

# **EFFICIENCY AND RELIABILITY OF STRATIFIED SAMPLING IN AUDITING – RESULTS OF SIMULATION STUDY**

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# Audit and survey sampling

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**The aim of financial audit tests:** to establish **audit (true) value** of a position of financial statement / to establish **error amount (book value – audit value)** in a position of financial statement

## Nature of audit work:

- very large populations being tested
- need to control inference risk and precision
- easy access to additional information – book value
- cost and time constraints

## Consequences:

- tests based on samples
- **area for survey sampling application**

# Description of the simulation study

**Subject:** efficiency and reliability of interval estimation

**Studied sampling strategies:** stratified sampling + confidence interval for global audit value based on Horvitz – Thompson point estimator with assumption of its asymptotic normality

$(t_{y\pi w} - u_{\alpha/2} v^{1/2}(t_{y\pi w}); t_{y\pi w} + u_{\alpha/2} v^{1/2}(t_{y\pi w}))$ , where:

$$t_{y\pi w} = \sum_{h=1}^H \sum_{i \in S_h} \frac{y_{hi}}{\pi_{hi}} = \sum_{h=1}^H t_{hy\pi},$$

$$v(t_{y\pi w}) = \sum_{h=1}^H \sum_{i \in S_h} \sum_{j \in S_h} \frac{\pi_{hij} - \pi_{hi}\pi_{hj}}{\pi_{hij}} \frac{y_{hi}}{\pi_{hi}} \frac{y_{hj}}{\pi_{hj}}$$

## **Stratification + allocation combinations:**

- Dalenius – Hodges stratification + Neyman optimal allocation – **DH\_OPT\_HT**
- Equal aggregate size (total book value) stratification + allocation proportional to total book value in strata – **RWK\_WK\_HT**
- Thomsen stratification + proportional allocation – **TH\_PROP\_HT**
- Geometric stratification + Neyman optimal allocation – **GEO\_OPT\_HT**

# Description of the simulation study

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**Number of strata:** 5 and 10

**Sample size:** 50 and 100

**Number of samples drawn:** 1 000 from each population for each number of strata and each sample size

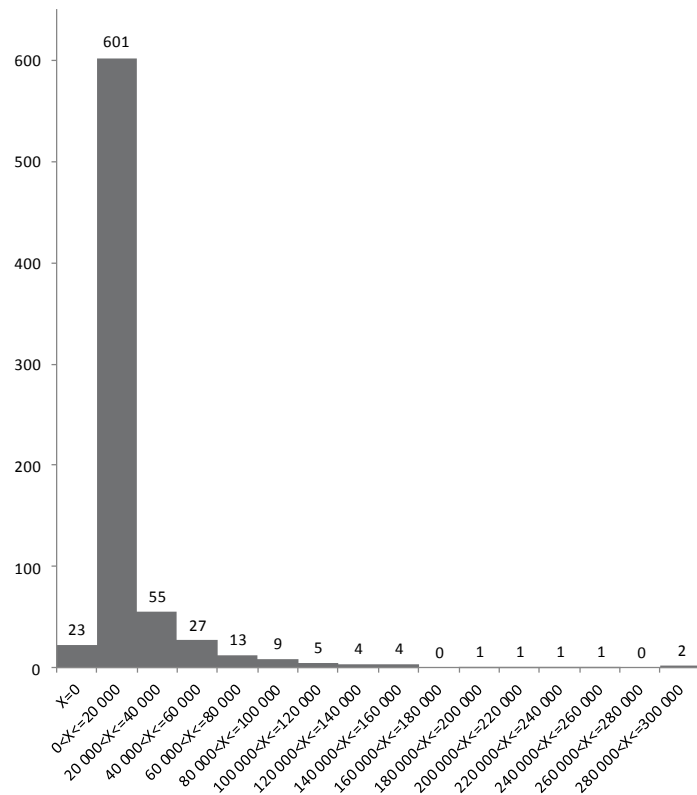
## **Main evaluation criteria:**

- actual confidence levels (number of intervals that contained global audit value / number of all estimated intervals) compared to nominal confidence level = 0,95
- average length of confidence intervals compared to population total book amount

