Income inequality in the Netherlands, 1860–1920: evidence from municipal taxes

Eva van der Heijden, Auke Rijpma, Rick Schouten, Paul Puschmann

September 1, 2023

Utrecht University & Radboud University Nijmegen

Introduction

Introduction

- Inequality is back on the agenda, but attention is largely focused on two periods:
  - National income tax era starting in twentieth century (following Piketty and Saez 2003; Piketty 2014), showing a great compression in wake of WWI, GD, WWII.
  - Premodern period (Alfani 2021 e.a.), showing a long secular rise in inequality.
- Nineteenth and early twentieth centuries have seen far less attention (cf. Modalsli 2018), despite great economic, institutional, and demographic change.
- Many proposed drivers of inequality currently on the table (economic growth, institutions, epidemics, war, unionisation, (de)globalisation).
- Heavy reliance on social tables for earlier periods (Lindert and Williamson 2017), though these are known known to underestimate inequality (Modalsli 2015; Fintel, Links, and Green 2023).

Today

- New sources and estimates for income inequality for the Netherlands, 1860-1920, complimenting WID series (Atkinson and Salverda 2005).
- Look at the proximate drivers of inequality in this period:
    - Growing inequality in developing regions of the Netherlands
    - Compression in middle combined with continued growth of top income shares.
- Extensive look on processing of imperfect sources:
    - Income harmonisation
    - Imputations
    - Weighting

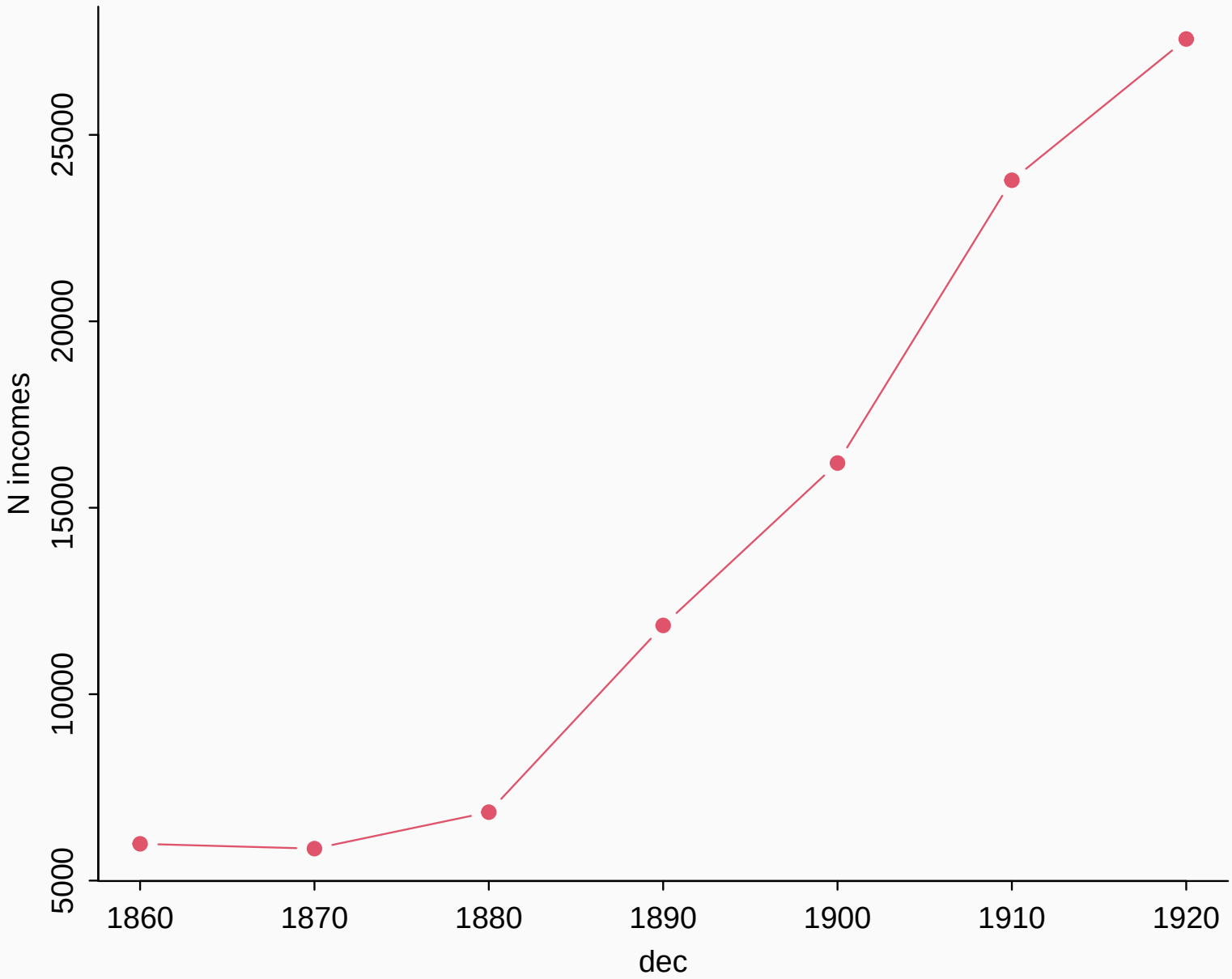
The HIP-NL project

The HIP-NL project

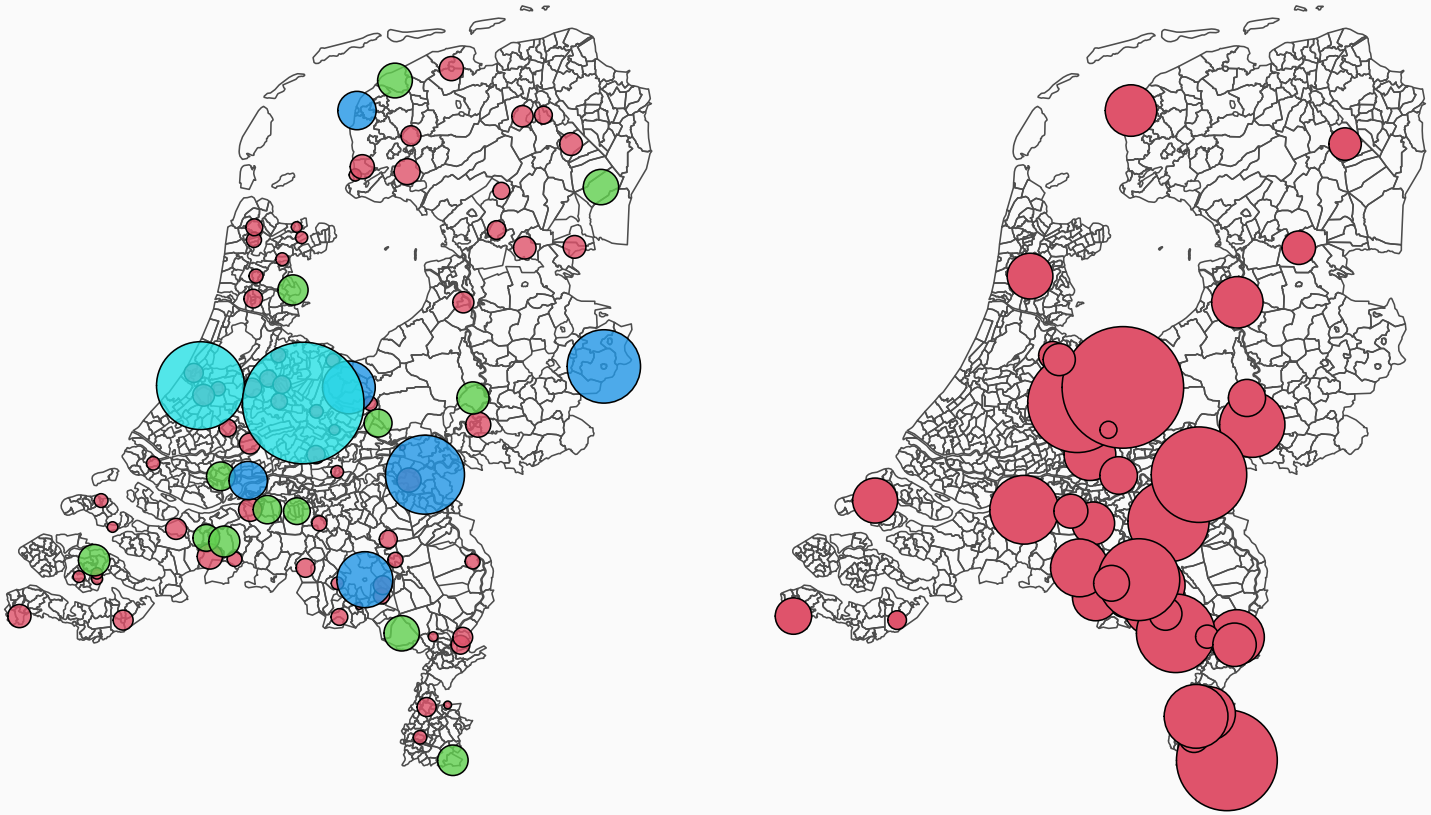
- The Historical Income Panel for the Netherlands (HIP-NL) is creating a panel out municipal income taxes for the period 1850-1920.
- Observations will be eventually be linked to population and civil registers.
- Work in progress. Income panel will eventually cover a 10% (100) sample of municipalities observed at 10-year intervals.
- Today: work-in-progress sample, with 38 municipalities, for 170 completed municipalities-years covering 98078 tax payers.

