Longitudinal analysis using warehouse techniques

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Statistics Netherlands

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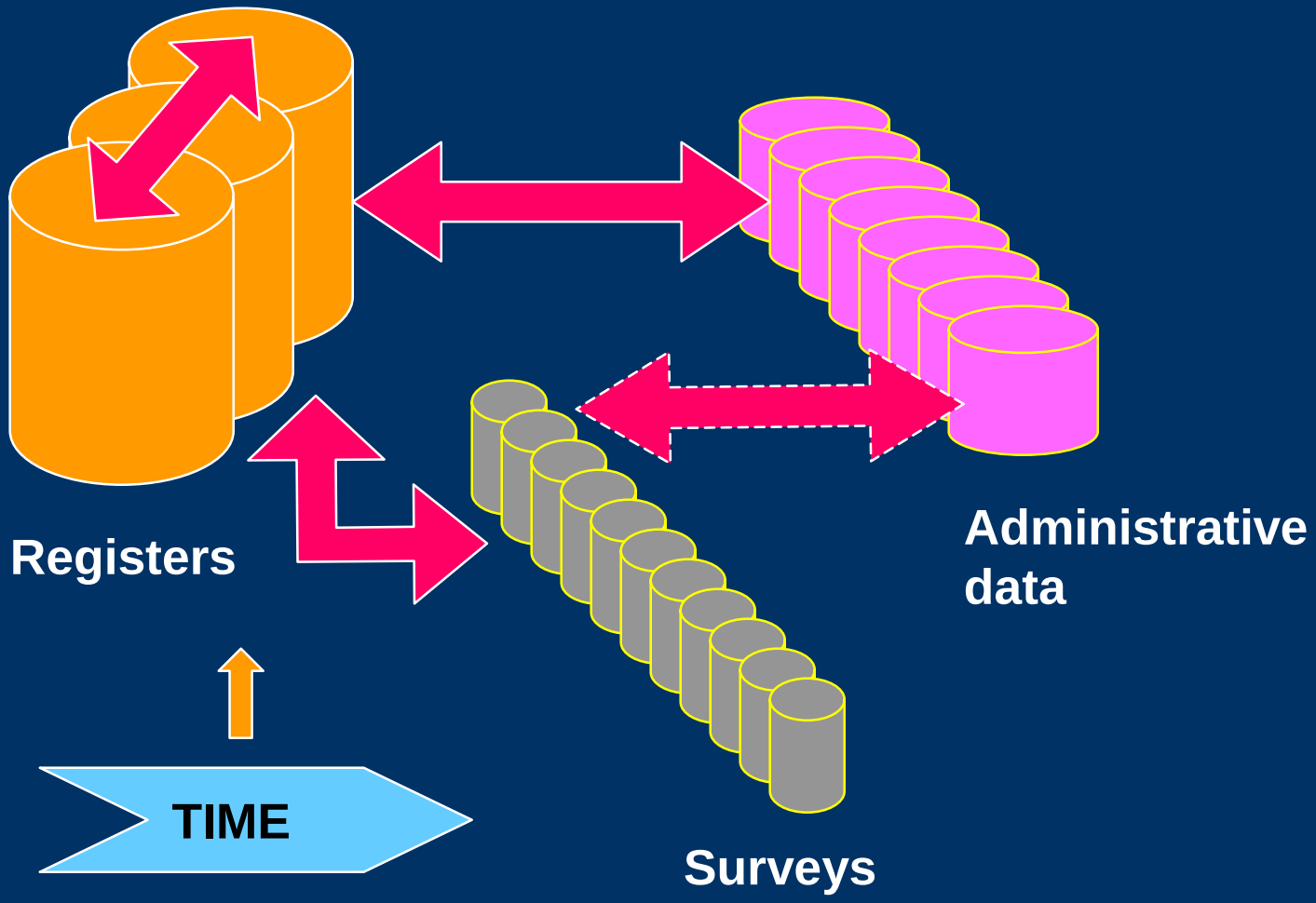
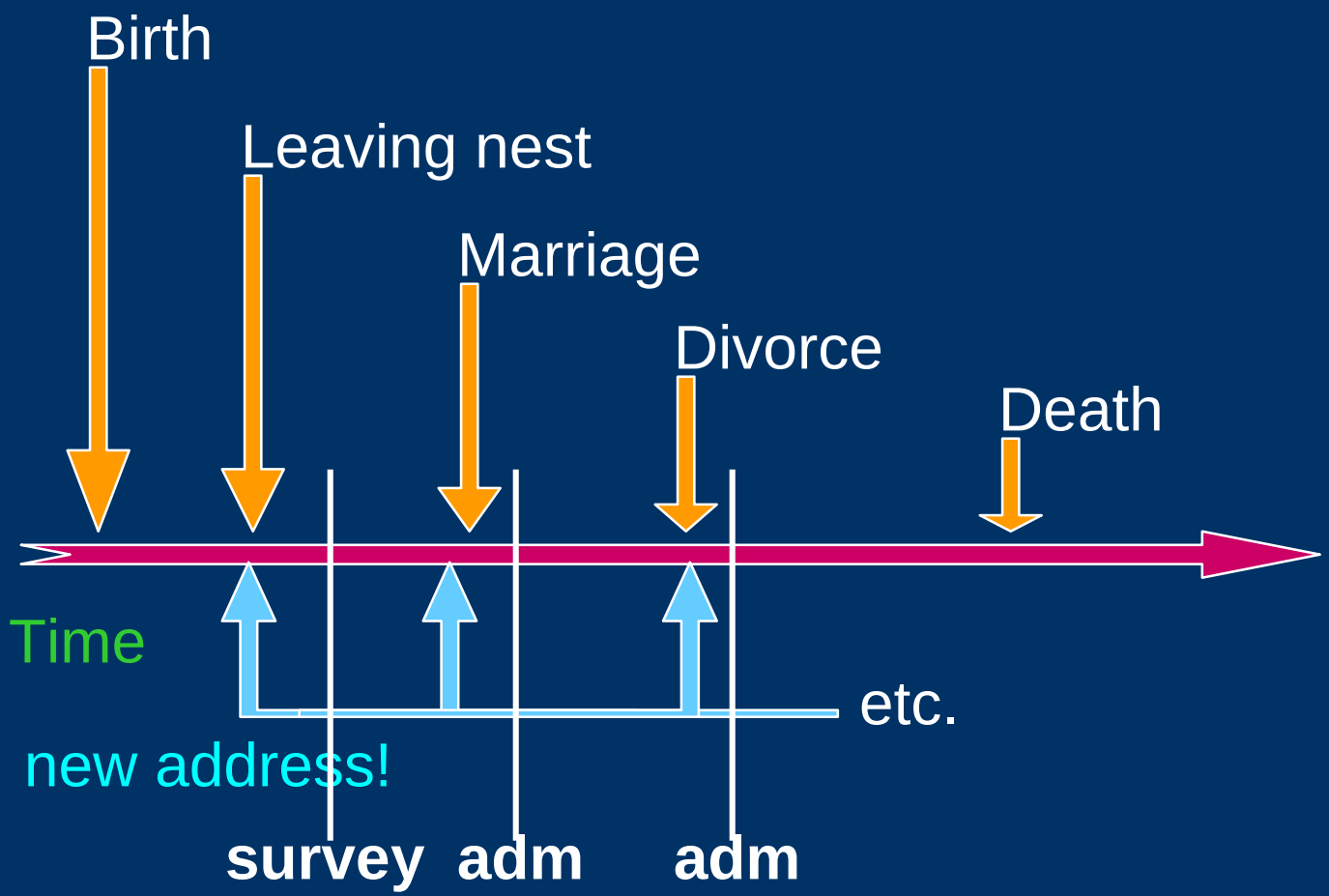
The Problem (1)



