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

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Introduction

Introduction

- Inequality back on the agenda, and attention focused on two periods:
  - National income tax era starting in twentieth century (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.
- Many proposed drivers of inequality currently on the table: economic growth, institutions, epidemics, war, unionisation, (de)globalisation.
- Nineteenth and early twentieth centuries have seen far less attention, despite great economic, institutional, and demographic change.
  - Current thinking for Netherlands is that inequality was flat throughout this period (Soltow and Van Zanden 1998).
  - Allen describes a classic n-shape for Britain (Allen 2019)

Today

- New data 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

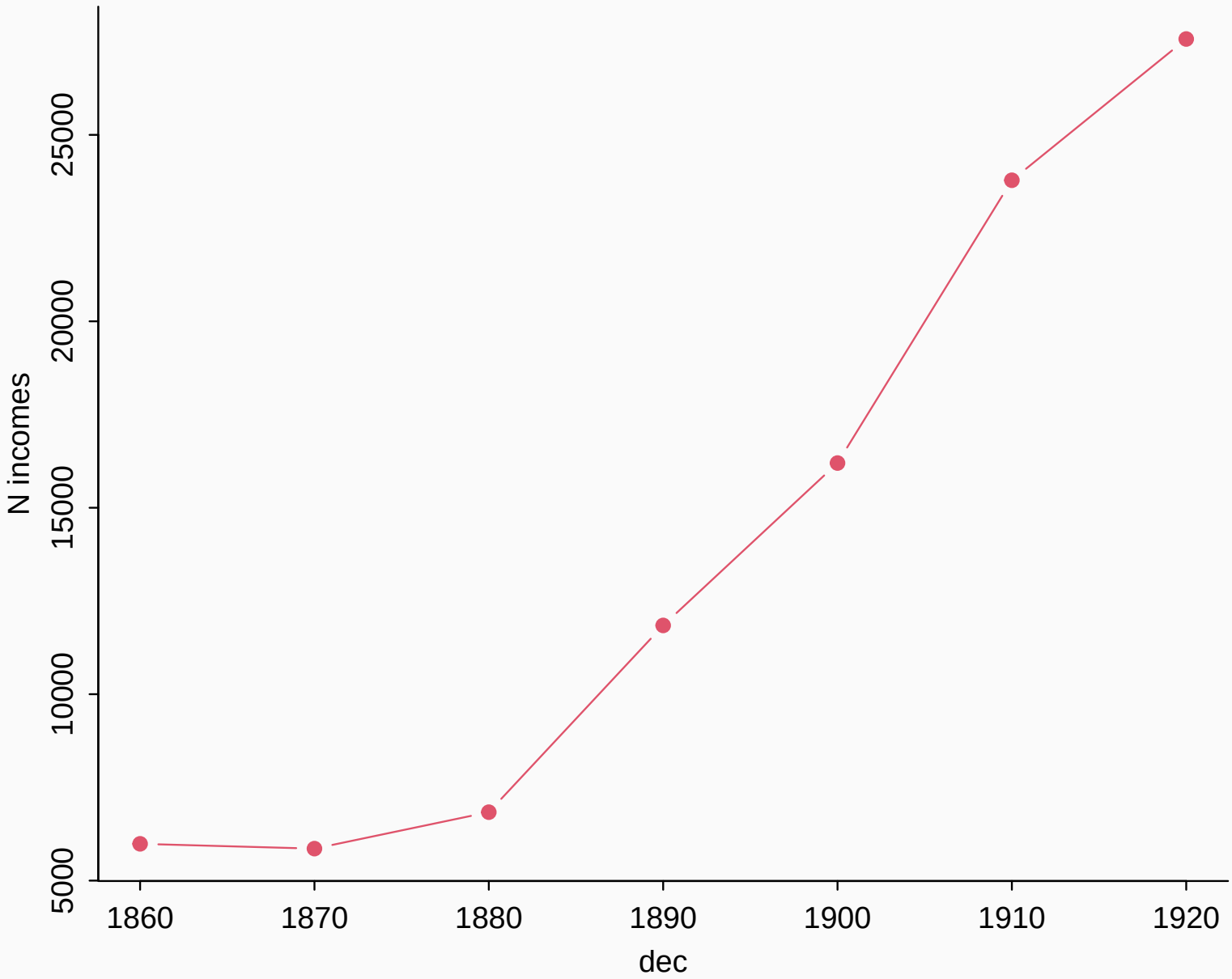
The HIP-NL project

The HIP-NL project

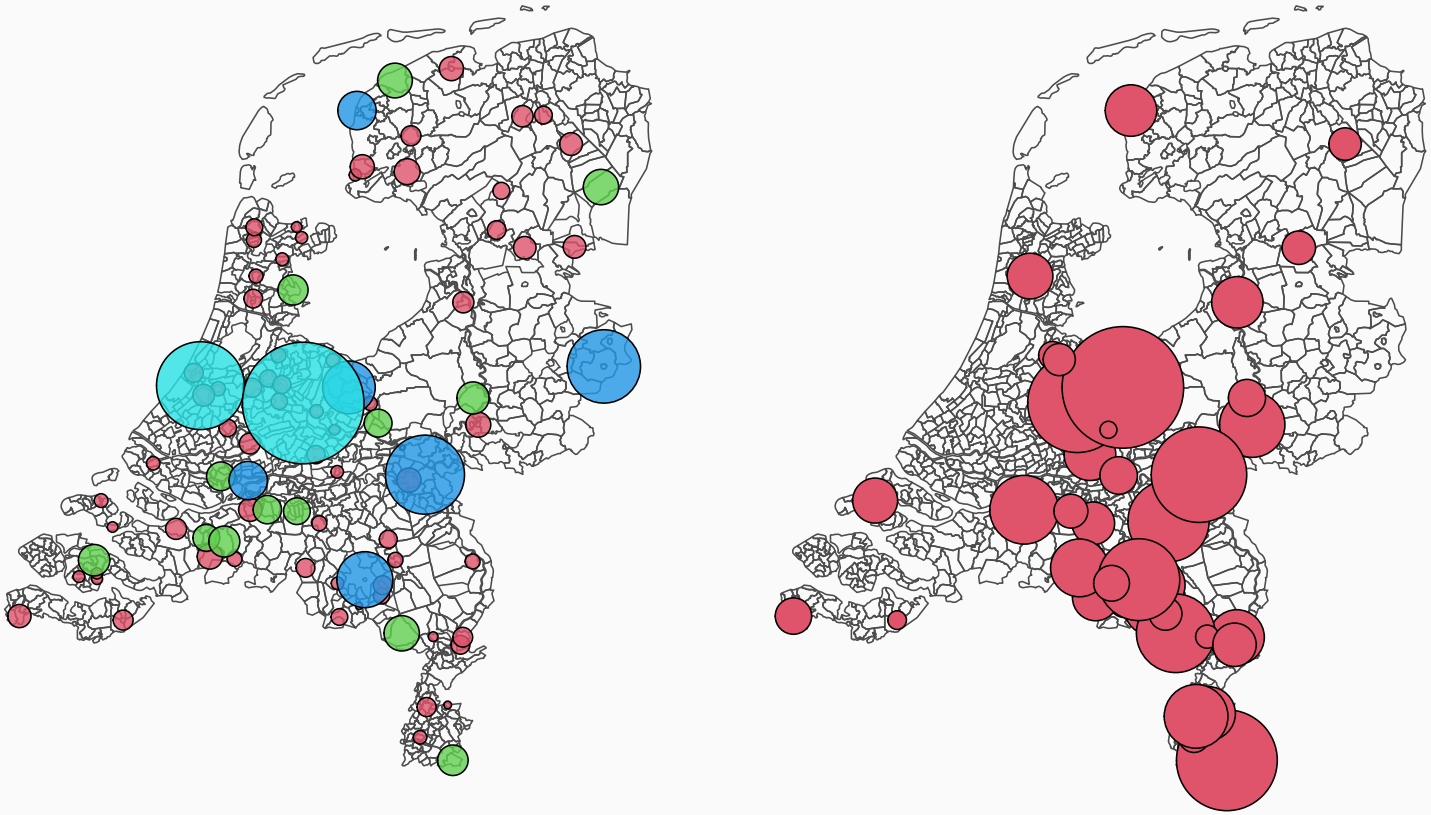