Number of municipalities covered over time

Number of taxed units



Planned and current sample



Dutch context

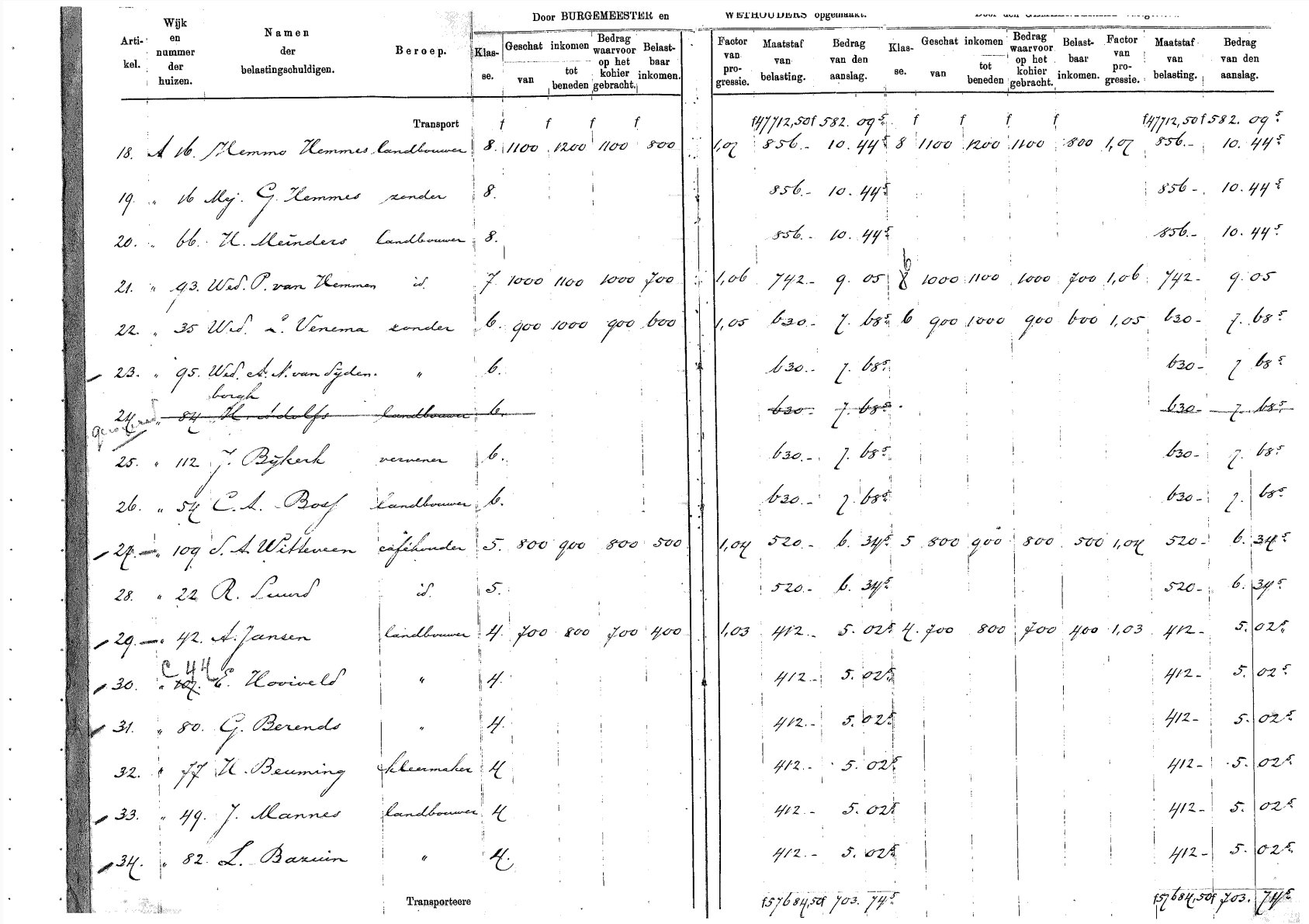
- Netherlands a relatively stagnant economy since the glory days of the Dutch Republic, most growth taking place in agriculture
- New constitution in 1848 puts the country on modern footing.
- Late to industrialise: 1880s and after.

The *Hoofdelijke omslag taxes*

The hoofdelijke omslag tax

- *Hoofdelijke Omslag* tax was an income tax by and for municipalities after the *Gemeentewet* of 1851.
- Variation in how this was implemented, with shared characteristics:
  - C. 1-3% of income, usually either a progressive tax, or allowing for subsistence deductions (often tied to household size).
  - Subsistence threshold: exempted poorest households living near subsistence.
  - Usually exempted: married women, (domestic) servants, children.
  - Tax unit is fairly close to the household, with the exemption of non-relatives living in one household, households with adult children with income (rare), institutional households.

The hoofdelijke omslag tax



Door BURGEMEESTER en WETHOUDERS opgemaakt.

Artikel.	Wijk en nummer der huizen.	Namen der belastingschuldigen.	Beroep.	Klasse.	Geschat inkomen van	Geschat inkomen tot beneden	Bedrag waarvoor op het kohier gebracht.	Belastbaar inkomen.	Factor van progressie.	Maatstaf van belasting.	Bedrag van den aanslag.
		Transport			f	f	f	f		f 47712,50	f 582. 09 ½
18.	A 16	J. Hemmo Hemmes	Landbouwer	8.	1100	1200	1100	800	1,07	856.-	10. 44 ½
19.	„ 16	Mej. G. Hemmes	zonder	8.						856.-	10. 44 ½
20.	„ 66	H. Meinders	Landbouwer	8.						856.-	10. 44 ½
21.	„ 93	Wed. P. van Hemmen	id.	7.	1000	1100	1000	700	1,06	742.-	9. 05
22.	„ 35	Wed. J. Venema	zonder	6.	900	1000	900	600	1,05	630.-	7. 68 ½
23.	„ 95	Wed. ed. A. van Syden.	„	6.						630.-	7. 68 ½
~~24.~~	~~„ 84~~	~~H. Adolfs~~	~~Landbouwer~~	~~6.~~						~~630.-~~	~~7. 68 ½~~
25.	„ 112	J. Bijkerk	vervener	6.						630.-	7. 68 ½
26.	„ 54	C. A. Bos	Landbouwer	6.						630.-	7. 68 ½
27.	„ 109	J. A. Witteveen	cafehouder	5.	800	900	800	500	1,04	520.-	6. 34 ½
28.	„ 22	R. Lund	id.	5.						520.-	6. 34 ½
29.	„ 42	A. Jansen	Landbouwer	4.	700	800	700	400	1,03	412.-	5. 02 ½
30.	C 44	G. Kooiveld	„	4.						412.-	5. 02 ½
31.	„ 80	G. Berends	„	4.						412.-	5. 02 ½
32.	„ 77	H. Beuming	Scheermaker	4.						412.-	5. 02 ½
33.	„ 49	J. Mannes	Landbouwer	4.						412.-	5. 02 ½
34.	„ 82	L. Barsen	„	4.						412.-	5. 02 ½
		Transporteere								f 57684,50	f 703. 74 ½

