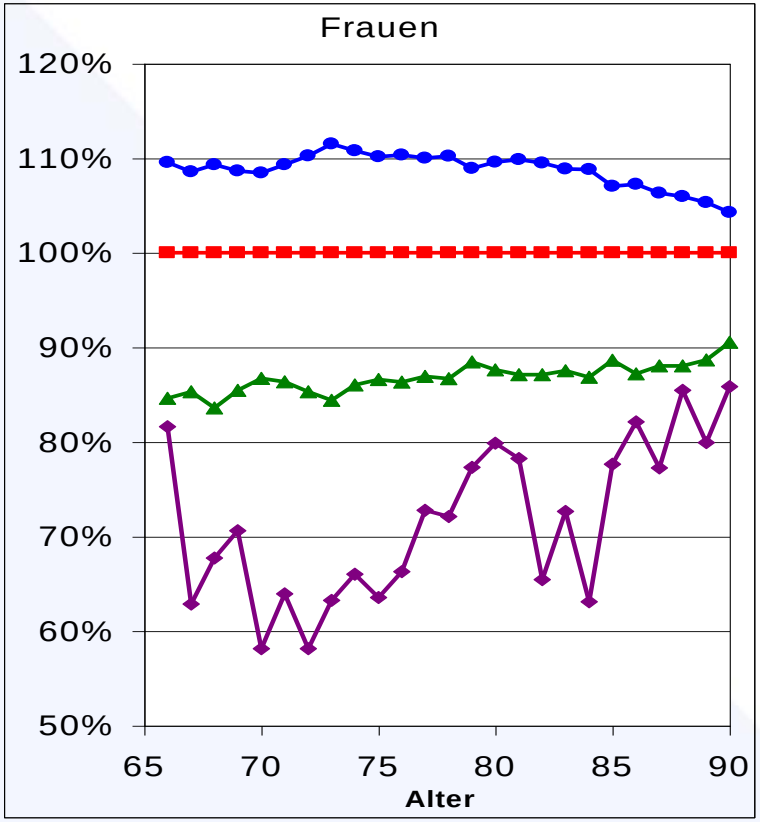
Professional judgment requires identifying and taking into account all relevant aspects.

Example: Tariffing (2)
Sociodemographic status - mortality

100% (red dotted line): Mortality of insured in social security system

Source: DAV Germany)





Tariffing requires professional judgment

Higher mortality for workers (“Arbeiter”)
Lower mortality for civil servants and white-collar employees

Example: Tariffing (3)

Sociodemographic status of insured affects life expectancy

Calculation of a deferred annuity tariff requires

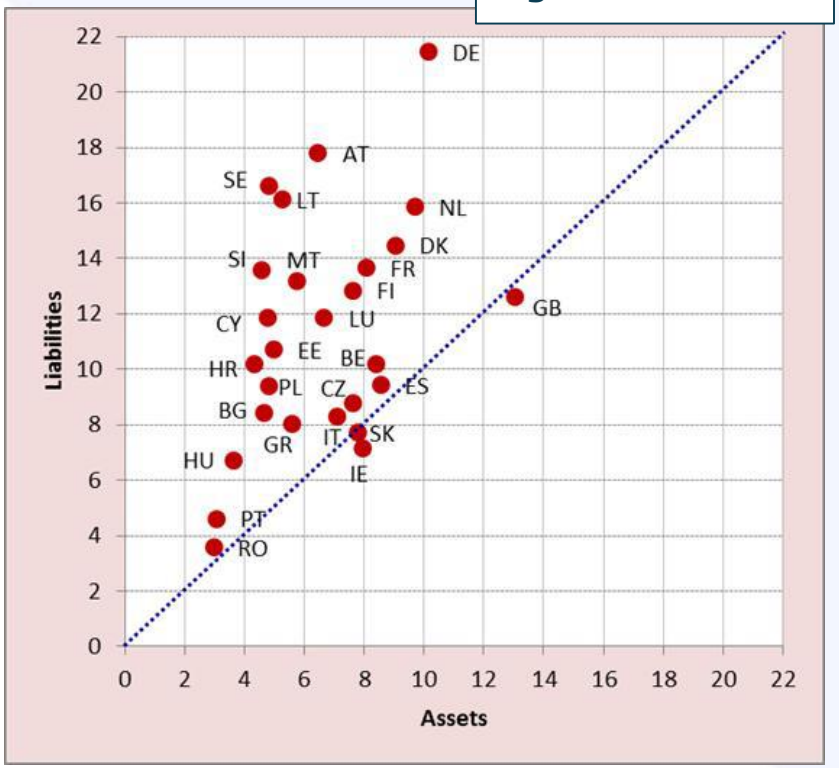
- Assessment and use of available data
- Deriving mortality rates (considering target group)
- Underwriting policy, including limitation of the annuity rates
- Risk assessment:
  - Higher social status comes along with higher life expectancy
  - Higher social status comes along with higher annuities
  - Risk of anti-selection at end of deferment period