- The Historical Income Panel for the Netherlands (HIP-NL) is creating a panel out municipal income taxes for the period 1850-1920.
- Currently linking observations to population and civil register microdata.
- Work in progress. Income panel will eventually cover a 10% sample of municipalities (90) observed 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

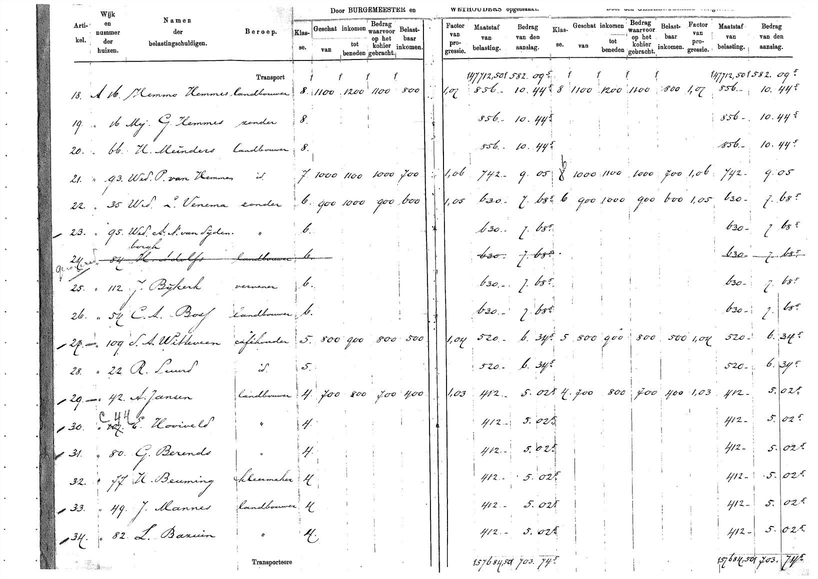
- Netherlands in c19 a relatively stagnant economy since the glory days of the Dutch Republic, most growth taking place in agriculture in first half c19.
- New constitution in 1848 puts the country on modern footing (Van Zanden and Riel 2004).
- Late to industrialise: 1880s and after.

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).
  - Tax threshold: exempted poorest households .
  - Tax unit is fairly close to the household, with the exemption of non-relatives living in one household, households with adult children with income, institutional households.
- Municipalities designed their own taxes, so lot of variation.

