Skatteverket

Using AI to increase accuracy and efficiency in tax audits

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Deductions - Income from employment

2 Avdrag - Tjänst

2.1 Resor till och från arbetet *Du får avdrag endast för den del som överstiger 11 000 kr. Fyll i totalbeloppet.*	
2.2 Tjänsteresor	
2.3 Tillfälligt arbete, dubbel bosättning och hemresor	
2.4 Övriga utgifter för ditt arbete *Du får avdrag endast för den del som överstiger 5 000 kr. Fyll i totalbeloppet.*	

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Deductions …

… for costs necessary for the acquisition of income

- Business trip (2.2)
- Other expenses for you work (2.4)

Normally these costs are paid by the employer

… for costs that in principle are private

- Journeys to and from work (2.1)
- Temporary work, dual residence and journeys home (2.3)

Private costs that are deductible to increase mobility in the labor market

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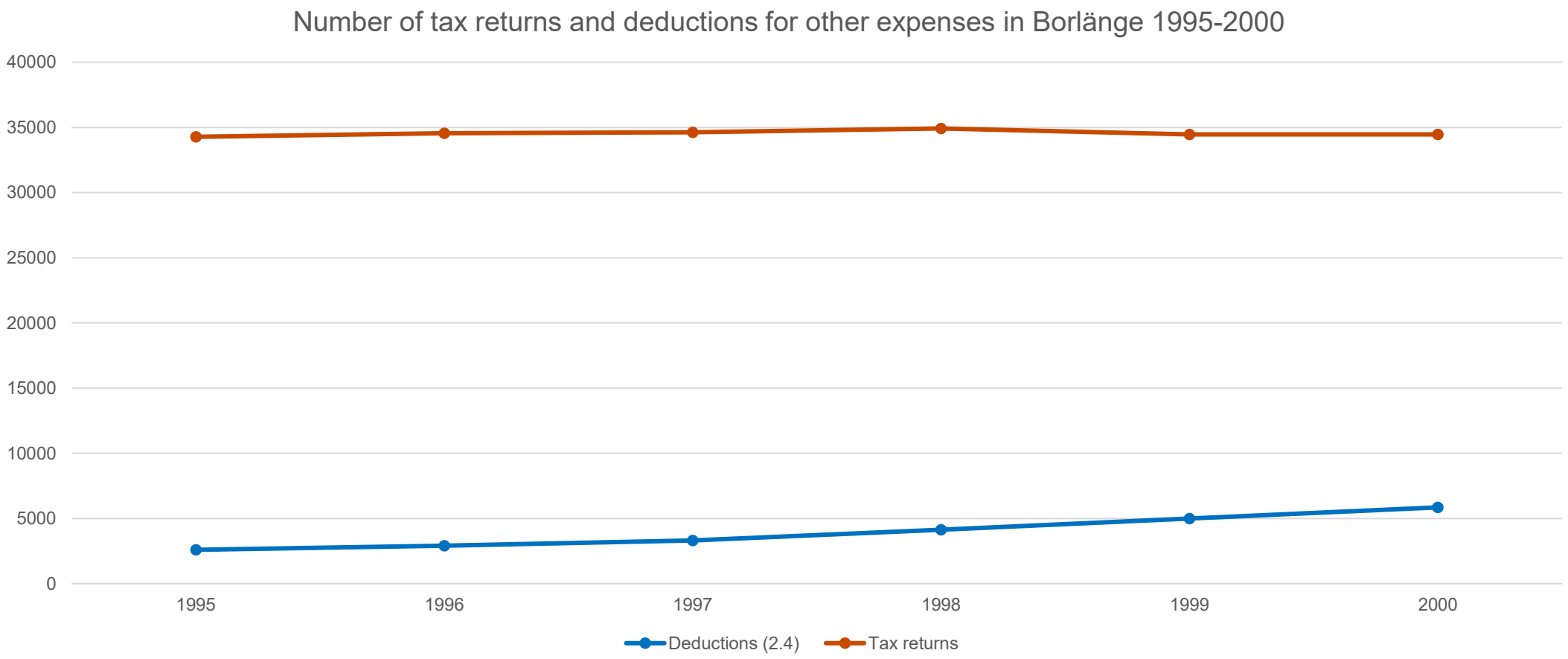
Borlänge 2001 – deductions 1995-2000



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Borlänge 2001 – background for local project

- The number of deductions for other expenses had incresed yearly by > 10 %
- Most of the deductions that were audited (desk audits) were incorrect
- Rate of deductions audited were ~7-8 %
- A large, and increasing number, of deductions were made be people taking a chance (i.e. they did not send any response when we requested it)