Communication of results (1)

Example: Cashflow–analysis in former Insurance stress tests

Insurance stress test 2014: A focus of this stress test was on duration mismatch. Duration of liabilities was measured by Macaulay duration.

Figure 103: LYA



Based on the Macaulay duration i.a. the depicted result was published. Duration mismatch was broadly discussed in the Stress test report 2014. (IRR was analysed in addition)

The results of the Low Yield module analysis suggest that some undertakings are operating with considerable duration and/or internal rate of return mismatches. In some cases this is mitigated by relatively high capitalisation, but this does not remove the underlying vulnerabilities created by such mismatches.

Communication of results (2)

Stress test report 2016:

77. **The different duration concepts have limitations and cannot be used indistinctly for every purpose.**

The Macaulay estimator: designed for fixed-income assets and assumes **fixed cash-flows** are computed appropriately and can be interpreted as the average time of maturity of the underlying asset or liability cash flows.

However: Assessment of sensitivity of the best estimate to changes in the interest rates is not always possible. Some cash-flows actually do move when rates change, due to the existence of optionalities in the insurance contracts.

78. When the sensitivity to changes in interest rates is at stake, then **the optionalities and the contingent nature of the liabilities are better kept with an effective duration estimator**

Communication of results (3)

Stress test report 2016 (excerpt)

	Approximate effective duration	Macaulay duration (liabilities)
Austria	9.96	15.77
Belgium	7.65	10.99
Germany	8.67	21.40
Denmark	16.53	17.59
Spain	10.89	10.10
The Netherlands	14.67	16.40
UK	4.59	10.57
EU/EEA	**8.23**	**13.97**

Stress test report 2016:
The risk assessment of assets and liabilities can be done by means of duration estimation.
Macaulay duration was used in 2014 to assess the matching in terms of maturity between assets and liabilities, also under the low-for-long scenario

EIOPA refrained from publishing duration gaps in this report

Available data determine insurers business

Data sources

Traditional Sources: Structured data from data base of insurance undertaking with long history, open data (e.g. statistical data, social data) Conventional tariffs	Digitalization: Increased use of real-time data Pay-as-you-live-tariffs (e.g. use of wearables) Pay-as-you-drive-tariffs or Pay-how-you-drive-tariffs (use of telematics in car insurance)	Big data, analytics and unstructured data: Use of artificial intelligence. Machine learning to generate smart data, use of algorithms

Big data, etc. and insurance products

Making use of this "big data" in tariffing:

- Artificial intelligence can help to identify structures
- Algorithms analyse preferences or risk behaviour of people

But: Algorithms need validation!

Conformity with legal requirements

(e.g. GDPR: General data protection regulation)

Example: GDPR Article 9, Paragraph 1: *Processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be prohibited.*

Actuarial professional judgment required

- Correlation vs. causality,
- Identification of possible confounders or mistakes in history
- Assessing risk related to an algorithms before use
- Issues to be considered: Accounting, Solvency, Cost, Fiscal treatment, …

Big data: Nassim Taleb's (pessimistic?) view

Quotes (https://fs.blog/2013/02/the-big-errors-of-big-data/):

I am not saying here that there is no information in big data.
There is plenty of information.
The problem — the central issue — is that the needle
comes in an increasingly larger haystack.