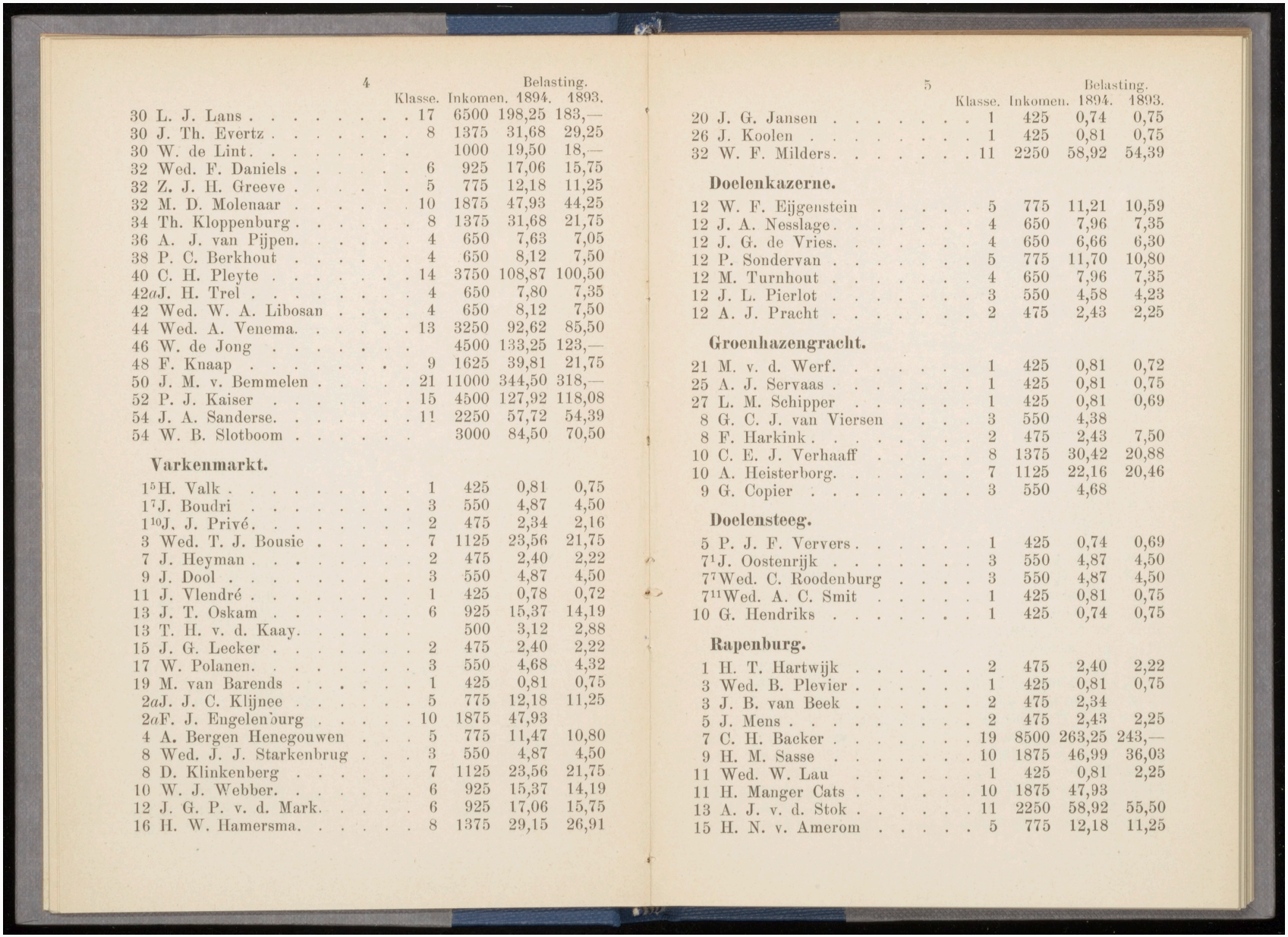
The hoofdelijke omslag tax (Haren)



Door BURGEMEESTER en WETHOUDERS opgemaakt. — Door den [illegible]

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	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 147712,50	f 582.09^5		f	f	f	f		f 147712,50	f 582.09^5
18.	A 16.	Hemmo Hemmes	landbouwer	8.	1100	1200	1100	800	1,07	856.-	10.44^5	8	1100	1200	1100	800	1,07	856.-	10.44^5
19.	" 16	Mej. G. Hemmes	zonder	8.						856.-	10.44^5							856.-	10.44^5
20.	" 66.	H. Meinders	landbouwer	8.						856.-	10.44^5							856.-	10.44^5
21.	" 93.	Wed. P. van Hemmen	id.	7.	1000	1100	1000	700	1,06	742.-	9.05	6 7	1000	1100	1000	700	1,06	742.-	9.05
22.	" 35	Wed. L. Venema	zonder	6.	900	1000	900	600	1,05	630.-	7.68^5	6	900	1000	900	600	1,05	630.-	7.68^5
23.	" 95.	Wed. A. N. van Sydenborgh	"	6.						630.-	7.68^5							630.-	7.68^5
~~24.~~	~~" 84~~	~~H. Adolfs~~	~~landbouwer~~	~~6.~~						~~630.-~~	~~7.68^5~~							~~630.-~~	~~7.68^5~~
25.	" 112	J. Bykerk	verveener	6.						630.-	7.68^5							630.-	7.68^5
26.	" 54	C. A. Bos	landbouwer	6.						630.-	7.68^5							630.-	7.68^5
27.	" 109	S. A. Witteveen	cafehouder	5.	800	900	800	500	1,04	520.-	6.34^5	5	800	900	800	500	1,04	520.-	6.34^5
28.	" 22	R. Luurd	id.	5.						520.-	6.34^5							520.-	6.34^5
29.	" 42.	A. Jansen	landbouwer	4.	700	800	700	400	1,03	412.-	5.02^5	4.	700	800	700	400	1,03	412.-	5.02^5
30.	" ~~107~~ C 44	E. Hooiveld	"	4.						412.-	5.02^5							412.-	5.02^5
31.	" 80.	G. Berends	"	4.						412.-	5.02^5							412.-	5.02^5
32.	" 77	H. Beuming	kleermaker	4						412.-	5.02^5							412.-	5.02^5
33.	" 49.	J. Mannes	landbouwer	4						412.-	5.02^5							412.-	5.02^5
34.	" 82.	L. Bazuin	"	4.						412.-	5.02^5							412.-	5.02^5
		Transporteere								157684,50	703.74^5							157684,50	703.74^5

The hoofdelijke omslag tax (Leiden)