Issues

Estimating incomes

- HO reports different numbers:
  - Gross incomes
  - Income classes
  - Taxable incomes
  - Taxes due
- Because tax rates are not flat or because deductions affect the bottom of the distribution much more, we need to harmonise these estimates.
- If we ever want to analyse income dynamics, we also need consistent numbers.
- However: tax calculation not always reported.

Estimating incomes

- Solution here is to use 32229 observations where gross incomes are available, and use these to train a model to predict gross incomes from other data.
- Gradient boosting (Chen and Guestrin 2016; Hastie, Tibshirani, and Friedman 2009): ensemble of decision trees that partition the feature space and assigns outputs to each regions.
- A flexible and robust model that can – in principle – handle missing data, non-linearities, and interactions
- 70/30 test/training split: 22546 and 9683 observations in each.
- After modelling on test and evaluating on training data, we use this model to predict gross incomes where none are reported.

Estimating incomes

- Predict log(gross income) using the following features
  - log(taxable income)
  - log(unspc. income)
  - log(tax)
  - log(tax brackets)
  - log(income brackets)
  - log(corrected tax)
  - in top 0.5% tax
  - in top 0.5% taxable income
  - N. children
  - decade and municipality dummies
- Separate models:
  - taxable incomes present: RSME 0.10 (on average, predictions are fl. 1.10 off)
  - taxable incomes masked: RSME 0.15 (on average fl. 1.15 off)

Estimating incomes

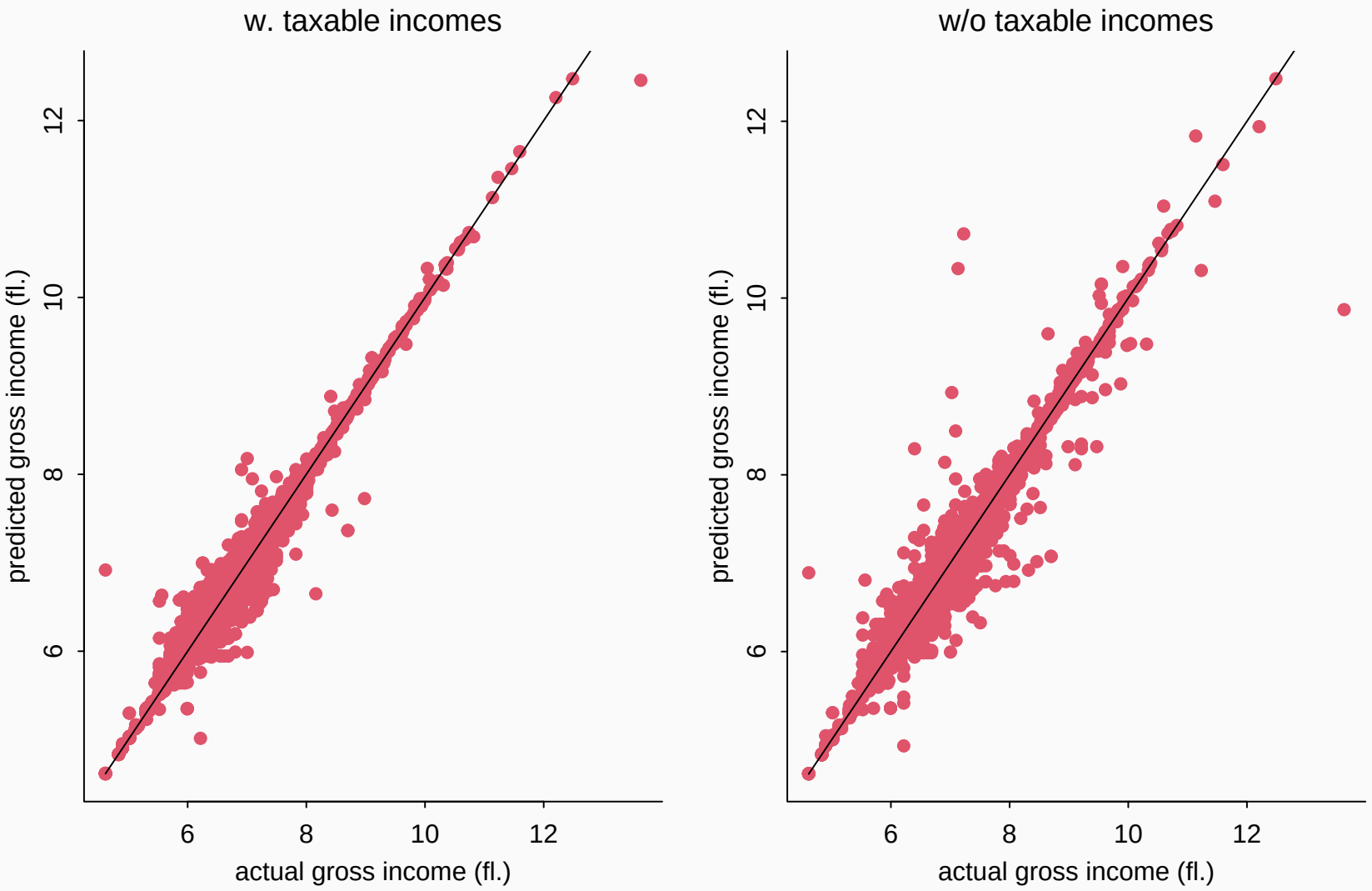
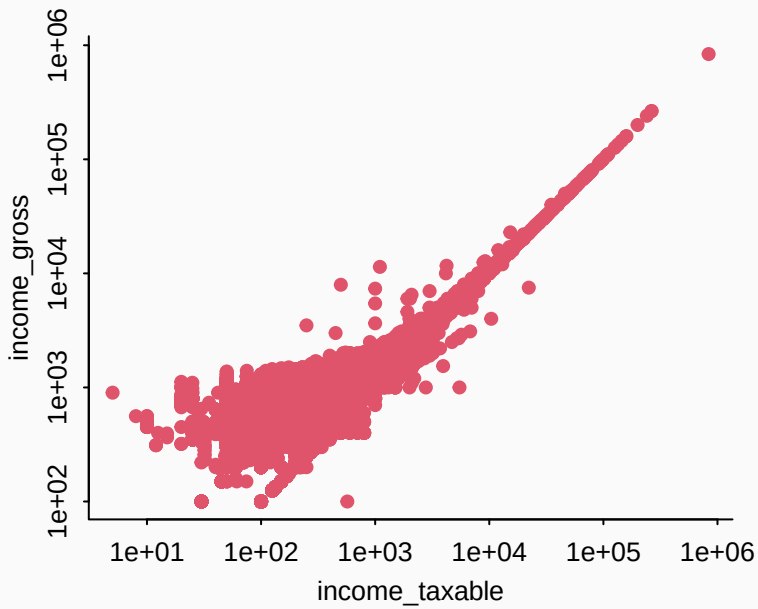
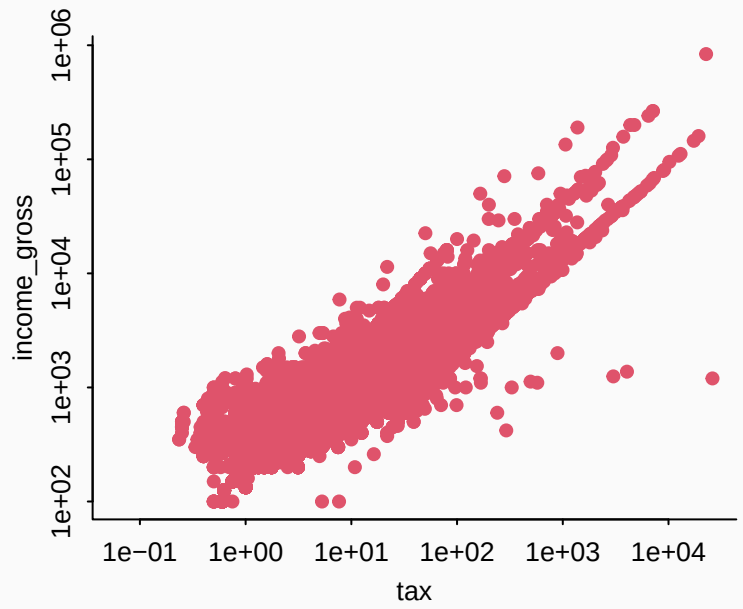
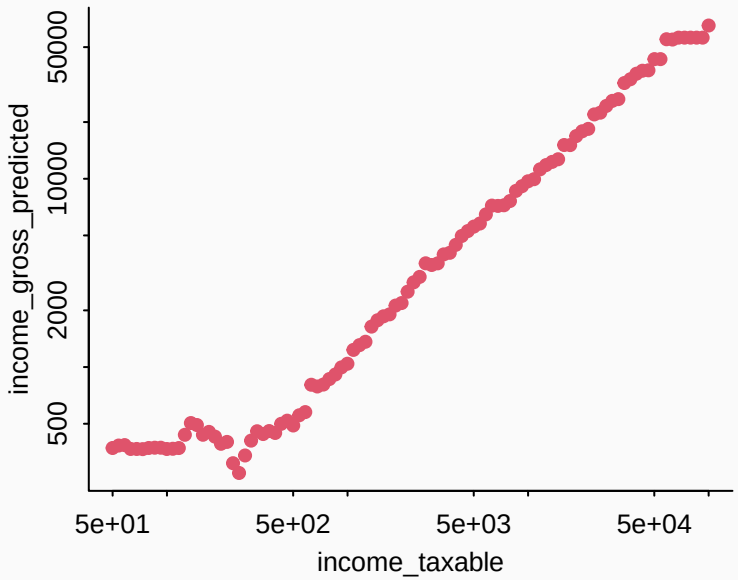