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Borlänge 2001 – local project

- Four students were employed as temporary workers during summer with one supervisor
- All deductions for other expenses > SEK 1400 (~ € 140) were audited (desk audits), no other selection rule had been triggered
- Requests were written using macros (Mouse and key recorder, Excel)
- If we had not received any response the decision documents were also written using macros
- 4 230 tax returns with deductions were examined and 3 965 were corrected
- The result was estimated to SEK 3 150 000 (~ € 315 000) for a cost of SEK 430 000 (~ € 31 500)

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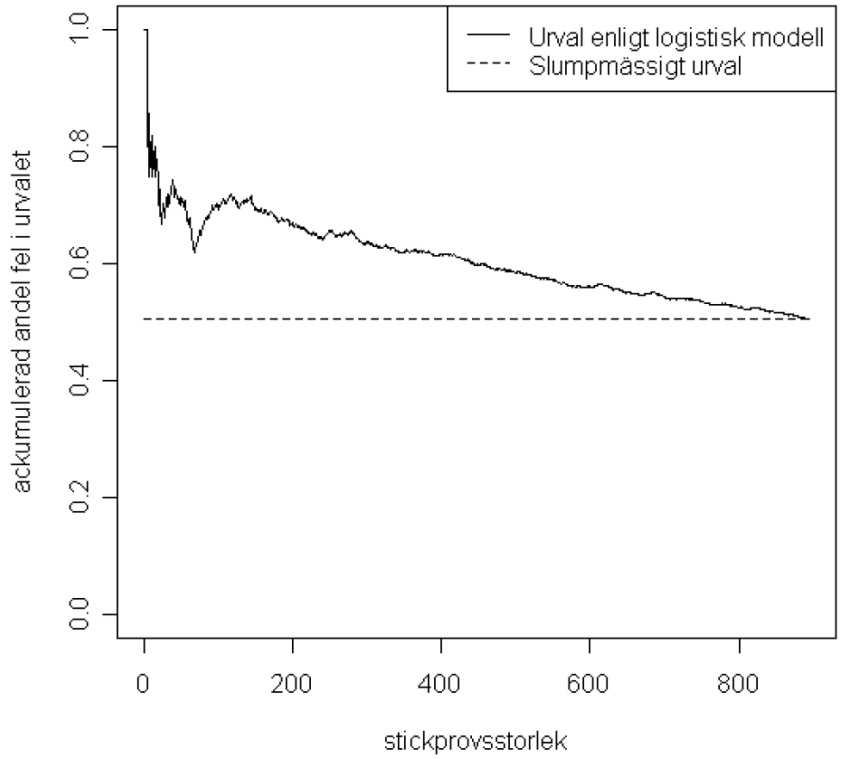
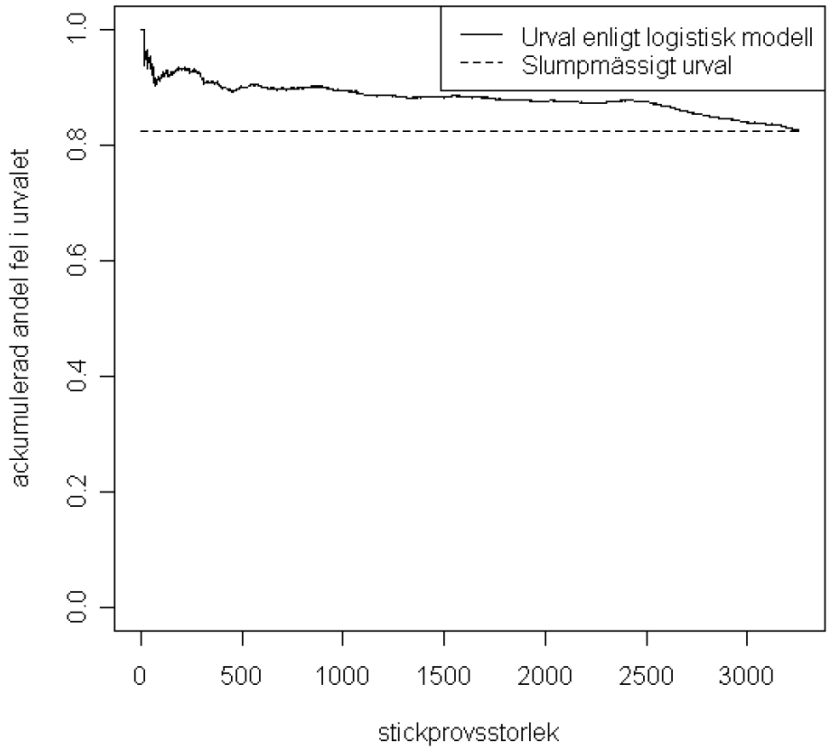
Infectious deductions 2004/2005 – Logistical regressions