		Klasse.	Inkomen.	Belasting. 1894.	1893.
30	L. J. Lans	17	6500	198,25	183,—
30	J. Th. Evertz	8	1375	31,68	29,25
30	W. de Lint		1000	19,50	18,—
32	Wed. F. Daniels	6	925	17,06	15,75
32	Z. J. H. Greeve	5	775	12,18	11,25
32	M. D. Molenaar	10	1875	47,93	44,25
34	Th. Kloppenburg	8	1375	31,68	21,75
36	A. J. van Pijpen	4	650	7,63	7,05
38	P. C. Berkhout	4	650	8,12	7,50
40	C. H. Pleyte	14	3750	108,87	100,50
42*a*	J. H. Trel	4	650	7,80	7,35
42	Wed. W. A. Libosan	4	650	8,12	7,50
44	Wed. A. Venema	13	3250	92,62	85,50
46	W. de Jong		4500	133,25	123,—
48	F. Knaap	9	1625	39,81	21,75
50	J. M. v. Bemmelen	21	11000	344,50	318,—
52	P. J. Kaiser	15	4500	127,92	118,08
54	J. A. Sanderse	11	2250	57,72	54,39
54	W. B. Slotboom		3000	84,50	70,50
	Varkenmarkt.				
1[5]	H. Valk	1	425	0,81	0,75
1[7]	J. Boudri	3	550	4,87	4,50
1[10]	J. J. Privé	2	475	2,34	2,16
3	Wed. T. J. Bousie	7	1125	23,56	21,75
7	J. Heyman	2	475	2,40	2,22
9	J. Dool	3	550	4,87	4,50
11	J. Vlendré	1	425	0,78	0,72
13	J. T. Oskam	6	925	15,37	14,19
13	T. H. v. d. Kaay		500	3,12	2,88
15	J. G. Lecker	2	475	2,40	2,22
17	W. Polanen	3	550	4,68	4,32
19	M. van Barends	1	425	0,81	0,75
2*a*	J. J. C. Klijnee	5	775	12,18	11,25
2*a*	F. J. Engelenburg	10	1875	47,93	
4	A. Bergen Henegouwen	5	775	11,47	10,80
8	Wed. J. J. Starkenbrug	3	550	4,87	4,50
8	D. Klinkenberg	7	1125	23,56	21,75
10	W. J. Webber	6	925	15,37	14,19
12	J. G. P. v. d. Mark	6	925	17,06	15,75
16	H. W. Hamersma	8	1375	29,15	26,91

		Klasse.	Inkomen.	Belasting. 1894.	1893.
20	J. G. Jansen	1	425	0,74	0,75
26	J. Koolen	1	425	0,81	0,75
32	W. F. Milders	11	2250	58,92	54,39
	Doelenkazerne.				
12	W. F. Eijgenstein	5	775	11,21	10,59
12	J. A. Nesslage	4	650	7,96	7,35
12	J. G. de Vries	4	650	6,66	6,30
12	P. Sondervan	5	775	11,70	10,80
12	M. Turnhout	4	650	7,96	7,35
12	J. L. Pierlot	3	550	4,58	4,23
12	A. J. Pracht	2	475	2,43	2,25
	Groenhazengracht.				
21	M. v. d. Werf	1	425	0,81	0,72
25	A. J. Servaas	1	425	0,81	0,75
27	L. M. Schipper	1	425	0,81	0,69
8	G. C. J. van Viersen	3	550	4,38	
8	F. Harkink	2	475	2,43	7,50
10	C. E. J. Verhaaff	8	1375	30,42	20,88
10	A. Heisterborg	7	1125	22,16	20,46
9	G. Copier	3	550	4,68	
	Doelensteeg.				
5	P. J. F. Ververs	1	425	0,74	0,69
7[1]	J. Oostenrijk	3	550	4,87	4,50
7[7]	Wed. C. Roodenburg	3	550	4,87	4,50
7[11]	Wed. A. C. Smit	1	425	0,81	0,75
10	G. Hendriks	1	425	0,74	0,75
	Rapenburg.				
1	H. T. Hartwijk	2	475	2,40	2,22
3	Wed. B. Plevier	1	425	0,81	0,75
3	J. B. van Beek	2	475	2,34	
5	J. Mens	2	475	2,43	2,25
7	C. H. Backer	19	8500	263,25	243,—
9	H. M. Sasse	10	1875	46,99	36,03
11	Wed. W. Lau	1	425	0,81	2,25
11	H. Manger Cats	10	1875	47,93	
13	A. J. v. d. Stok	11	2250	58,92	55,50
15	H. N. v. Amerom	5	775	12,18	11,25

Issues

Estimating incomes

- HO reports different numbers:
  - Gross incomes
  - Income classes
  - Taxable incomes
  - Taxes due
- Tax are progressive or feature deductions that affect the bottom of the distribution more, so 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 (work in progress).

Estimating incomes

- Here we 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): flexible and robust model that can – in principle – handle missing data, non-linearities, and interactions.
- 70/30 test/validation split: 22546 and 9683 observations in each.
- After modelling on training and evaluating on validation 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(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
- Two models:
  - taxable incomes present: RSME 0.10 (on average, predictions are fl. 1.10 off)
  - taxable incomes masked: RSME 0.14 (on average fl. 1.15 off)