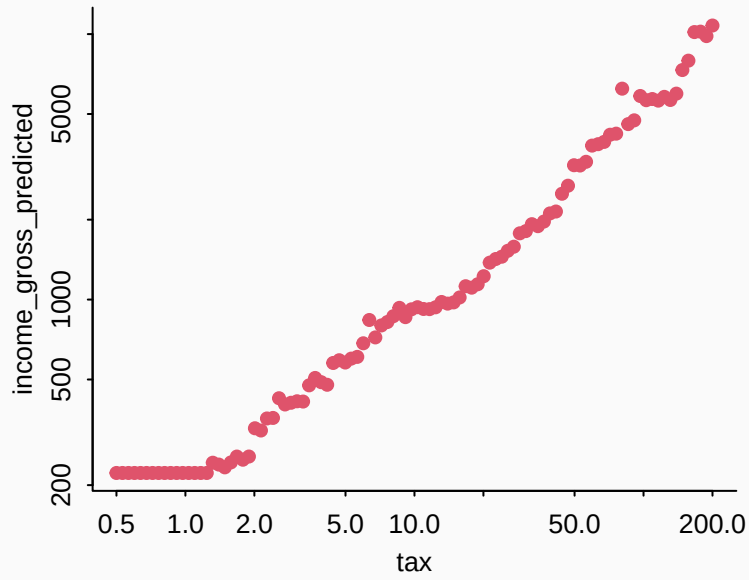
Figure 2: Actual and predicted incomes

Estimating incomes: non-linearities





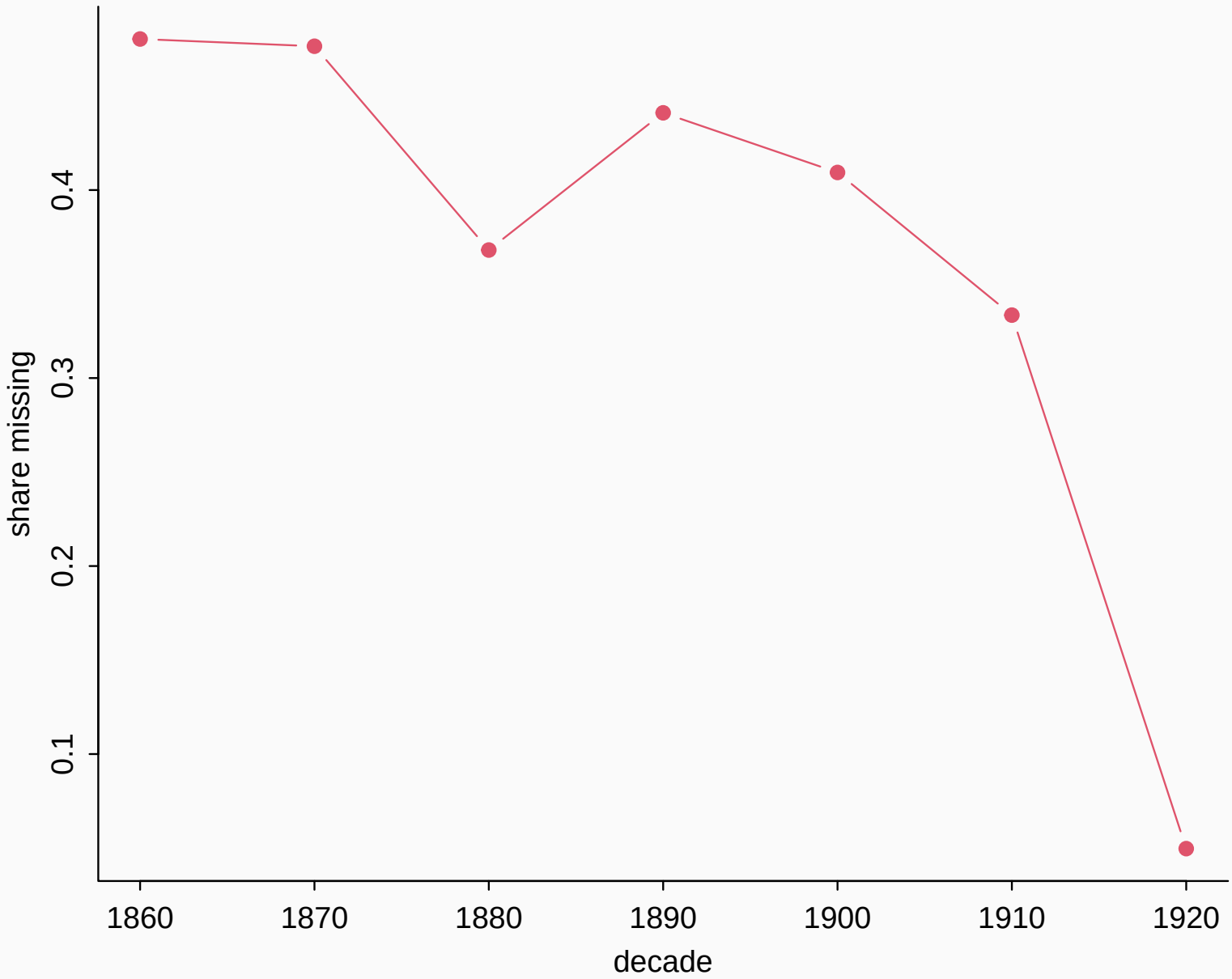




Imputations

- Know that HO implemented a tax threshold, usually motivated by part of population living at subsistence.
- These numbers could be fairly high.
- Use census count of households to estimate the number of missing tax units, assuming here that each household is taxed once.
    - Possible to improve this number