The Problem (2)



The Population register

- **Yearly snapshot**
  - All municipalities submit snapshot
  - Dates vary; January to February
- **Continuous updates**
  - Automatic reception
  - Coupled to inter municipal network

- **Statistics Netherlands**
  - Keeps obsolete copy (few months)
  - Integrates snapshots and updates

(New) Storage Solutions

Data Warehouse

The rise of BI (0)

The rise of BI (1)

- **Analysis of point-of-sale data**
- **Analysis of real time sales**
  - Television
  - web stores

– **Analysts not proficient with programming tools**
– **Explorative type of analysis, output unknown to programmers**

The rise of BI (2)

- **FILE: (200 mil x 4k = 800Gb)**
  - Sold articles to person at moment in time
- **Attributes**
  - Date, customer-id, name, number, address, amount, salesperson, invoice#, article#, article name etc. (4kb per record)

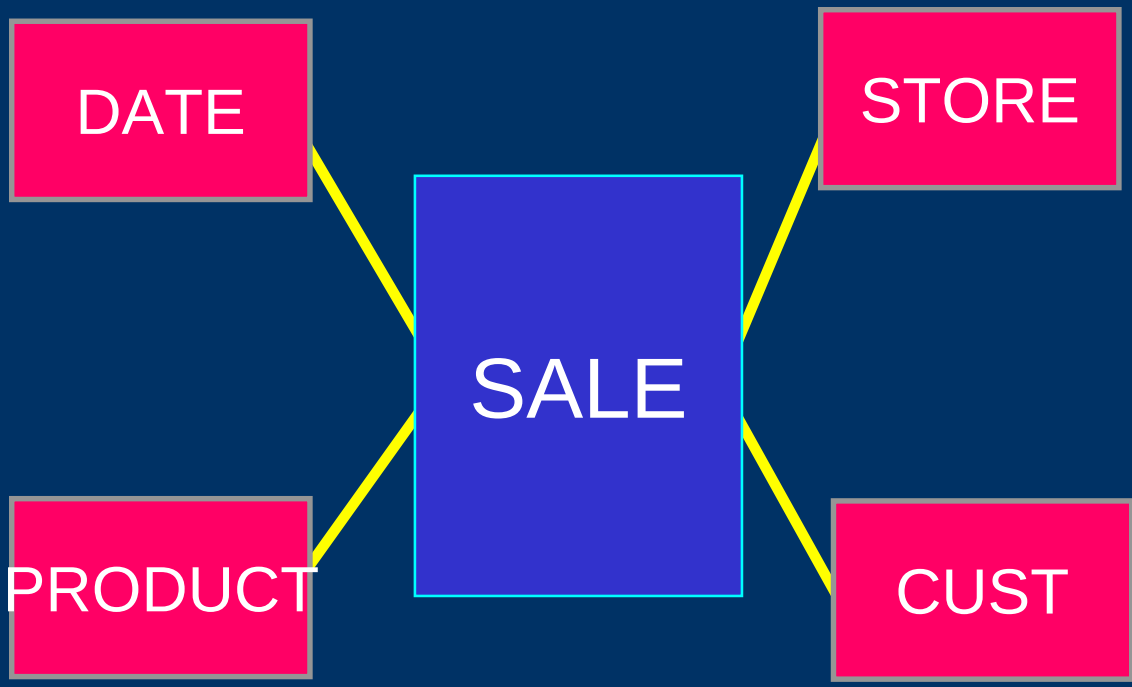
This file tells you all there is to know about the sales side of this business

The rise of BI (3)

- **dissociate the file:**
  - Customer attributes (20.000 x 1k = 20 Mb)
  - Salesperson attributes (100 x 1k = 100 Kb)
  - Location attributes (6 mil x 1k = 6 Gb)
  - Date attributes (1000 x 1k = 1Mb)