Estimating incomes

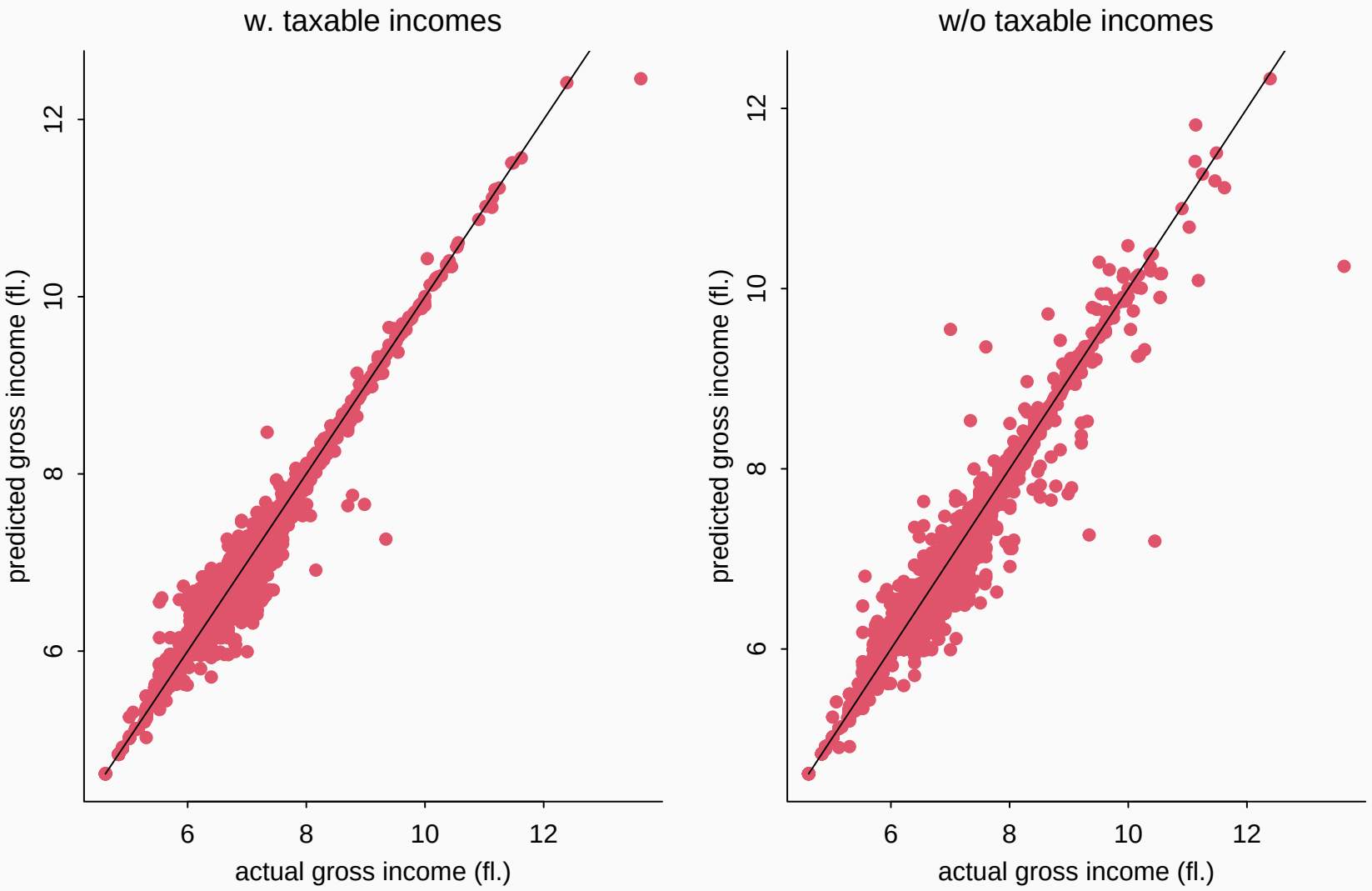
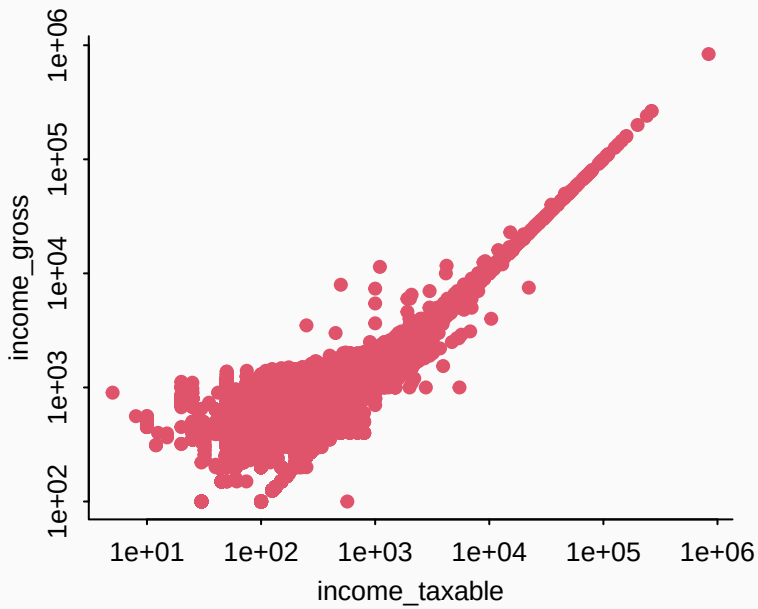
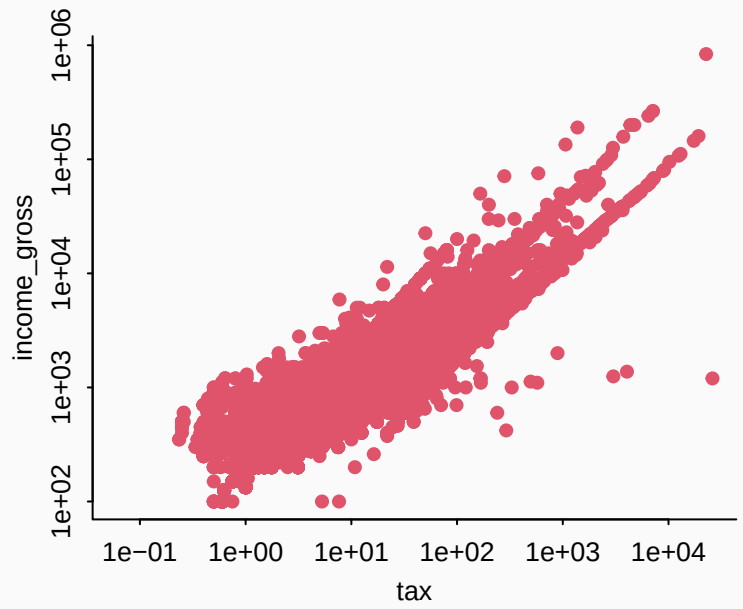
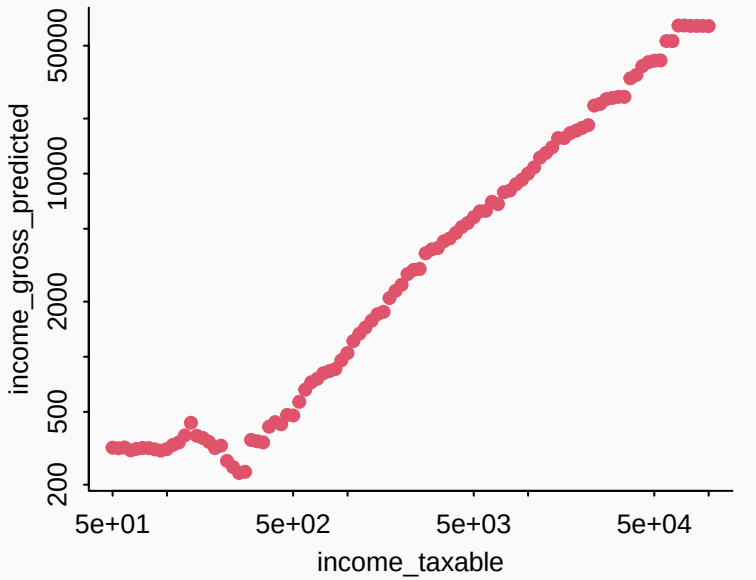