Imputations



Imputations

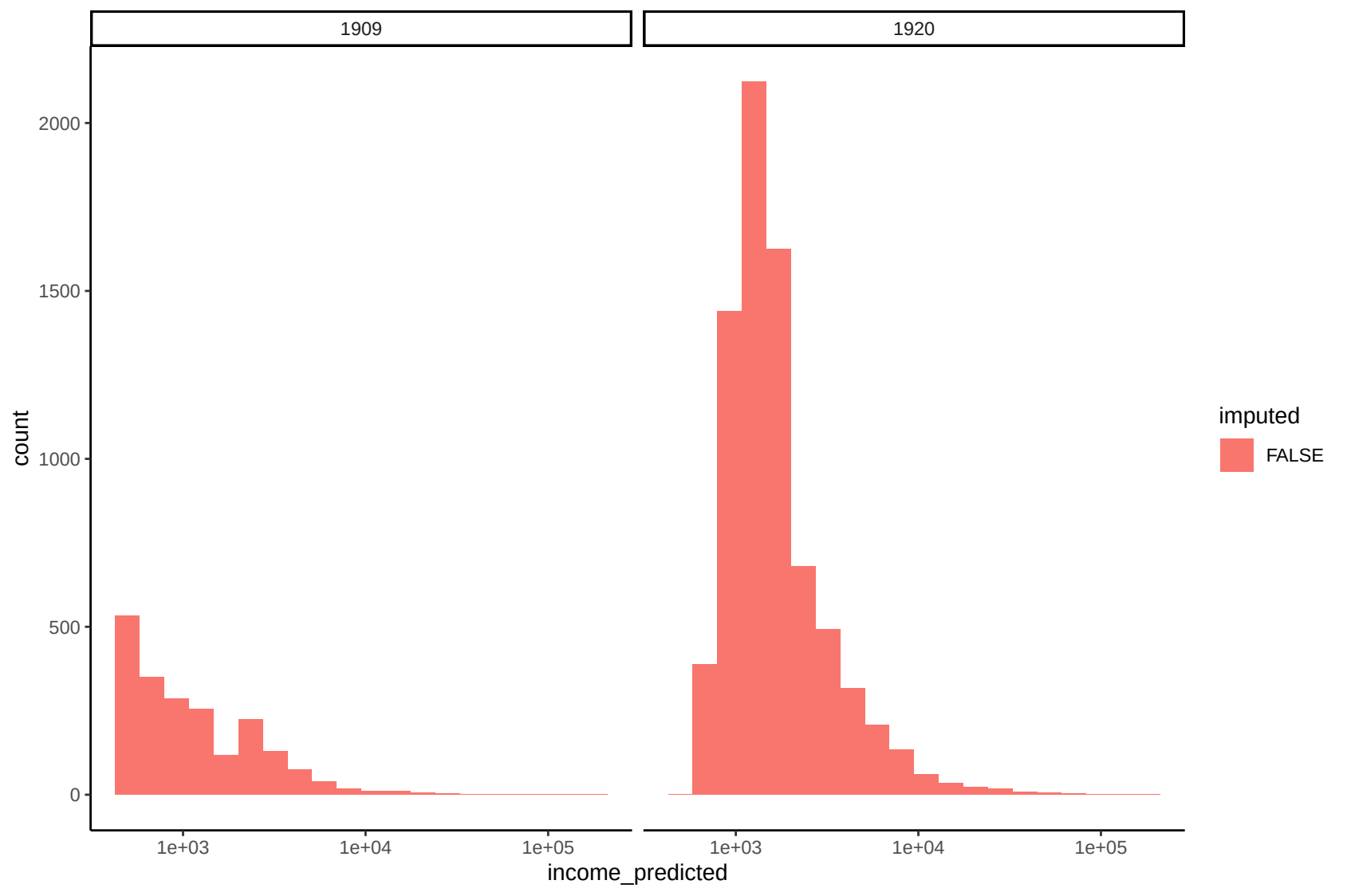


Figure 4: Censored distributions in Amersfoort

Imputations

- Missing households below the tax threshold might mean we are dealing with trunacted distributions
- We use the number of missing tax units to estimate a censored lognormal distribution, and draw additional tax units from that.