Lift - Deductions for Journeys to and from work (2.1)



Lift - Deductions for other expenses (2.4)



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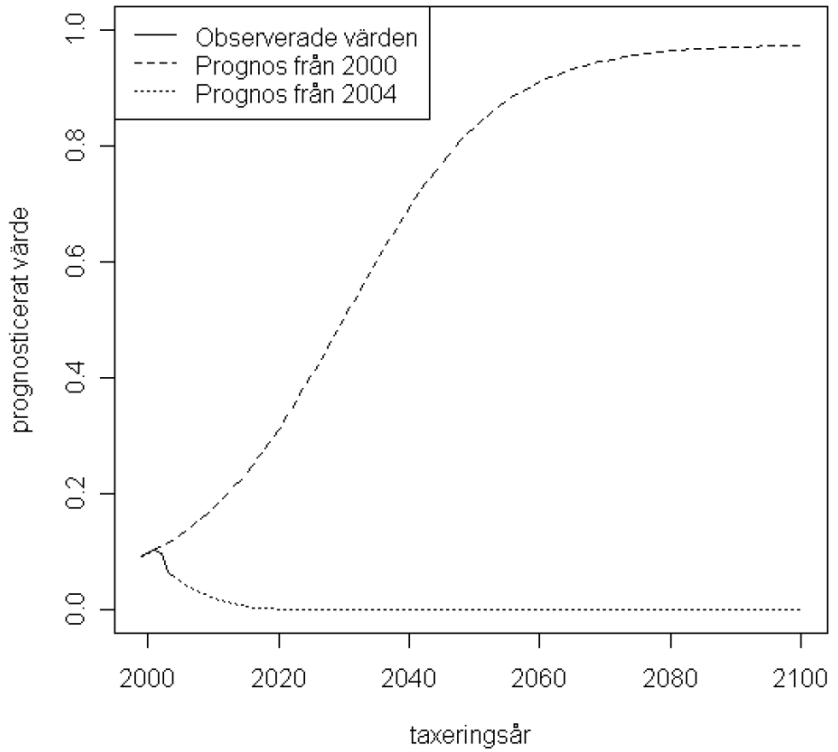
Infectious deductions 2004/2005 – Epidemic model

Estimation of epidemic model

$$P^{+}_{t} = r\, P_t\, (1\text{-}P_{t+1}) + \varepsilon$$

$$P^{-}_{t} = \beta\, (H_t / N) + \gamma\, (1\text{-}\, P_t)\, P_t + \varepsilon$$

Forecast of number of deductions



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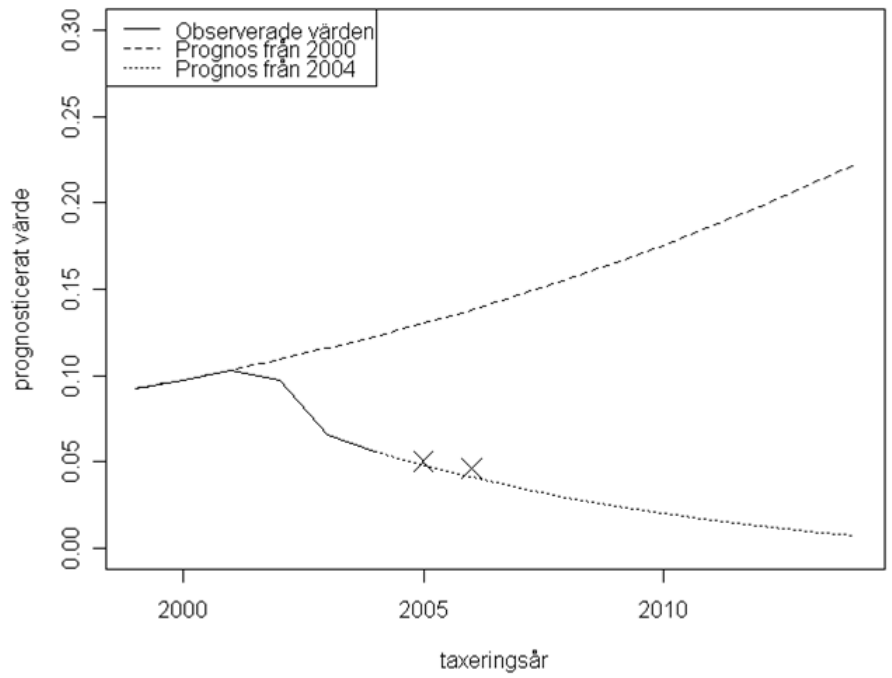
Infectious deductions 2004/2005 – Outcome