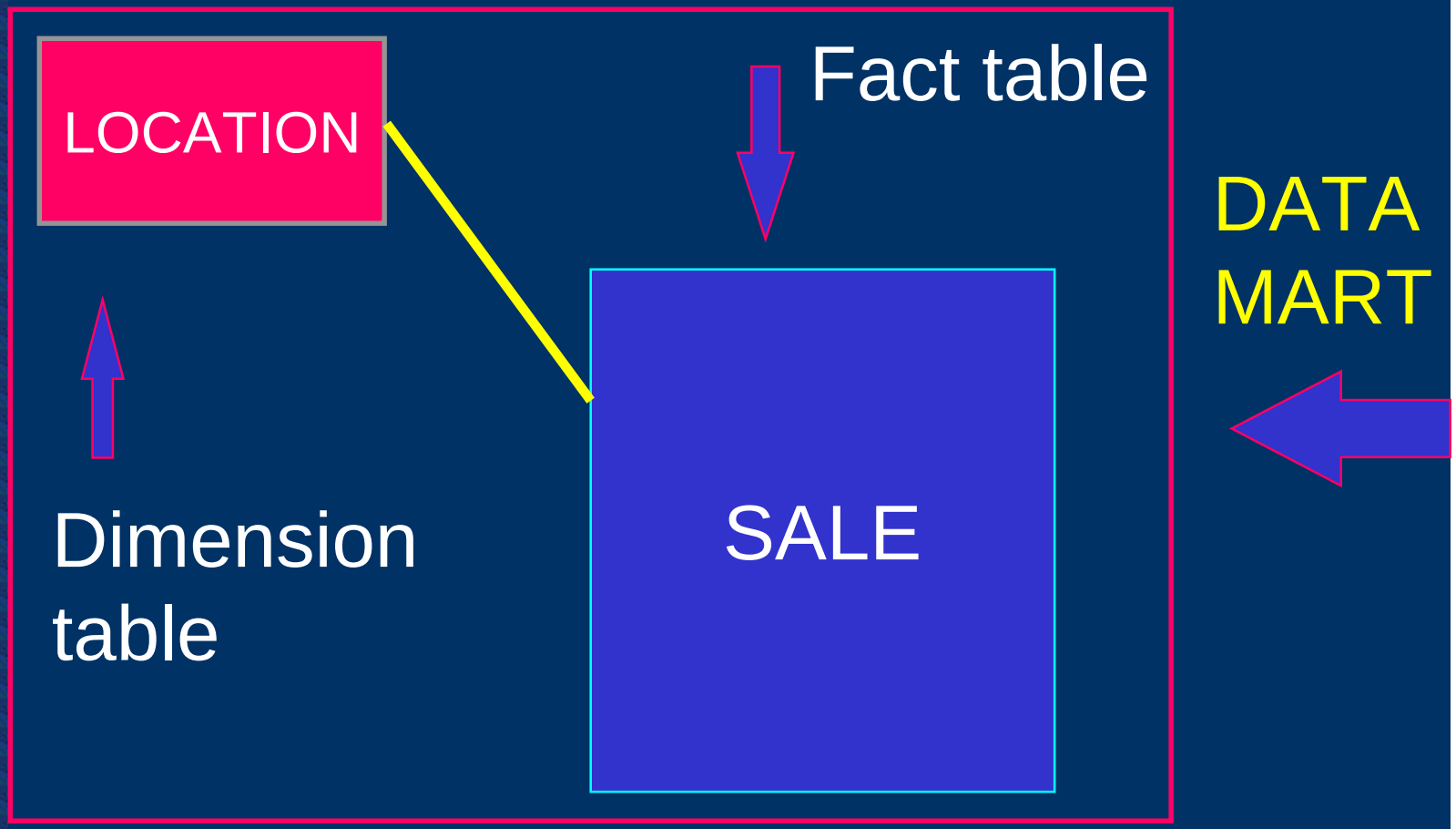
  - Above keys + amount (200 mil x 25b = 5Gb)

The rise of BI (5)



Data Mart

The Dimensional Model



(New) Storage Solutions

OLAP Engines

Olap Engines (1)

- Main functions:
  - Performance increase
  - Access control
  - Presentation layer
- Most important subsystem:
  - Pre aggregation engine

OLAP Engines (2)