Imputations

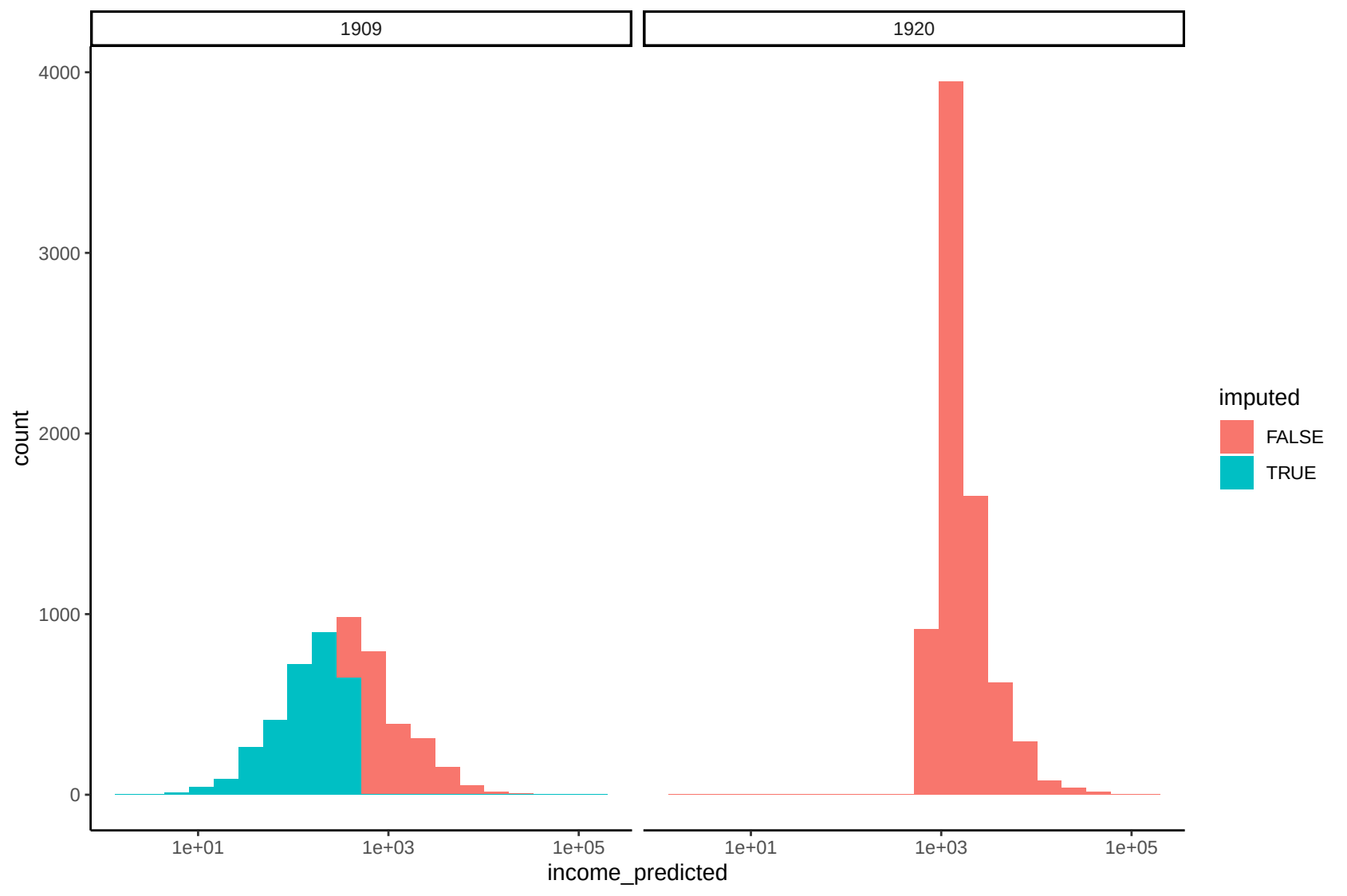


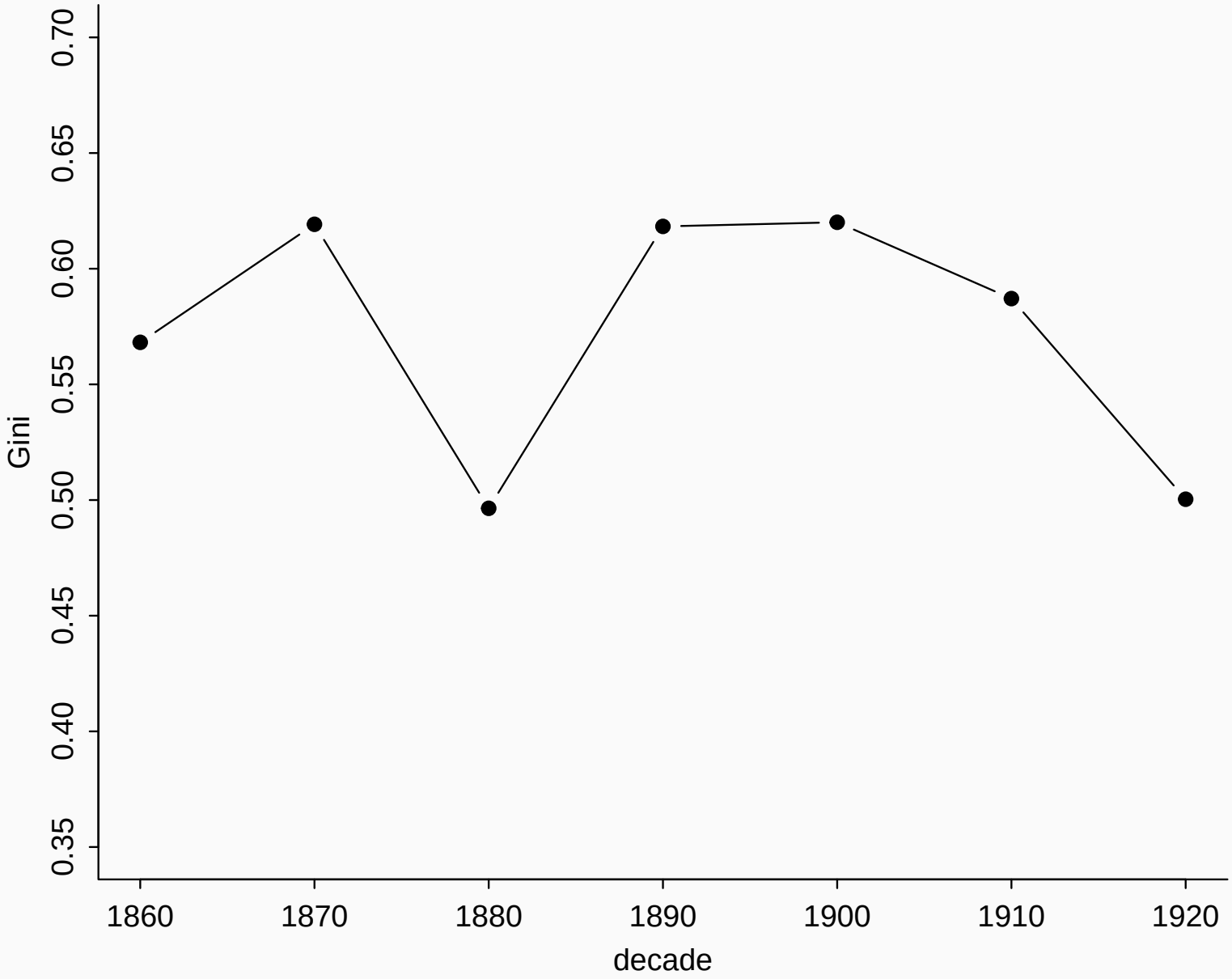
Figure 5: Imputed distributions in AmersfoorT

Weighting

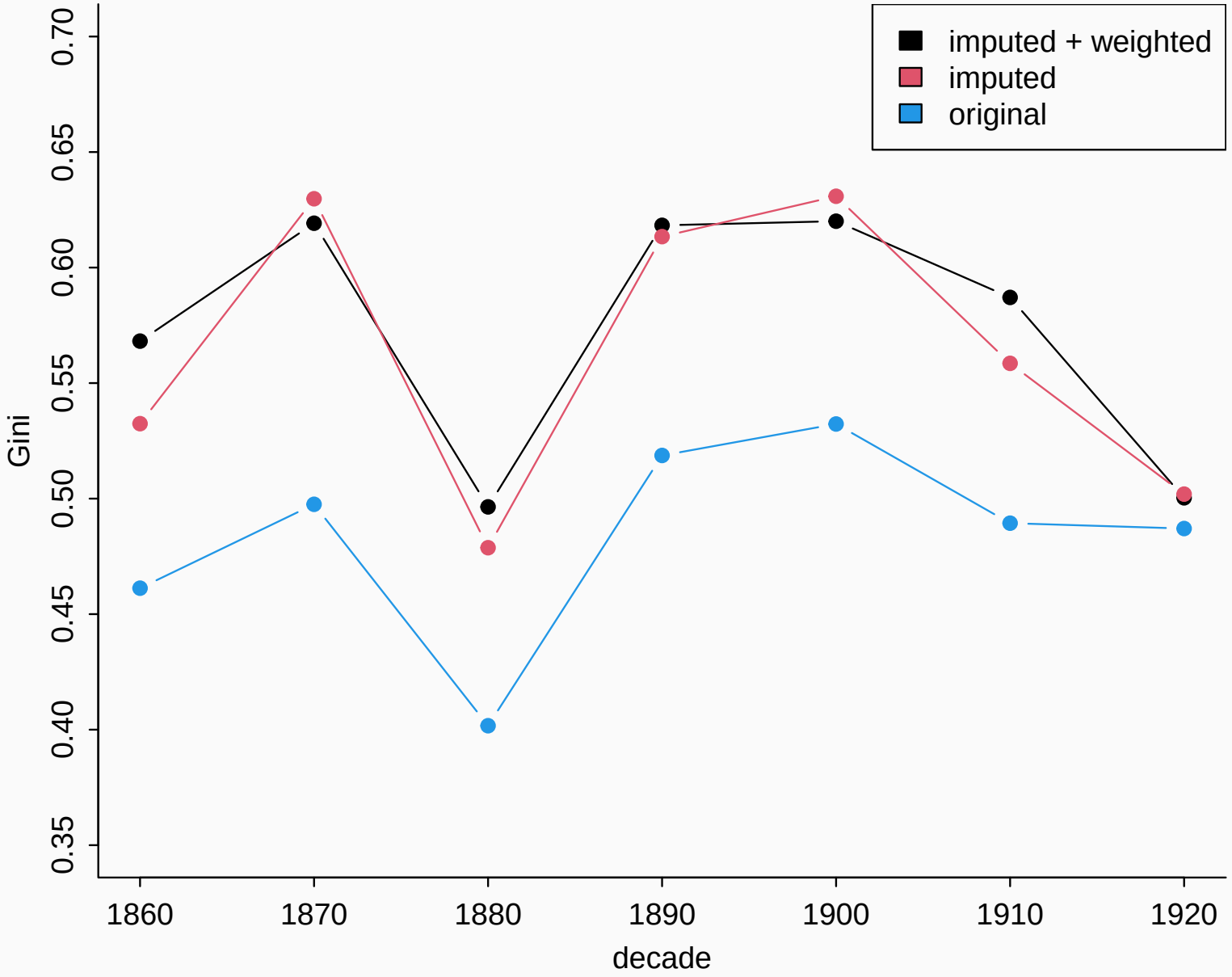
- Weighting necessary as current sample reflects work in progress, not actual sample design.
- In particular: rural, southern bias.
- Simple weighting scheme because data needs to be richer to support more extensive weighting schemes
- Rural/new urban/old urban (Soltow and Zanden 1998) for each decade.
    - new/old urban based on 1850-1920 population growth exceeding Dutch growth (100%).
- Calculate total tax units in each category for all of Netherlands, and stratified those numbers w. replacement from empirical sample distribution.