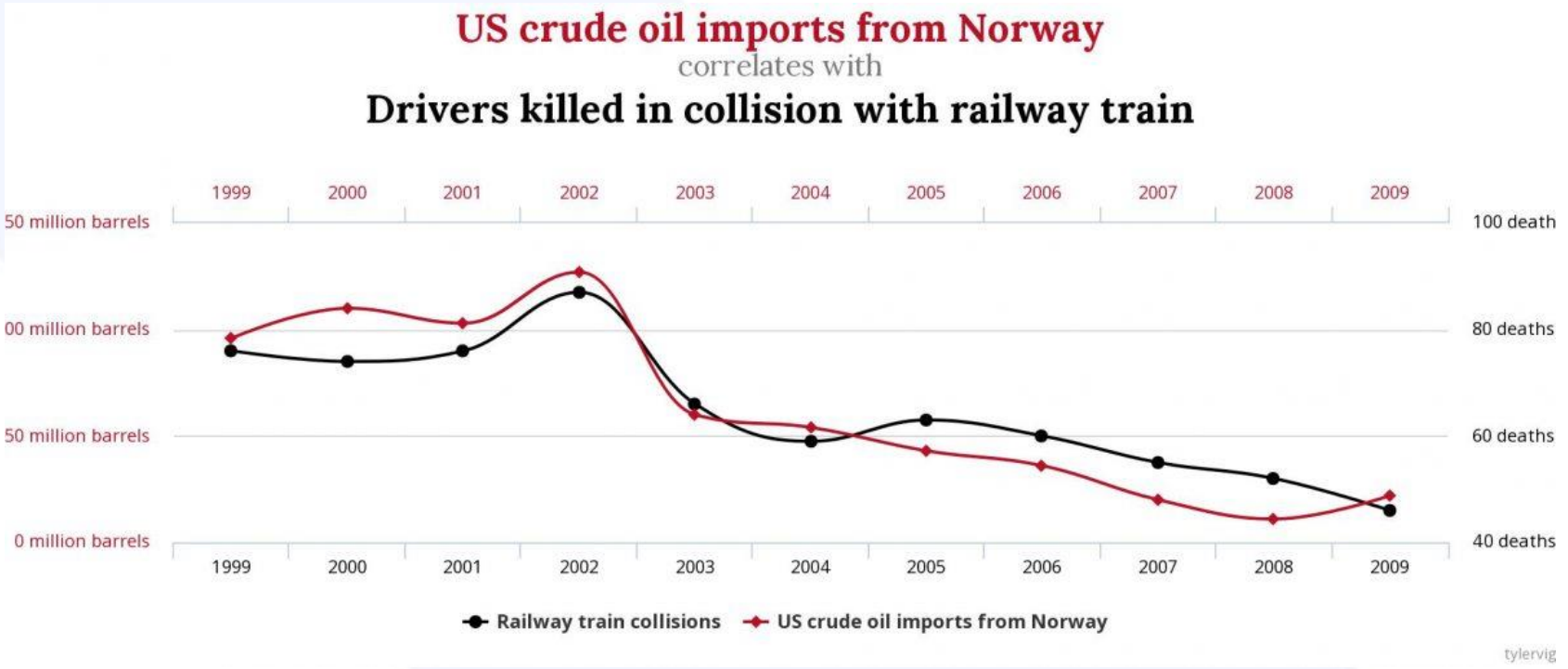
With big data, researchers have brought cherry-picking to an industrial level.

Modernity provides too many variables, but too little data per variable. So the spurious relationships grow much, much faster than real information.

In other words: Big data may mean more information, but it also means more false information.

Professional judgment required to identify useful information!