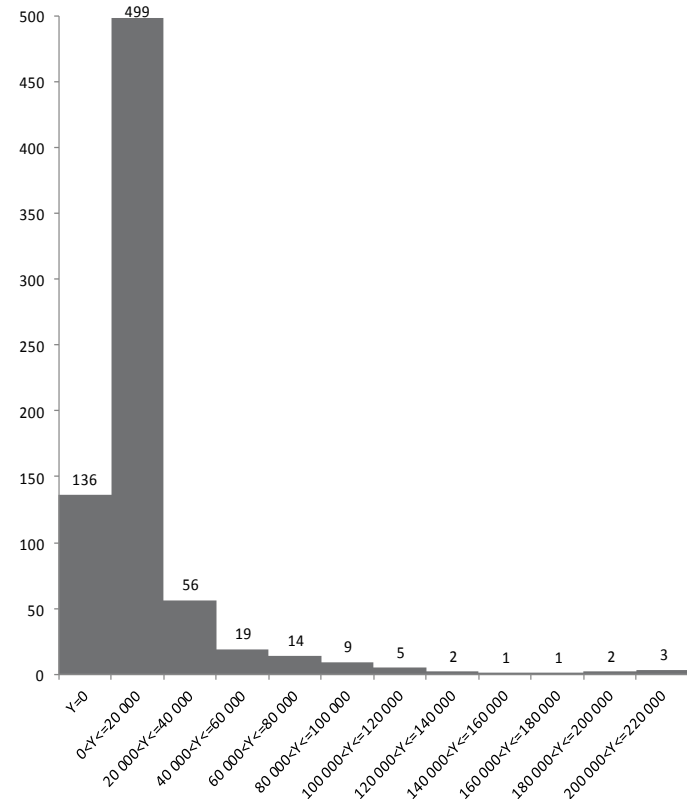
# Populations used for the simulation study

13 sets containing results of annual inventory of stocks in manufacturing plants +  
12 generated populations with lowered error rates

## Book value distribution



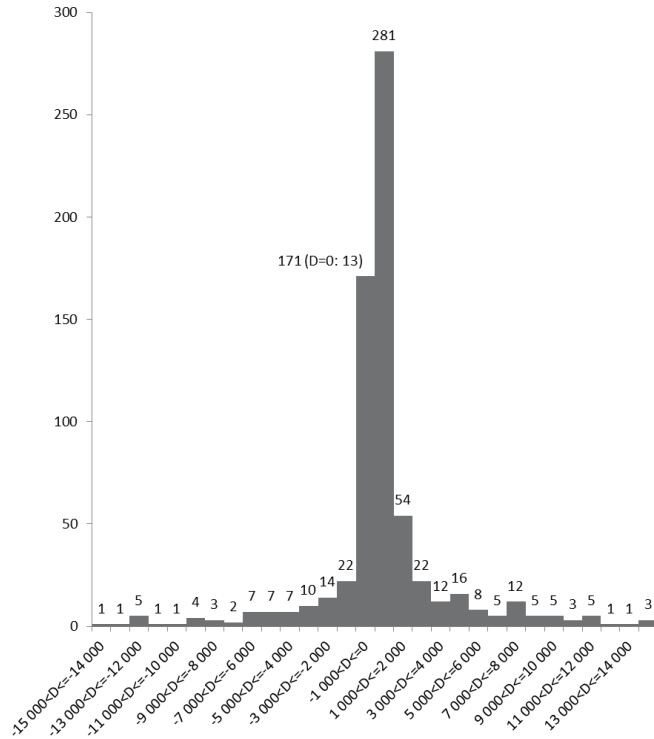
## Audit value distribution



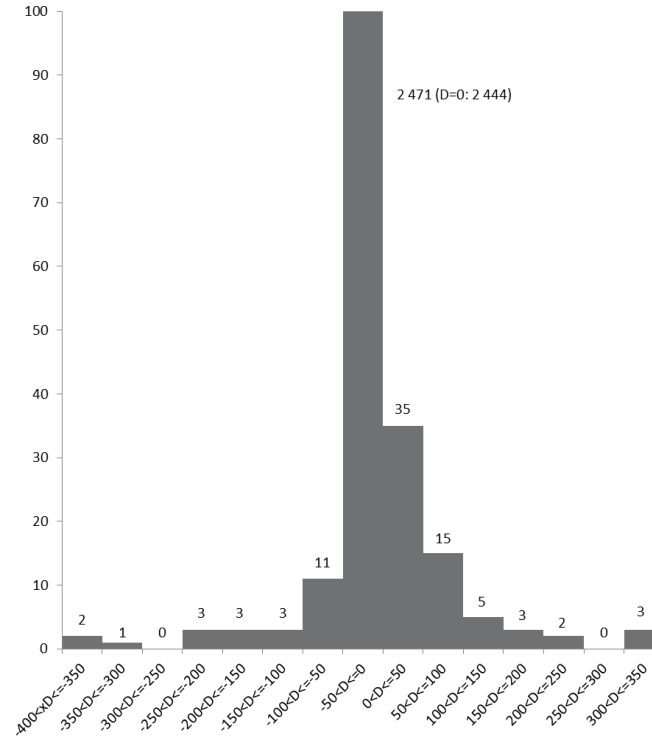
# Populations used for the simulation study