Results

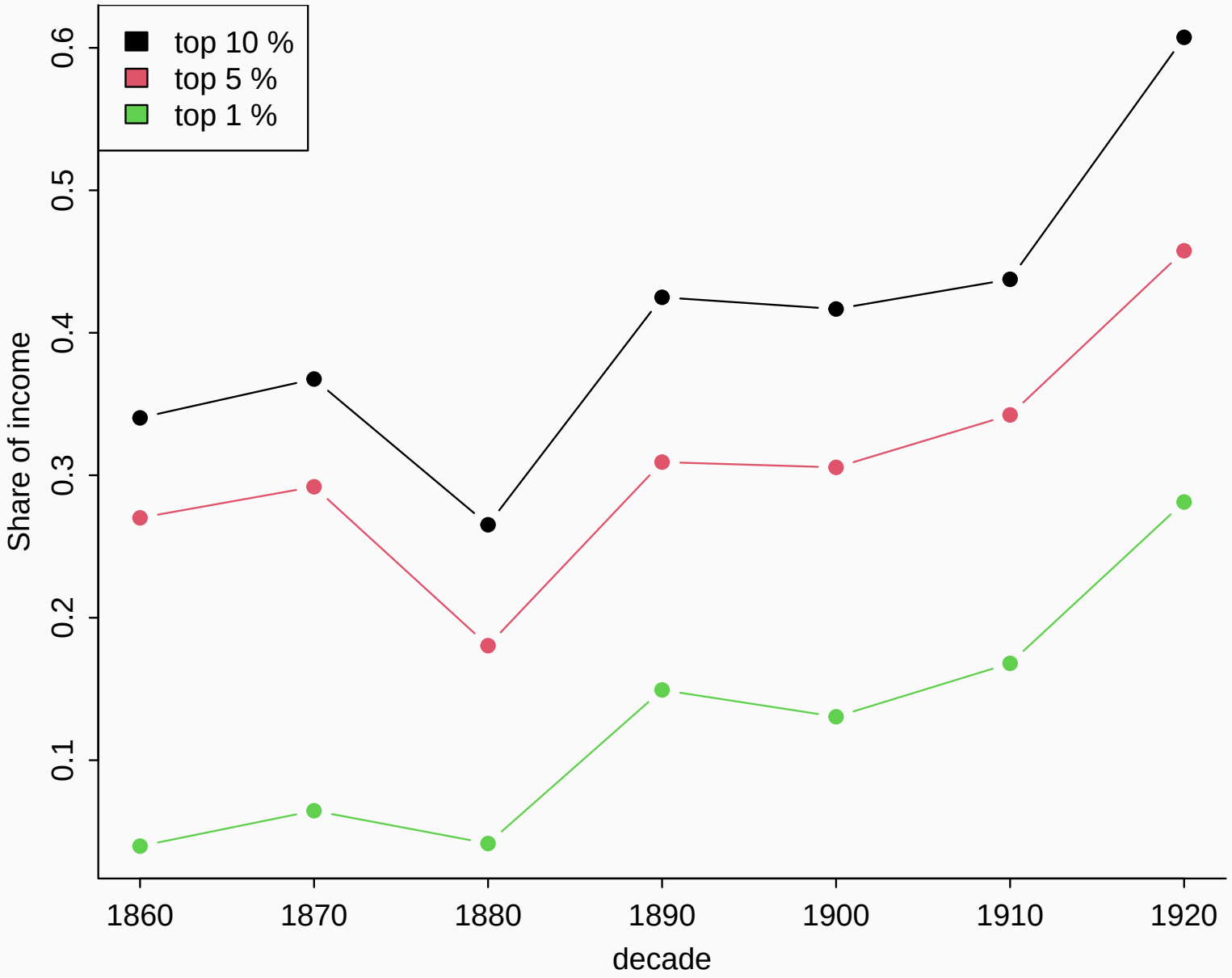
Results: Gini,1860–1920



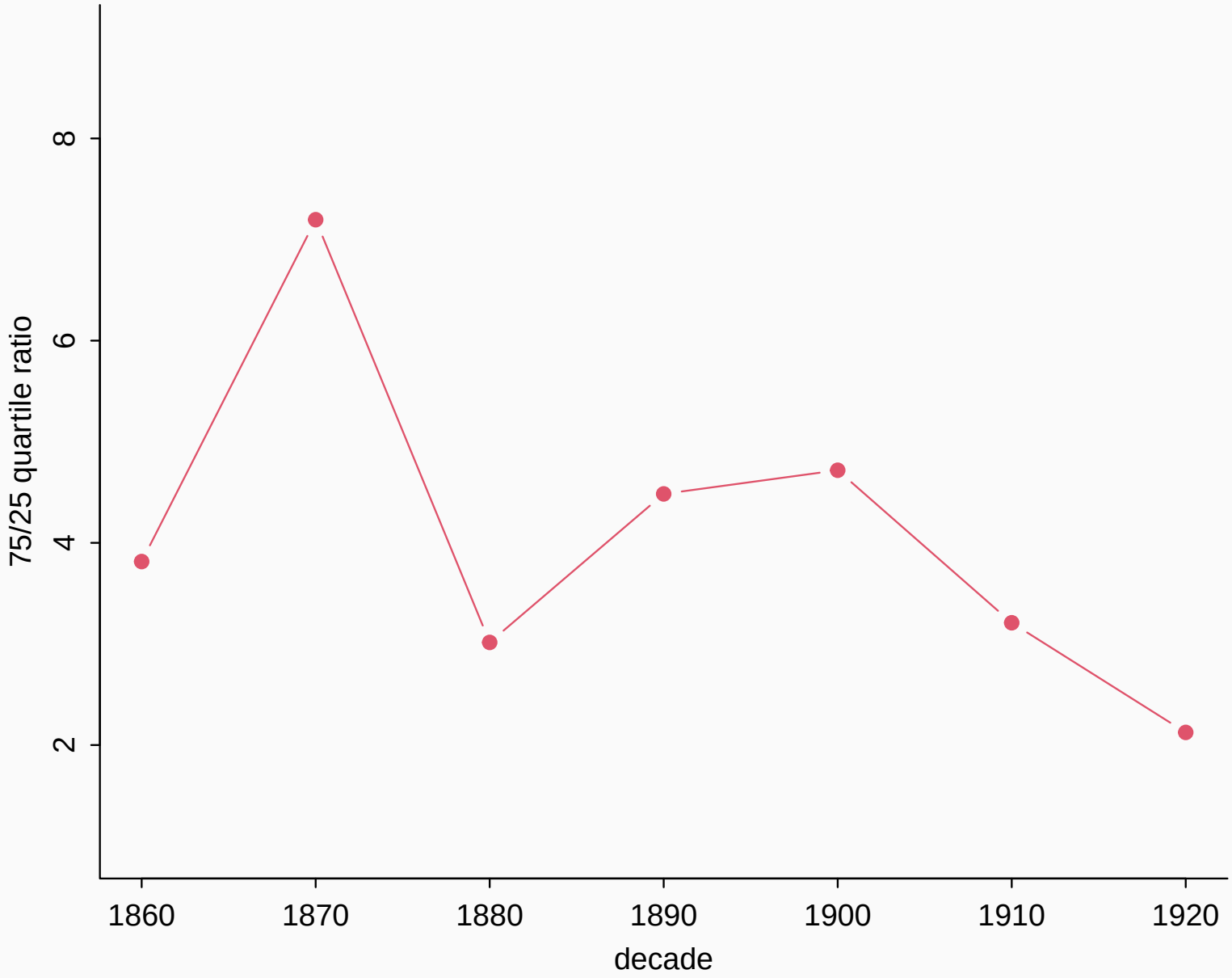
Results: Gini by method



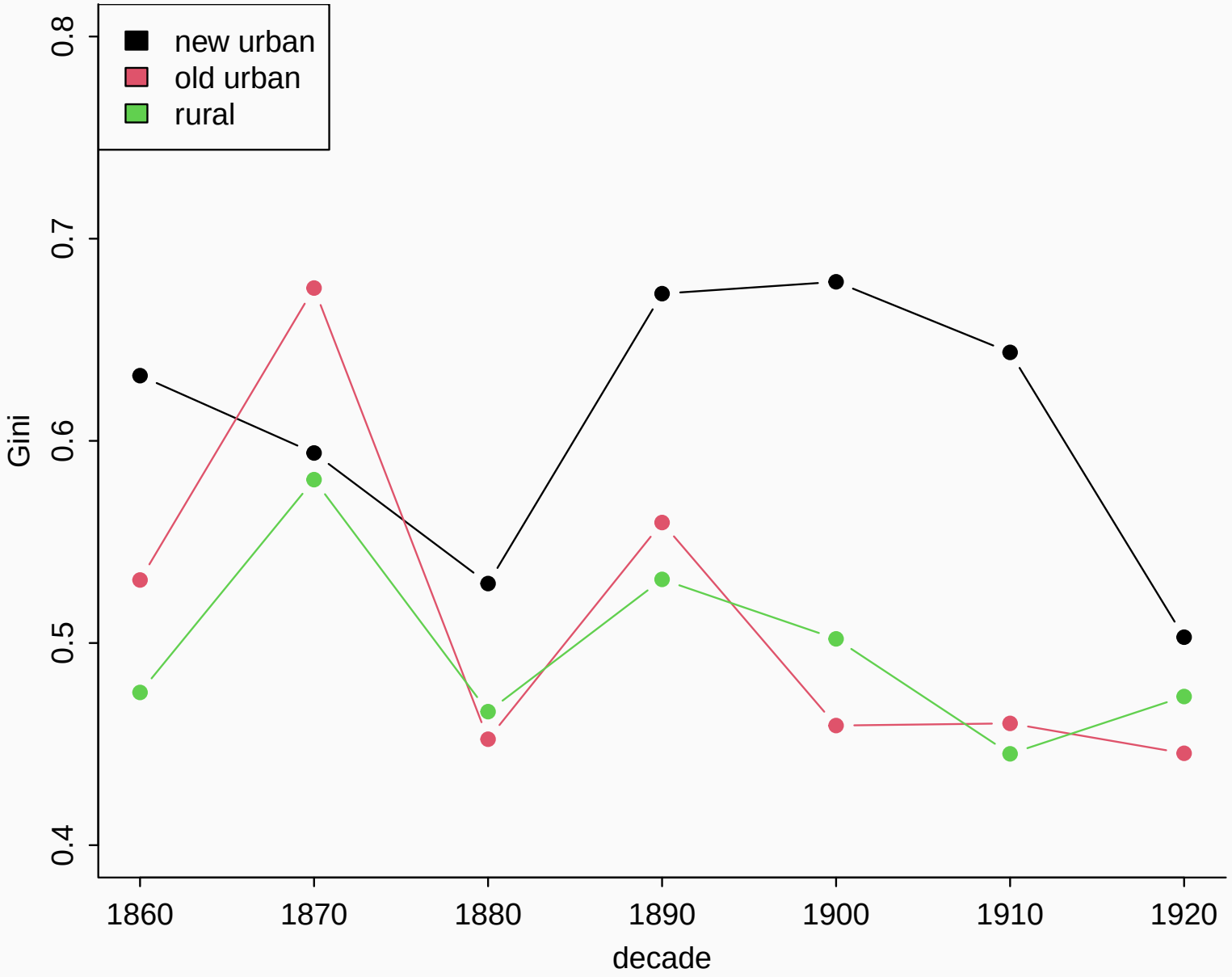
Results: Top 10%, 5%, and 1% income shares



Results: 75%/25% quintile ratio



Results Gini by type of settlement



Conclusions

- New sources allow us to push income distributions back into nineteenth century, though the data require considerable work.
- Rise of inequality in early days of Dutch industrialisation
- Pre-WW1 decline in inequality
- Rising top incomes coinciding with compression in rest of income distribution.

References

References i

Alfani, Guido. 2021. “Economic Inequality in Preindustrial Times: Europe and Beyond.” *Journal of Economic Literature* 59 (1): 3–44. https://doi.org/10.1257/jel.20191449.

Atkinson, Anthony B., and Wiemer Salverda. 2005. “Top Incomes in the Netherlands and the United Kingdom over the 20Th Century.” *Journal of the European Economic Association* 3 (4): 883–913. https://doi.org/10.1162/1542476054430816.

Chen, Tianqi, and Carlos Guestrin. 2016. “XGBoost: A Scalable Tree Boosting System.” In *Proceedings of the 22Nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 785–94. KDD ’16. New York, NY, USA: ACM. https://doi.org/10.1145/2939672.2939785.

References ii