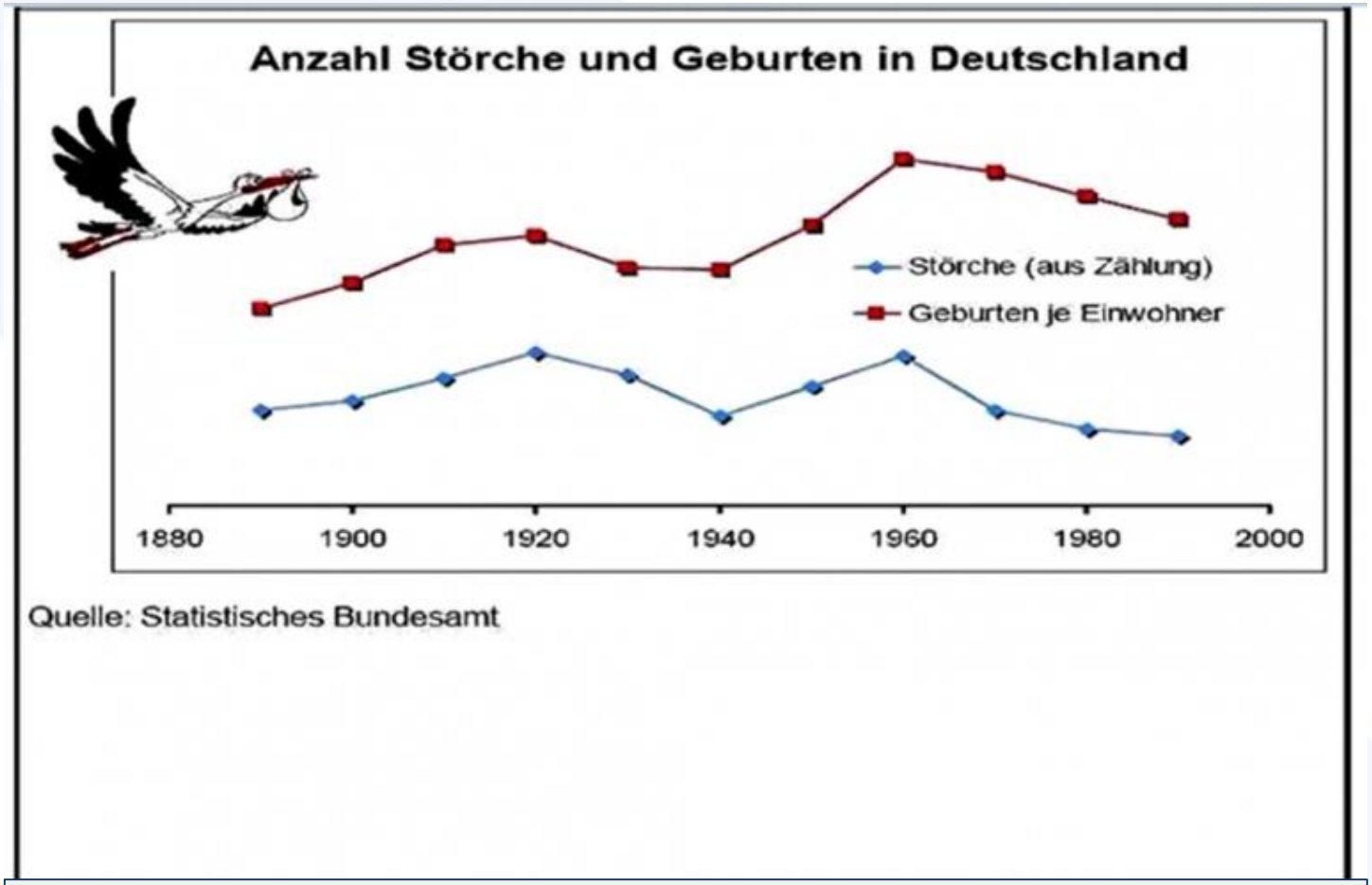
Spurious correlations



Should the US stop oil imports from Norway?