Outcome for 2005 and 2006



New legislation from 2007

- The limit amount for deductions for other expenses was raised from SEK 1000 (~ € 100) to SEK 5000 (~ € 500)

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Data Mining 2008 -

Data supply for models

- Data warehouse with complete history
- Each record in the database has a validity date from and to
- Standardized flows with code that retrieves data given person, accounting period and date
  - The date the audit began (Training data)
  - Today (Inference)

Applications

- Models for:
  - Deduction for input VAT
  - Tax payments
  - Missing Trader Intra Community fraud
  - Unreported income in business
  - …
- Using
  - SAS Enterprise Guide/Miner 2008-2015
  - Oracle Data Miner 2016-
  - Python 2021-

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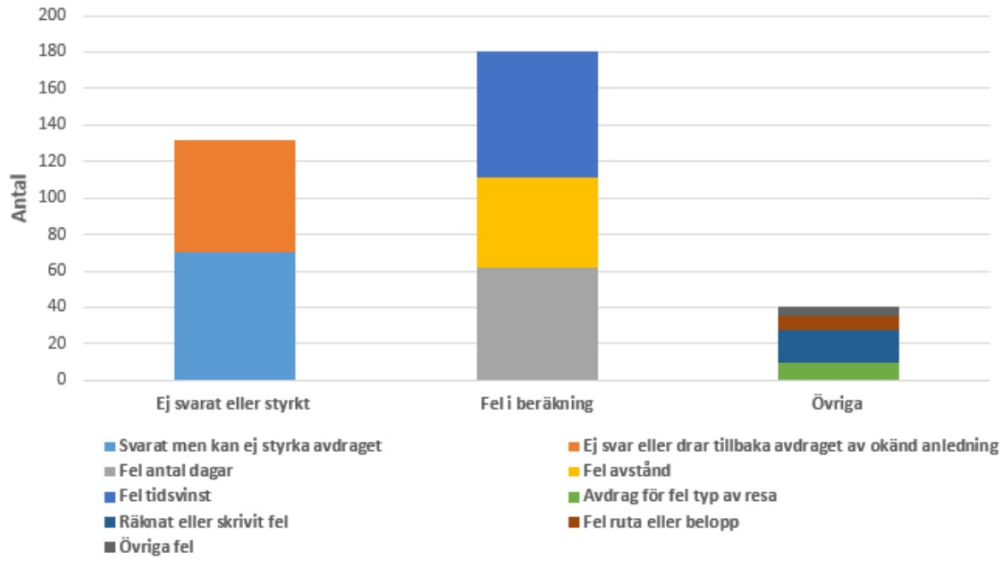
The effect of the tax audit on regulatory compliance by private individuals 2019

Analysis of randomly selected cases

Four (five) different questions:

- How long does the effect persist after a tax audit?
- Are there differences in effect between different groups?
- Does the audit have a greater effect if the person being audited is claiming a deduction for the first time or has done so previously?
- Can random audits lead to people who reported correctly starting to report errors after an audit as they experience a lower risk of detection?
- For travel deductions the effect is also studied in relation to different types of errors.

Different types of errors for deductions for journeys to and from work



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Deductions for journeys to and from work

Conditions for deducting cost for travels with car:

- There must be at least 5 kilometers between your home and workplace.
- You must save at least two hours per day by taking your car instead of public transport.
- Deductions are only allowed for the part of your total travel costs during the year that exceeds SEK 11,000. (~ € 1 100)
- The deduction only applies to days when you actually travelled to work.

(Otherwise, deduction with the cheapest public transport.)

Of those audited, with a random selection, 38 % did not respond or responded that they could not prove their deductions.

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Tax relief for commuting 2019

A Swedish Government Official Reports suggested that the possibility of making deductions should be replaced with an automatic tax relief calculated based on the distance between work and home. This would make incorrect deductions impossible.
(SOU 2019:36)

The Government then proposed that the deductions would be replaced but that it would still be possible to manually change the spacing manually in the income tax return. (Prop. 2021/22:228)

The proposal was approved but was reinstated by a new legislative amendment before it could enter into force. (Prop. 2022/23:18)

Conclusion: Back to where we started.