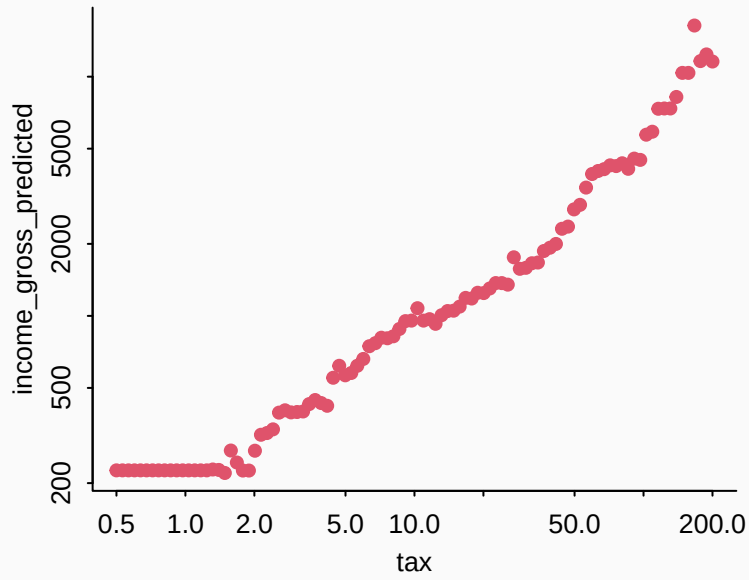
Figure 3: Actual and predicted incomes

Estimating incomes: non-linearities





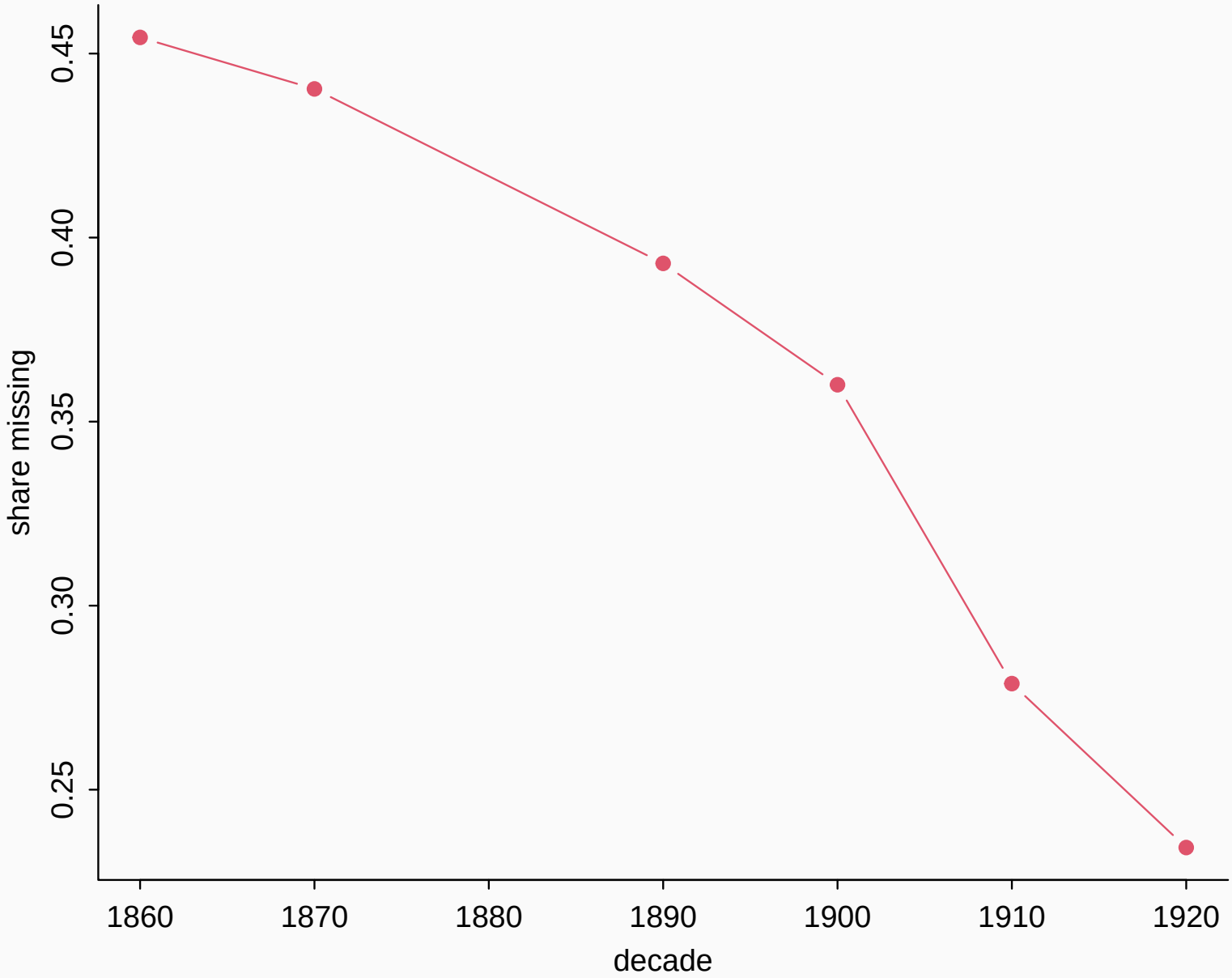




Imputations

- Know that HO implemented a threshold, usually motivated by part of population living near subsistence.
- The number of households exempted can be high in earlier period; by end HO is often complete coverage.
- Use census count of households and labour force to estimate the number of missing tax units, trying to reconstruct the HO tax unit for each municipality.