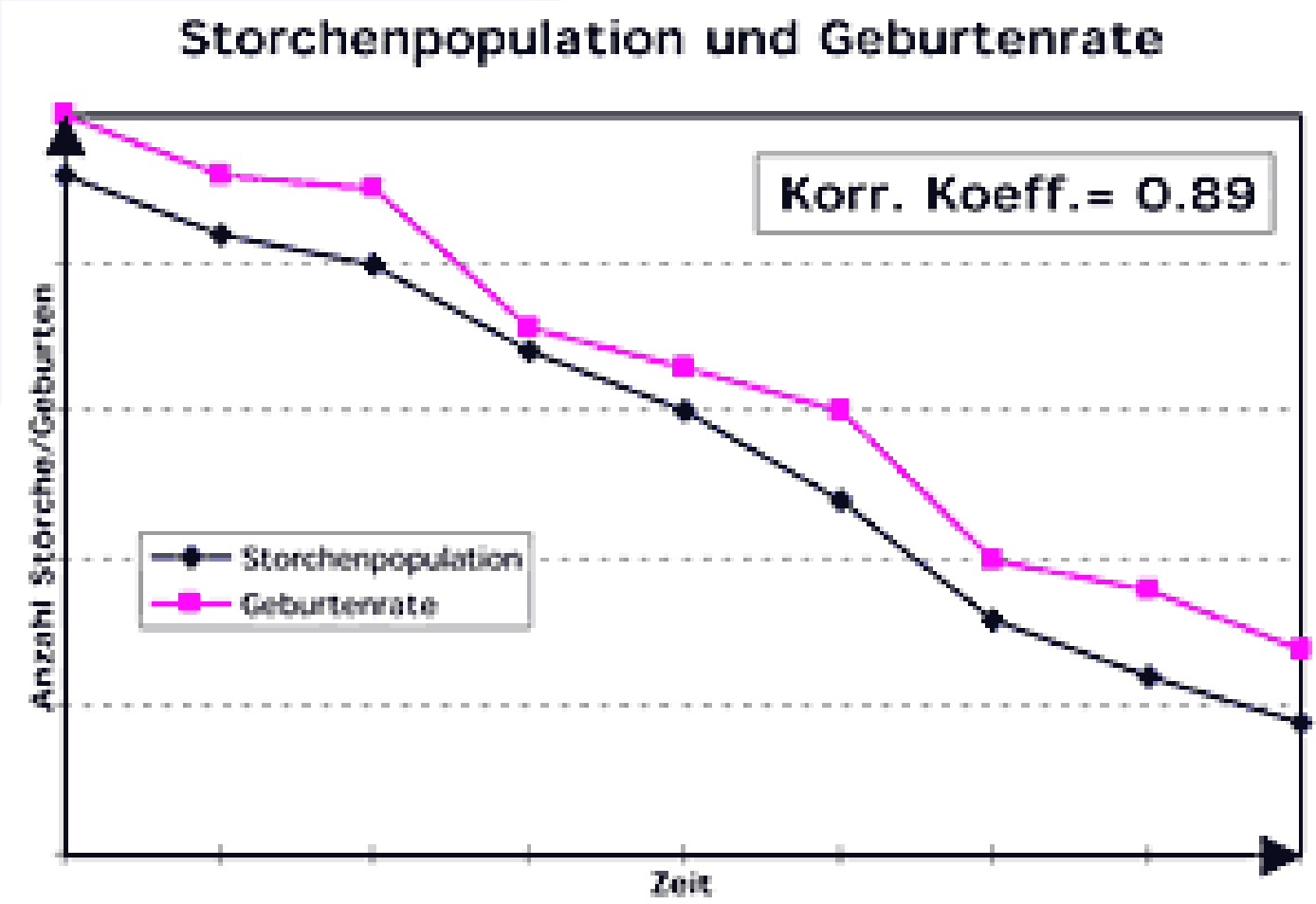
Source: Tyler Vigen: Spurious correlations

Spurious correlations



Number of storks compared to birth rates in Germany

Spurious correlations



Population of storks correlated to birth rates in Germany