2010 Joint Statistical Meetings in Vancouver, British Columbia
Activity 119: Statistical Literacy 2010

Statistical Literacy for Managers: Analyzing Time Series Data

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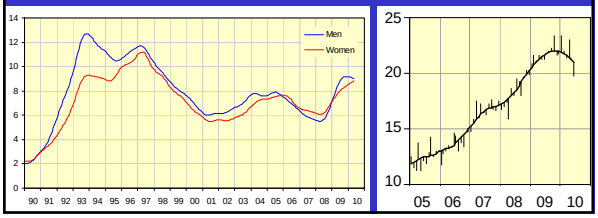
Cross section data:

Sweden	
May 2010	Unemployment
Men	9.1 %
Women	8.6 %
Both sexes	8.9 %

Enterprise X	
June 2010	$ Millions
Sales	20
Costs	18
Profit	2

Time series data:



University education:

Statistical science: Cross-section data dominates

Master programme:

Very few take a course in time series analysis

Many students of engineering and business administration take courses in statistics, but no applied time-series analysis for their future jobs

More important: A gap between "statistical theory" and statistical literacy = deeper understanding, discussions of real cases etc.

Universities	Future jobs at enterprises
Statistical "theory"	
Methods for analysing data Randomised experiments Sampling theory	Administrative data, not statistical data
Inference Theory	Registers, no sampling Monthly reports with administrative data
Probability Theory	Accounting is not statistics But Six-Sigma is a sucess
Statistical literacy	
Real cases from Social science or Medicine Cross-section data only	

Profit and loss statement for enterprise X, June 2010, $ Millions

	Outcome		Budget		Previous year	
	June 2010	Jan-Jun 2010	June 2010	Jan-Jun 2010	June 2009	Jan-Jun 2009
Sales	20	112	24	123	19	117
Costs	18	99	18	104	17	105
Profit	2	13	6	19	2	12

Is this statistics?

Have statistical methods been used? (Good or bad?)

What shall the CEO do?

Increase or decrease the production capacity?

Accumulated sums from different periods are compared

Current prices only – no statistical time series analysis

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What shall the CEO do?

Increase or decrease the production capacity?

a)Are sales/costs/profits going up or down?

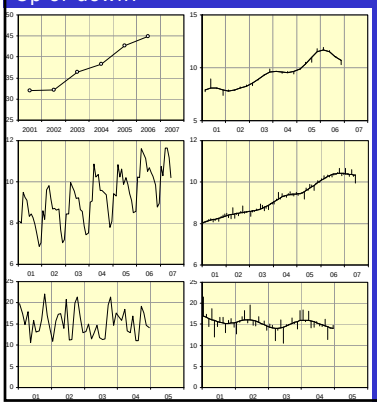
b)How much is it going up/down?

c)When did a change happen?

d)Why did it happen?

A course in applied time series analysis can start here!

Up or down?



How much?

2001	32.0	
2002	32.2	0.5%
2003	36.4	13.1%
2004	38.3	5.4%
2005	42.7	11.5%
2006	44.9	5.0%
2007	43.5	-3.1%

Introduce ARIMA-modeling

Extrapolate the local trend!

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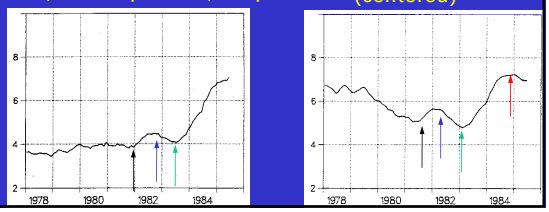
a) When did a change happen?

b) Why did it happen?

Fixed prices
Correct trend (centered)

Sales, $ Millions per month, enterprise X



Statistical literacy – how are the students trained?

Table 1:

Average monthly salary

Men	5 000 $
Women	4 000 $

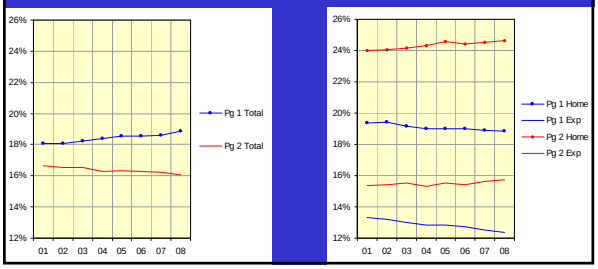
Quality?
- Sampling errors
- Non-response errors

Are these men and women comparable?
- Age
- Level of education
- Occupation

Table 2:	Men	Women
Private sector	5 400 $	5 600 $
Public sector	3 400 $	3 600 $
All:	5 000 $	4 000 $

The same statistical literacy teaching should be used for time series!

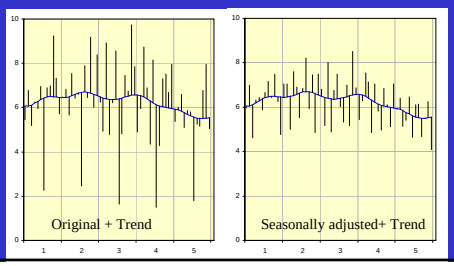
Gross profit margin % 2001	Product group	
	Pg 1	Pg 2
Homemarket	19.4%	24.0%
Export	13.3%	15.4%
Total	18.1%	16.7%



Random variation and statistical literacy:

•If you don't understand random variation, then short term changes will be misinterpreted

$ Millions						
Year	Month	NewOrders	Seasonally adj	TC	E	stan res
5	11	7.960	6.268	5.516	0.752	0.82
5	12	5.053	4.101	5.541	-1.440	-1.51



Conclusions:

•Time series data are more important than cross section data for managers and many others

•Teaching of time series is often mathematical only, statistical literacy for time series is missing

•Statistical description of time series is not trivial – this is essential for the students future jobs

•Don't misinterpret change, there can be a hidden factor that is the cause!

•The random component is visible! It must be understood!

•If you teach statistics to students of Business Administration you must have a genuine interest in this subject