## Error value distribution

### Original sets



### Generated sets



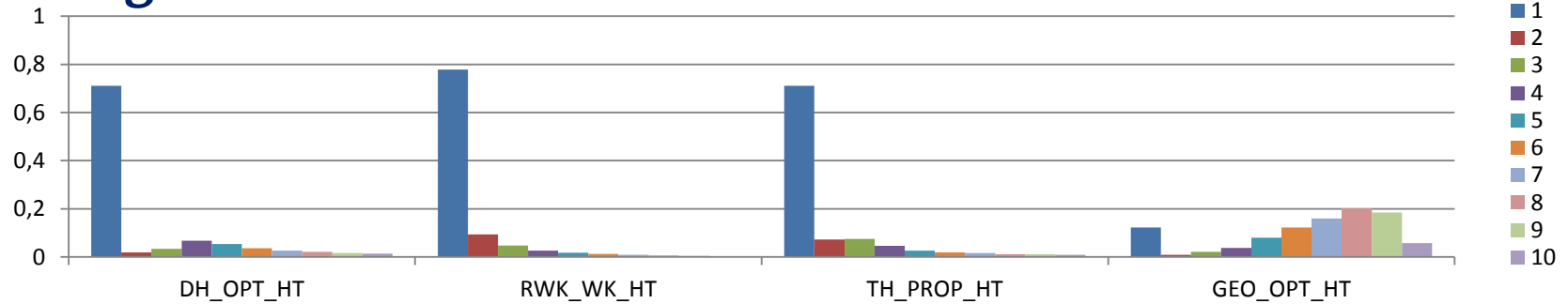
- very high error rates: from 0,428 to 0,98
- distribution of error amount strongly concentrated around zero
- with increasing absolute error amount number of errors decreases

- error amount distribution - nonstandard mixture of distributions:

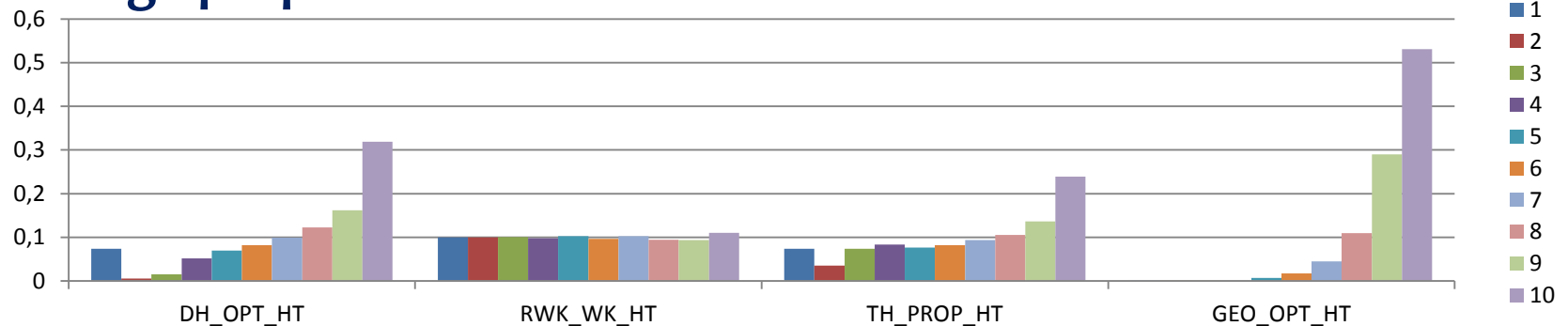
$$D_i = \begin{cases} D'_i, & \text{with probability } \nu, \\ 0, & \text{with probability } (1 - \nu), \end{cases}$$