Fintel, Dieter von, Calumet Links, and Erik Green. 2023. “Estimating Historical Inequality from Social Tables: Towards Methodological Consistency.” {WorkingPaper} 2023:247. Department of Economic History, Lund University.

Hastie, Trevor, Robert Tibshirani, and J. H. Friedman. 2009. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. Second edition, corrected 7th printing. Springer Series in Statistics. New York: Springer.

Lindert, Peter H, and Jeffrey G Williamson. 2017. *Unequal Gains: American Growth and Inequality Since 1700*. http://www.vlebooks.com/vleweb/product/openreader?id=none&isbn=9781400880348.

References iii

Modalsli, Jørgen. 2015. “Inequality in the Very Long Run: Inferring Inequality from Data on Social Groups.” *The Journal of Economic Inequality* 13 (2): 225–47. https://doi.org/10.1007/s10888-014-9279-6.

———. 2018. “The Regional Dispersion of Income Inequality in Nineteenth-Century Norway.” *Explorations in Economic History* 67 (January): 62–79. https://doi.org/10.1016/j.eeh.2017.09.001.

Piketty, Thomas. 2014. *Capital in the Twenty-First Century*. Cambridge Massachusetts: The Belknap Press of Harvard University Press.

Piketty, Thomas, and Emmanuel Saez. 2003. “Income Inequality in the United States, 1913–1998*.” *The Quarterly Journal of Economics* 118 (1): 1–41. https://doi.org/10.1162/00335530360535135.

References iv

Soltow, Lee, and Jan Luiten van Zanden. 1998. *Income and Wealth Inequality in the Netherlands: 16th - 20th Century*. Amsterdam: Het Spinhuis.