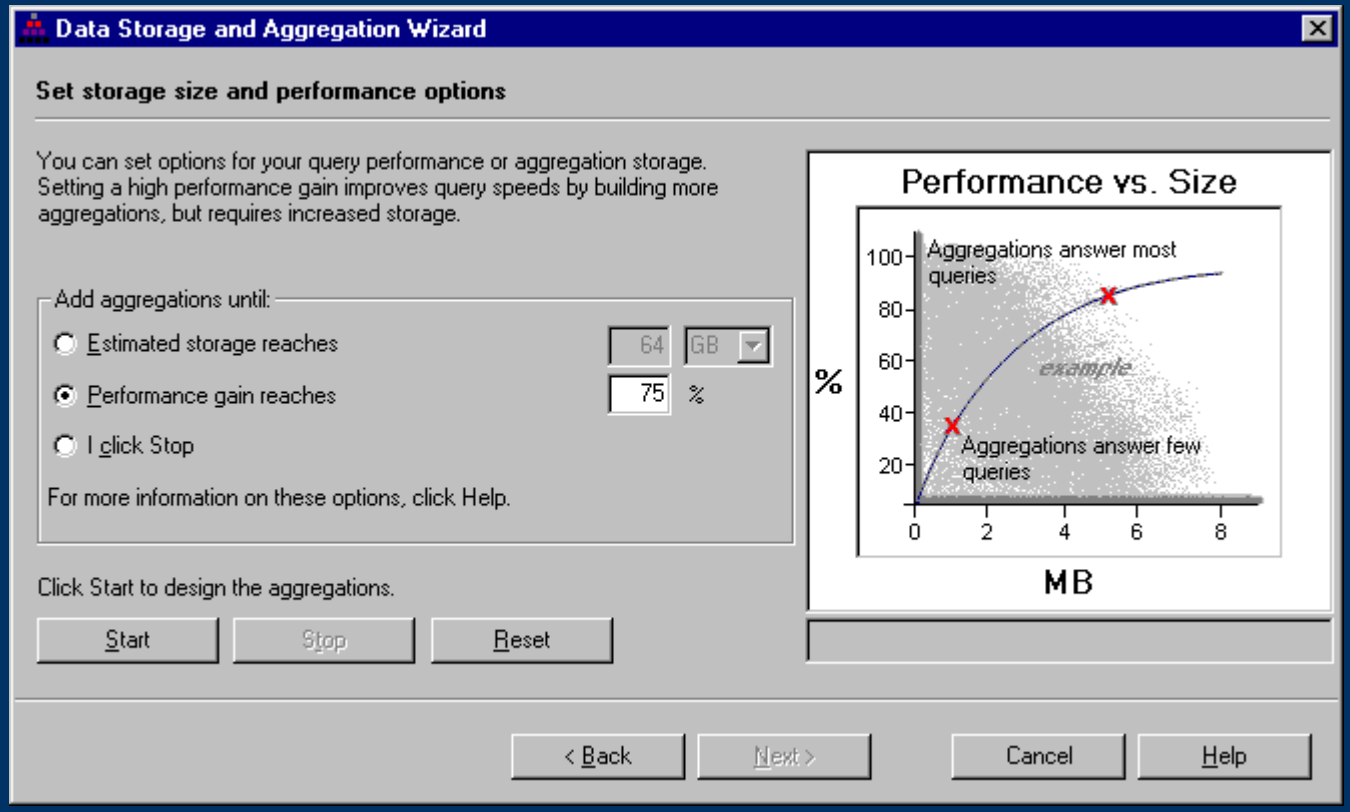
- **How Aggregates work:**
  - **Reduce cardinality in the dimensions and use hierarchic structure:**
    - Create an aggregate without person-ID
    - Create an aggregate without municipality
  - **Direct: summing over province uses the aggregate on province and the combined persons**
  - **Indirect: summing over country uses aggregate on province etc. (automatic)**

OLAP engines (3)

	12	600	1000
key	*province*	*municip.*	*hamlet*
00234	limburg	sittard	ondermergel
00233	limburg	sittard	urmond
00288	limburg	geleen	munstergeleen