Imputations



Imputations

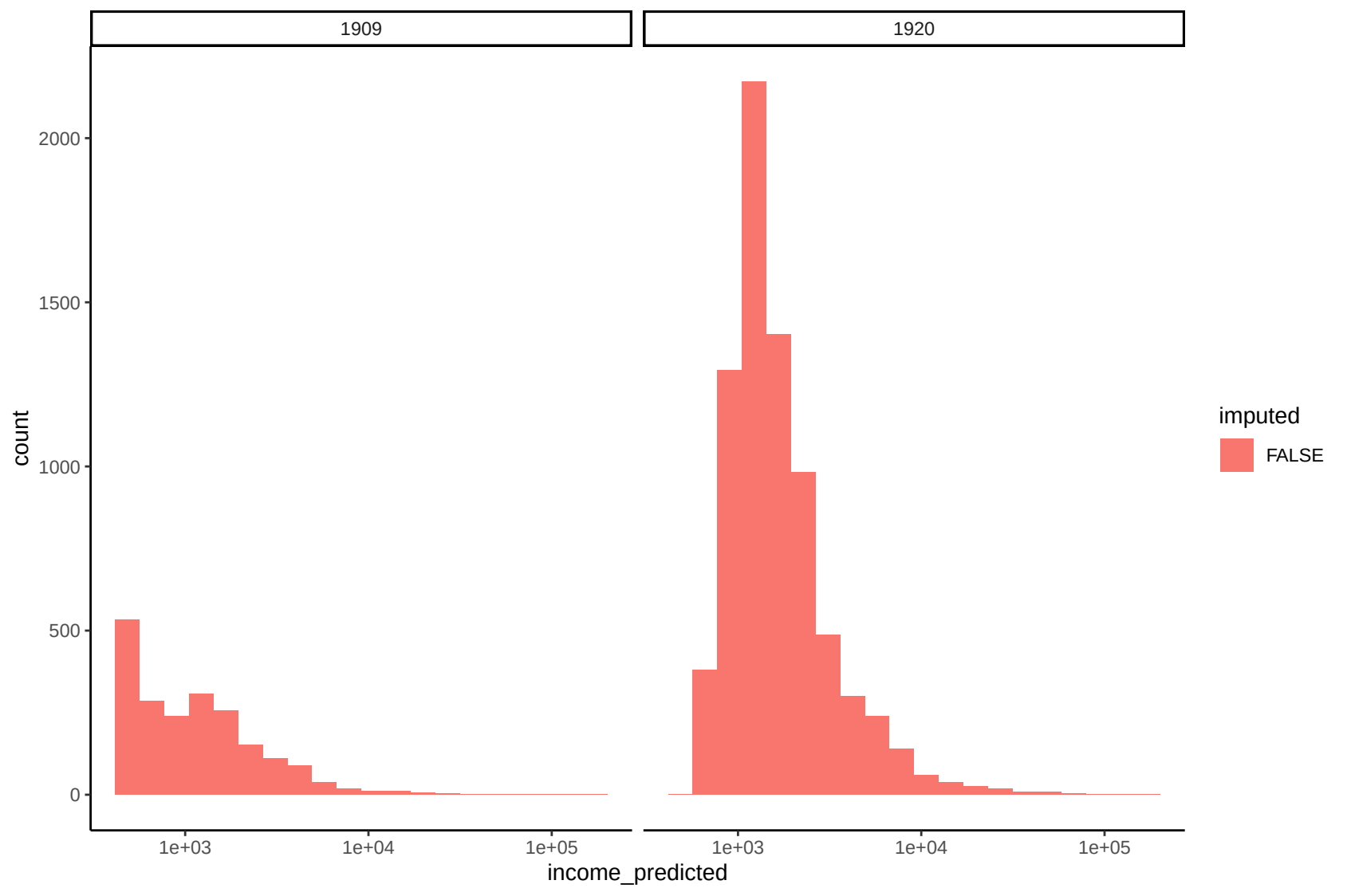


Figure 5: Censored distributions in Amersfoort

Imputations

- Missing households below the tax threshold means we are dealing with trunacted distributions.
- We use the number of missing tax units to estimate a censored lognormal distribution from the observed tax units for each municipality.
- Draw additional tax units from that distribution.

