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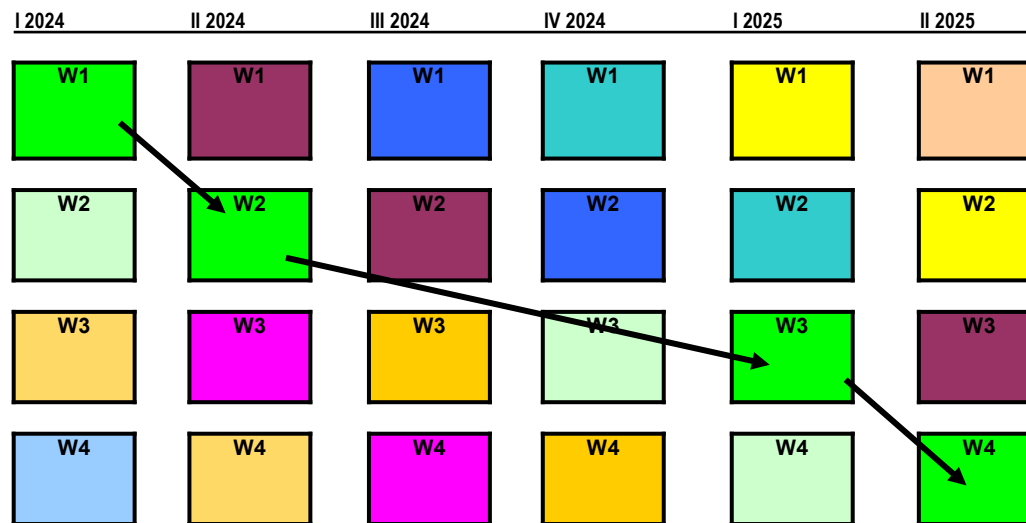
# Auxiliary information and variance estimation in the Swiss Labor Force Survey

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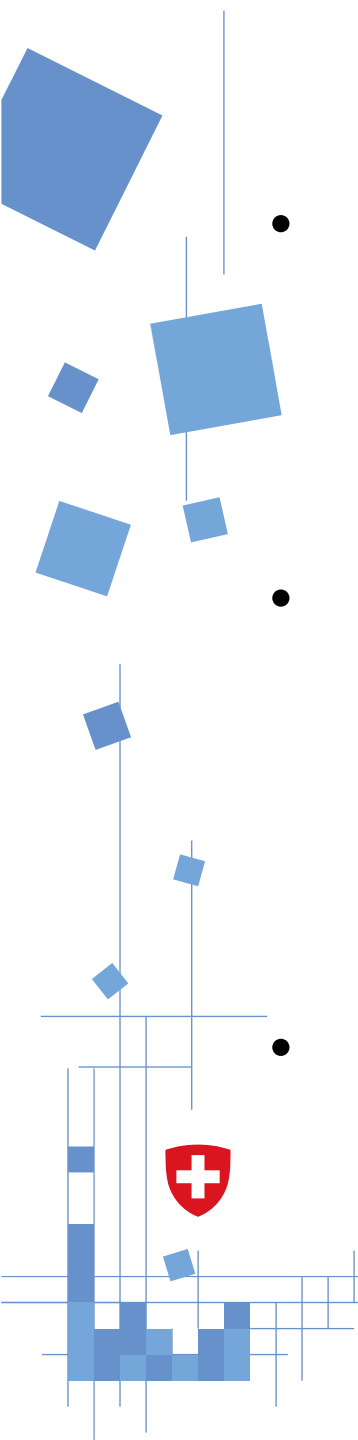
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# 1. The Swiss Labor Force Survey

- Around 30'000 interviews each quarter.
- Mixed-mode CAWI/CATI survey since 2021 (CATI before)
- Rotating panel in which the respondents are interviewed four times over a one and a half-year period: 2-2-2 scheme.



- The incoming panel is surveyed for two consecutive quarters.
- Break of two quarters.
- The panel is surveyed again for two consecutive quarters.