Reduction of records to be summed: 1000x max

Automatic aggregates



Longitudinal Analysis

NOT looking at events in a certain period

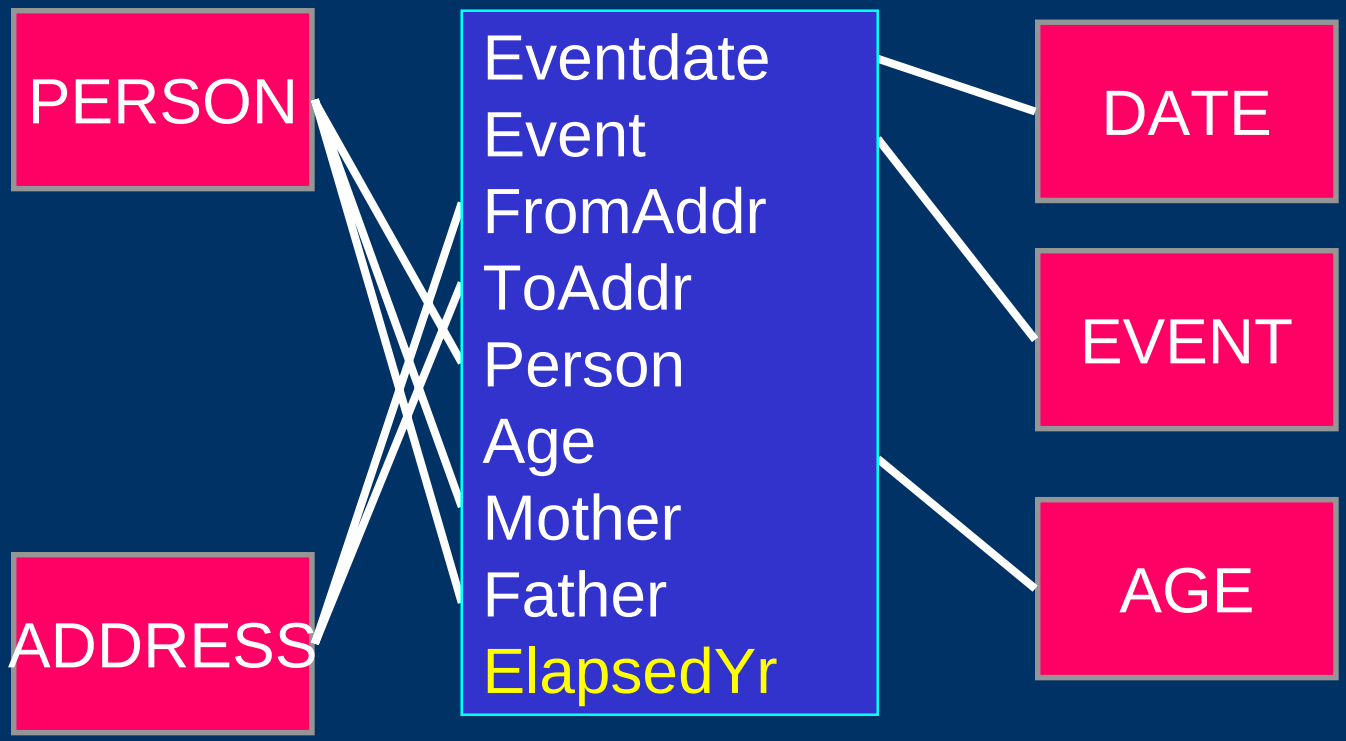
BUT

- looking at a sequence of events (at least 2)
- preferably over a long, long period
- preferably considering the “population” from which the events arise
- choosing a relevant time origin and scale

SO:

- not trends of averages/ distributions
- but averages/distributions of trends

Data mart MIGRATION



simplified

Near-Longitudinal Analysis

Mean value of duration, compare different groups:

- For all movers to Amsterdam last year; time at previous address, grouped by age etc.
- For all movers in the Netherlands last year; time at previous address

Mean value of duration, compare different eras

- For all movers to Amsterdam last year; time at previous address, grouped by age etc.
- For all movers to Amsterdam 5 years ago; time at previous address, grouped by age etc.

Time ≠ Time in L.A.