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Pilot AI model 2020-2021

- Data from all desk audits of deductions during 2014-2019
- Generalised linear model for classification
- Target = The entire deduction was incorrect
- Deductions for
  - Journeys to and from work (2.1) and/or
  - Other expenses for you work (2.4)
- 500 tax returns selected for desk audits 2020
  - 82 % of deductions for journeys to/from work did not response or could not prove the deduction
  - 91 % of deductions for other expenses did not response or could not prove the deduction
- 1000 tax returns selected for desk audits 2021
  - 86 % of deductions for journeys to/from work did not response or could not prove the deduction
  - 92 % of deductions for other expenses did not response or could not prove the deduction

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Full scale model 2022 –

- Data from all desk audits of deductions during last six years (moving)
- LightGBM, a gradient-boosted decision tree algorithm model
- Only tax returns with deductions, not triggered by other selection rule
- Large scale selections for audits (desk examination)
  - 20 000 tax returns 2022
  - 10 000 tax returns 2023
  - 10 000 tax returns 2024
  - 15 000 tax returns 2025
- Selection is
  - 90 % by risk
  - 10 % random

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Explanatory variables (examples)

- Taxable income from employment
- Taxable income from social insurance
- Deducted amount
- Distance home – workplace
- NACE-code for main employer
- Number of months worked

- For colleagues at the same workplace:
  - Average deducted amount
  - Average distance home – workplace

- Data for the last three years:
  - Average of taxable income
  - Average of deducted amounts

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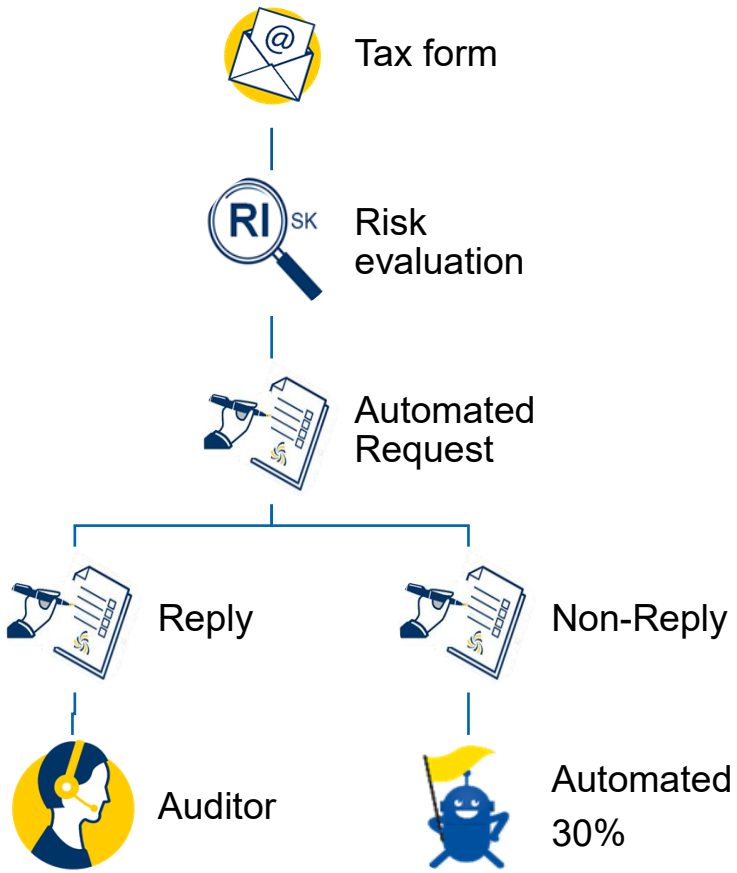
Automated process for audits



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But not automated decision-making !

Examples of European legislation:

- General Data Protection Regulation (EU) 2016/679

  Article 22 Automated individual decision-making, including profiling

  1. The data subject shall have the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her.

- Artificial Intelligence Act 2024/1689

  Article 86 Right to explanation of individual decision-making

  1. Any affected person subject to a decision which is taken by the deployer on the basis of the output from a high-risk AI system (…) shall have the right to obtain from the deployer clear and meaningful explanations of the role of the AI system in the decision-making procedure and the main elements of the decision taken.

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IT support for decision-making with human in the loop

- The case management system will send
  - Automated requests
  - Automated proposals for decision
- If we get no response the case will be put in a specific inbox after the deadline for responses has passed.
- A tax officer will check the cases and make decisions that triggers the case management system to
  - Register denial of deductions
  - Send decisions

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Risk of model drift

In 2020 no part of the training data set were selected with risk model

In 2026 the majority of training data (from 2020 – 2025) was selected with our risk models.

Very important to use the part that was selected randomly to check for model drift as well as for bias.

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