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- Exception for people aged 75 and over who are only interviewed once (less concerned by issues related to working life).
  - The weighting process is based on non-response adjustment and calibration, and takes into account some specific features of the survey (for example exception for people aged 75 and over).
  - We focus here on the calibration.

## 2. Auxiliary variables

- Are drawn from several register-based sources.
- Are available at unit level (micro-data) and are linkable with the sample.
- Are correlated with variables collected during the survey, but can differ from them (different definitions, time lag, measurement effect,...).

→ Availability of micro-data allows to overcome these differences.



## Old-Age and Survivor's Insurance (OASI)

- Status on the labour market (employed, self-employed, not concerned)
- Decile of income subject to contribution for OASI, or not concerned.
- Classification of economic activity of the company (NACE), or not concerned.
- Legal form of the company, or not concerned.
- ...



## Sociodemographic variables

- Gender
- Age
- Nationality
- Civil status
- Type of residence permit
- Duration of stay in Switzerland
- Region NUTS2, region NUTS3

## Other sources

- Registration with an regional employment office (yes / no)



It does not correspond to the definition of unemployment according to the International Labor Office  
+  
Time lag

- Duration of the registration.
- ...

Interactions between auxiliary variables are also taken into account.

# 3. Aim of calibration

- Consistency with other statistics.
- Correction of the under-coverage of some categories of the population. For example:
  - recent immigration cannot be selected in the oldest panels.
    - Calibration on auxiliary variables such as duration of stay in Switzerland allows to fill this gap, at least partially.
  - people just turning 15 can be selected only in the first wave.
    - Calibration on age.
- Gain of efficiency.

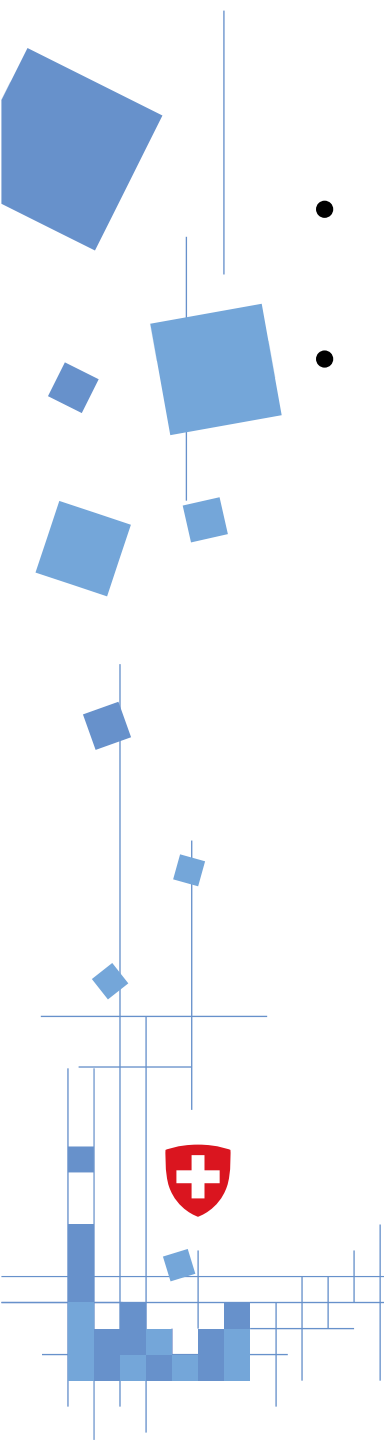


# 4. Variance estimation

- Variance estimation is based on formulas.
- Linearization if necessary.
- Effect of calibration is taken into account by replacing the variable of interest by the residuals of the regression over the calibration variables (cf. Deville and Särndal, 1992).
- Then variance is estimated thanks to Deville's formula (cf. Matei and Tillé, 2005).