Time measure as

- Calender date (Period)
- Age
- Time since event (marriage, migration, childbirth, widowing)

Central limitation

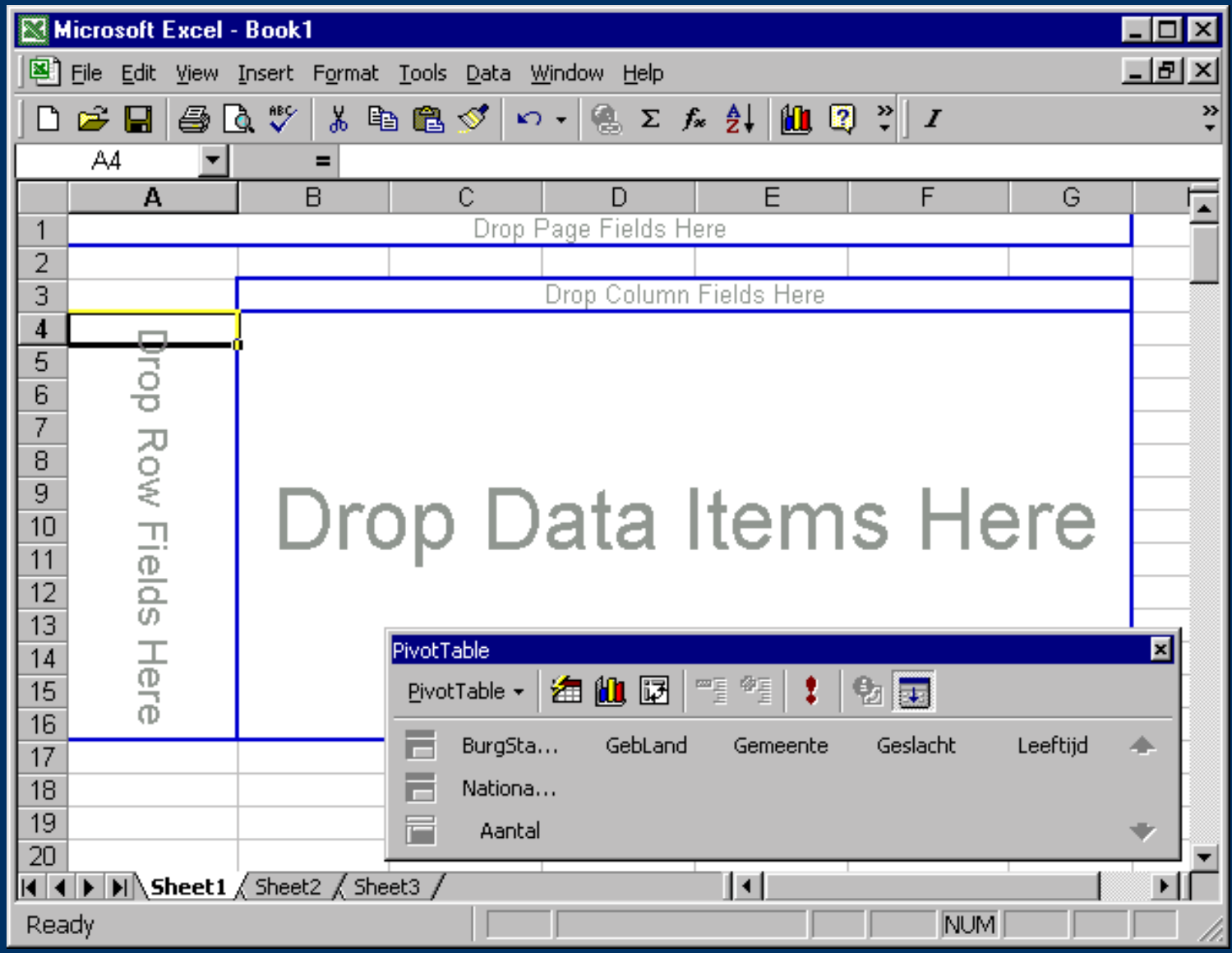
- Age, Period, Cohort are dependent

Longitudinal analysis (2)