# Stratification and allocation results

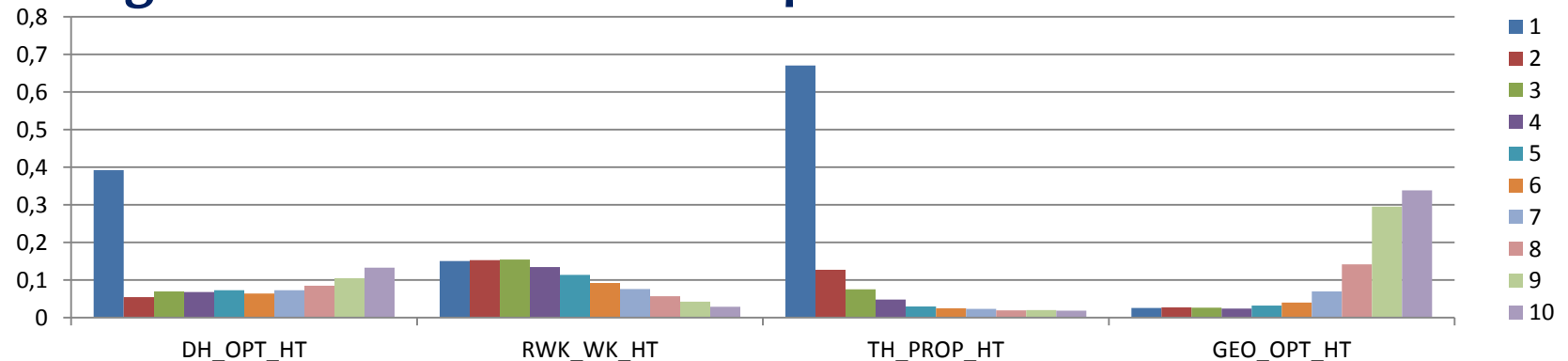
## Average fraction of elements in strata



## Average proportion of book value in strata

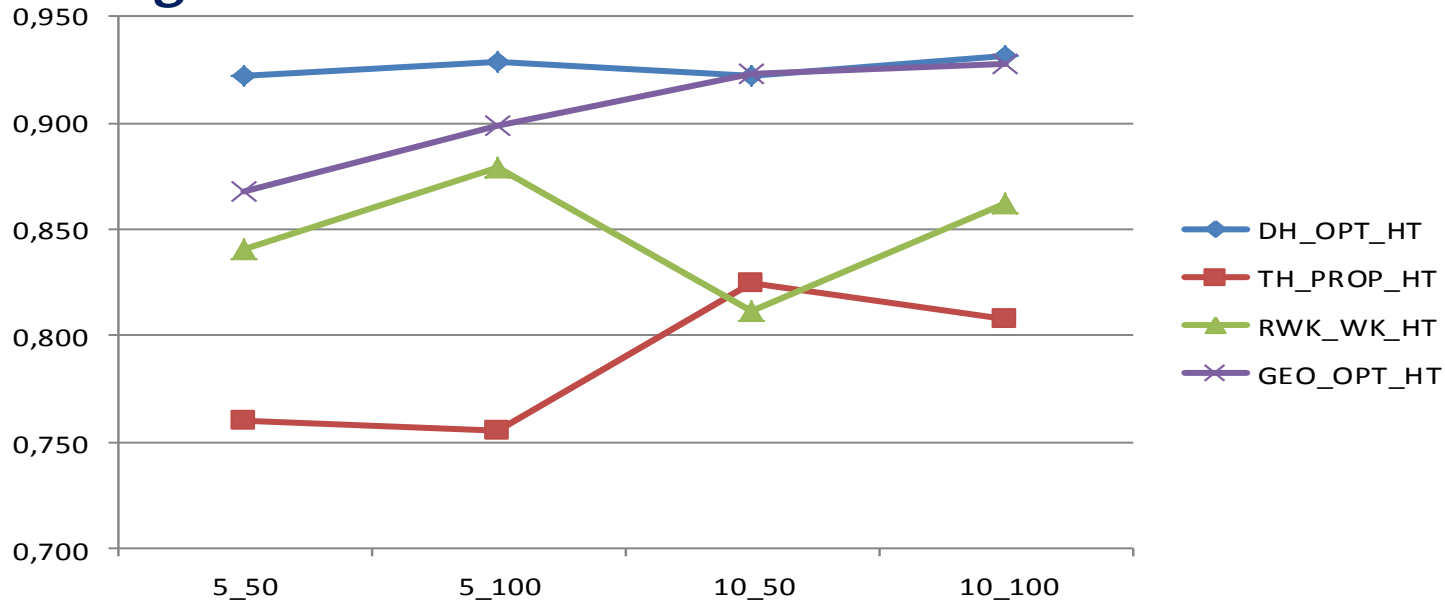


## Average fraction of elements sampled from strata



# Simulation results

## Average actual level of confidence



## Average (length of intervals / population book amount)