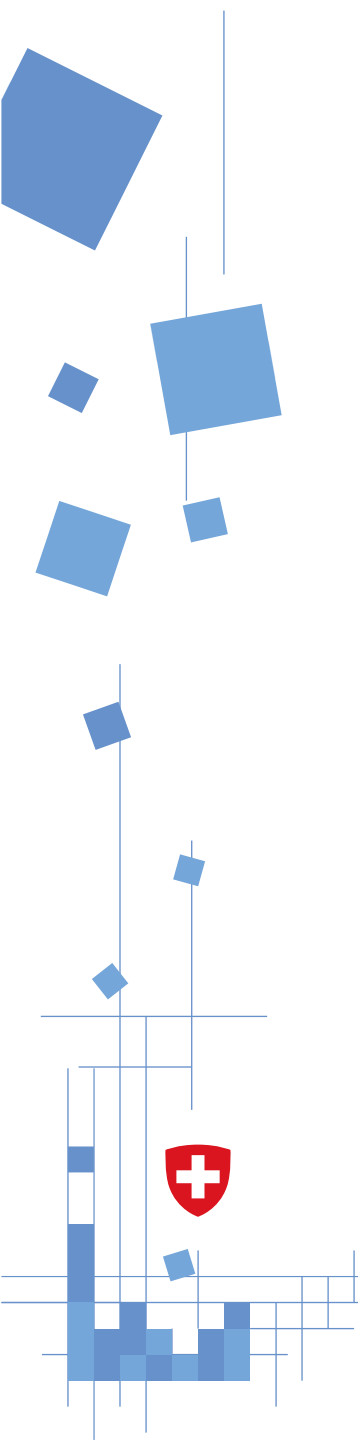
# 5. Efficiency gain due to calibration

	Coefficient of variation (in %)	Coefficient of variation without calibration (in %)	Gain due to calibration (in %)	This gain is equivalent to multiplying the size of the sample by:
Number of active people	0.27	0.56	51.7	4.3
15-24 years old	1.03	2.13	51.5	4.3
25-64 years old	0.24	0.66	63.4	7.5
65 and over years old	3.39	4.05	16.2	1.4
Number of unemployed people	3.02	3.55	15.0	1.4
15-24 years old	5.44	5.82	6.5	1.1
25-64 years old	3.63	4.41	17.7	1.5
65 and over years old	60.72	62.04	2.1	1.0

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- Generally important gain of precision.
  - Gains are lower for:
    - the estimation of the number of unemployed people.
      - correlation between unemployment according to the International Labor Office and auxiliary variable “Registration with a regional employment office” is not extremely strong (time lag, difference of definition).
    - People aged 65 and over.
      - Activity of people aged 65 and over is uncommon and difficult to predict (with available auxiliary information).

## 6. Variance of a mean over four quarters

- Example: mean of the estimated numbers of active people over the four quarters of a given year.
- Overlap between the samples must be taken into account, as well as the correlation between the measures of the variable of interest at different times.
- We apply a method proposed by Qualité and Tillé 2008.
- Example of gain of efficiency
  - Coefficient of variation of the quarterly estimation of the number of active people at national level  $\approx 0.27\%$
  - Coefficient of variation of the mean over four quarters  $\approx 0.17\%$

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- Gain of 37% in comparison to the quarterly estimation (gain of 50% with the pooling of four independent samples).
  - Due to the overlap of the samples, rotating panels are not the most efficient framework for a pooling.
  - However rotating panel is efficient to study changes over time (evolution)
    - Possible lead for future analysis
  - Limitations:
    - variance estimation requires an approximation of the correlation between the measures of the variable of interest at different times.
    - Such approximations are performed on the basis of the intersection of quarterly samples (risk of small sample sizes).
      - too detailed breakdown levels are problematic.

# 7. Conclusions

- The weighting process meets the challenges of the complexity of the survey.
- A rich set of auxiliary variables allows a gain of precision.
- Potential future developments:
  - Estimation of the variance of changes over time.
  - Integration of further auxiliary variables (increasing access to administrative data).

# References

Deville, J.C. and Särndal, C.E. (1992). Calibration estimators in survey sampling, *J. Amer. Statist. Assoc.*, 87, 376-382.

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