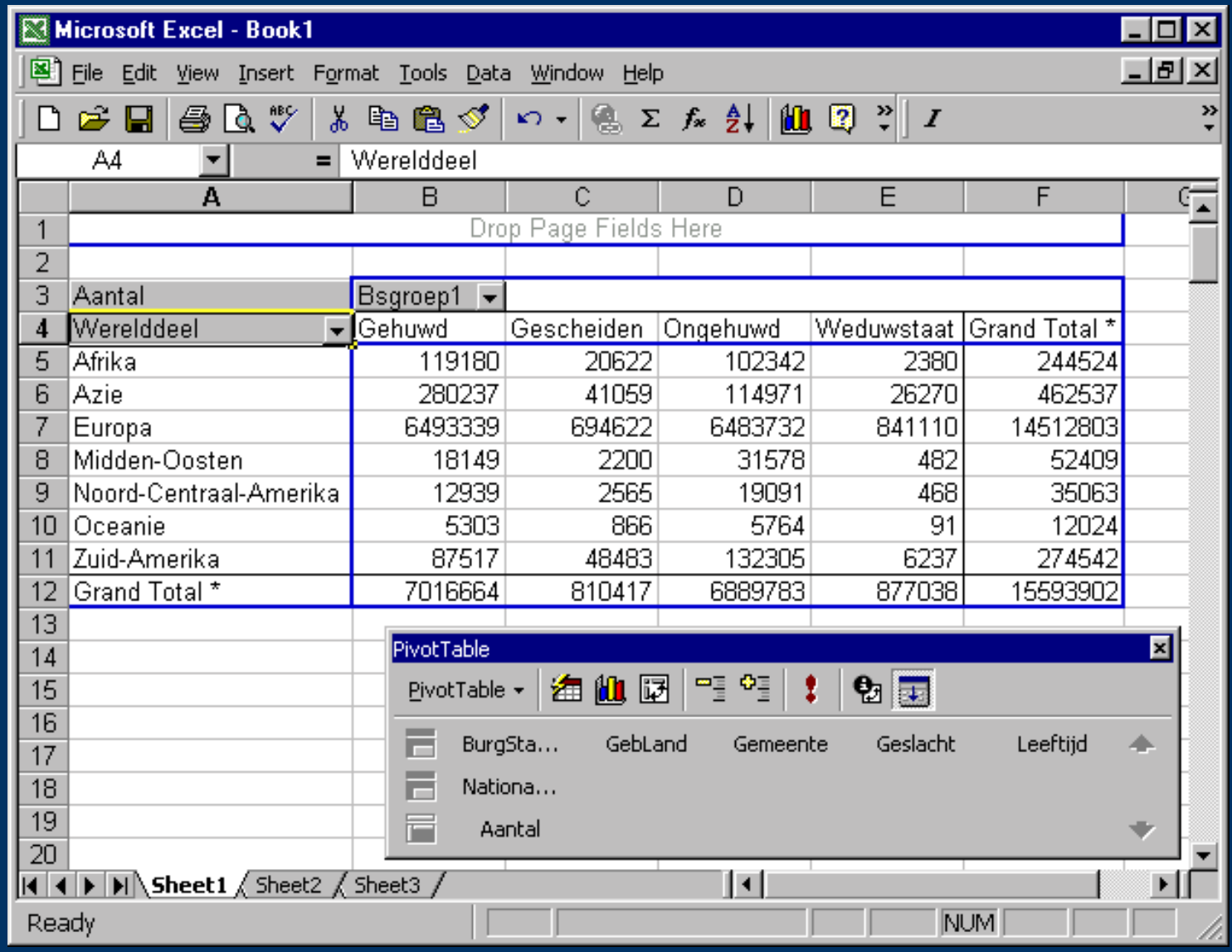
Pitfalls:

- **Need an accurate description of the population at risk**
  - Example: left/right handedness
  - time of residence before migration ≠ time of residence of movers
- **Beware of censoring problems**
  - Example: The graveyard fallacy
- **And other periods of non-observation**
  - Example: Giving birth while expatriate

Interactive usage



Interactive usage



Conclusions (1)

Use of OLAP and Warehouse techniques will speed up analysis considerably

- **Quicker than sequential files**
- **Variables all available and linked**
  - Especially over time
- **Integrated administration and meta**
  - This comes with the warehouse as consequence

Conclusions (2)

Rapid exploration will enable analysts to build up a much better and completer intuition about the statistic population

Population Registers can open a wealth of longitudinal insights, provided that the history of the records is maintained

Thank You !!