Imputations

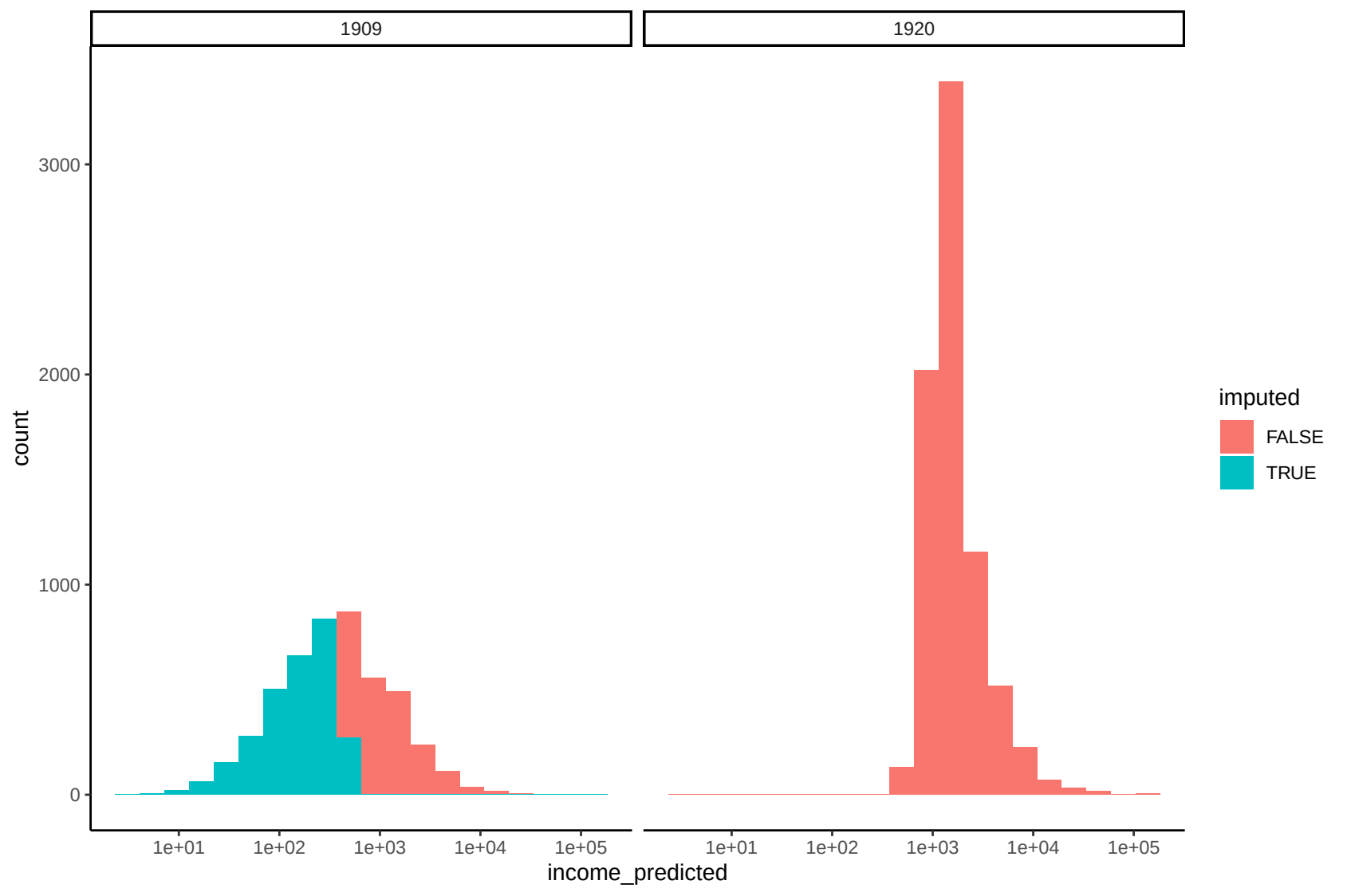


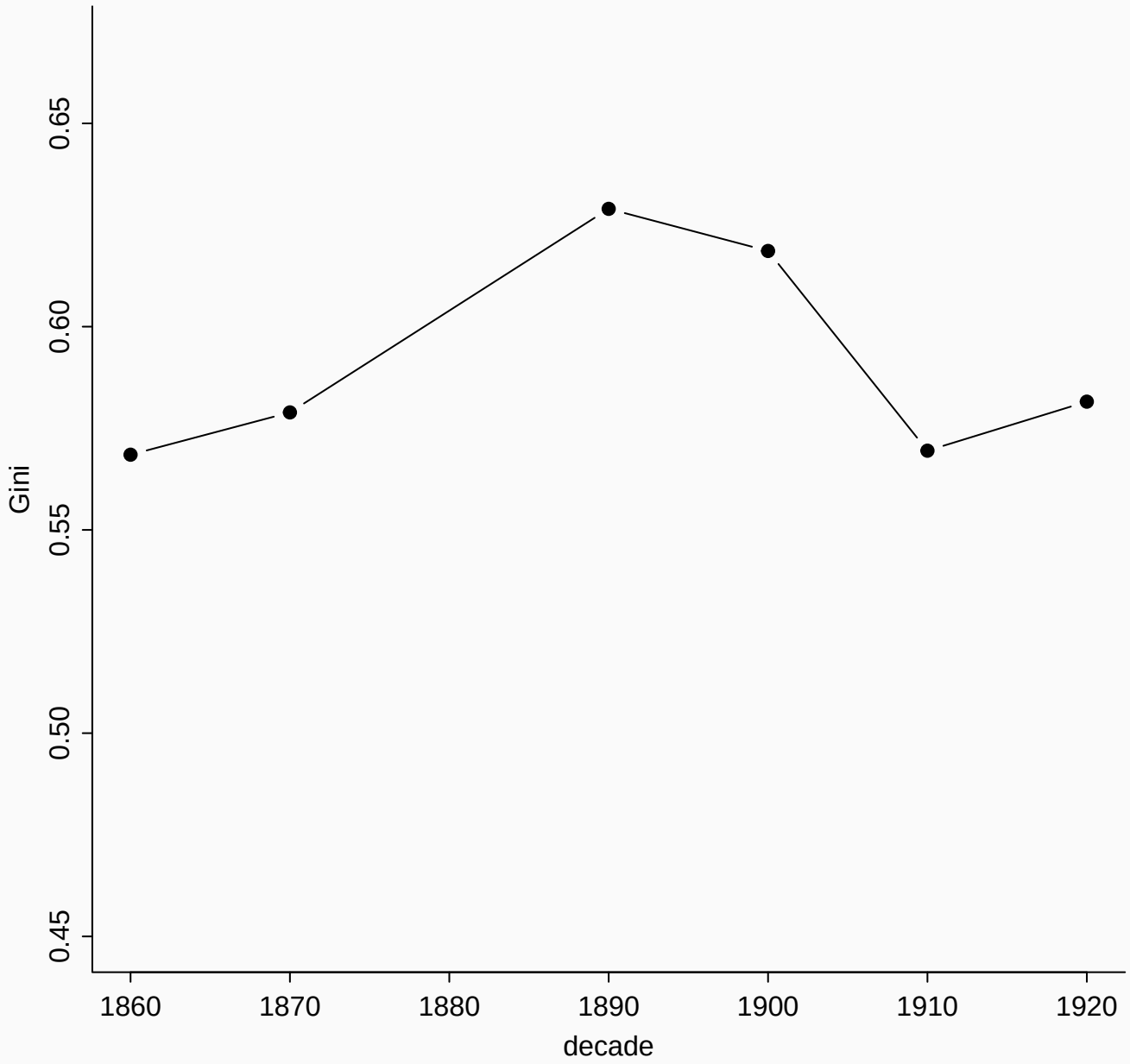
Figure 6: Imputed distributions in Amersfoort

Weighting

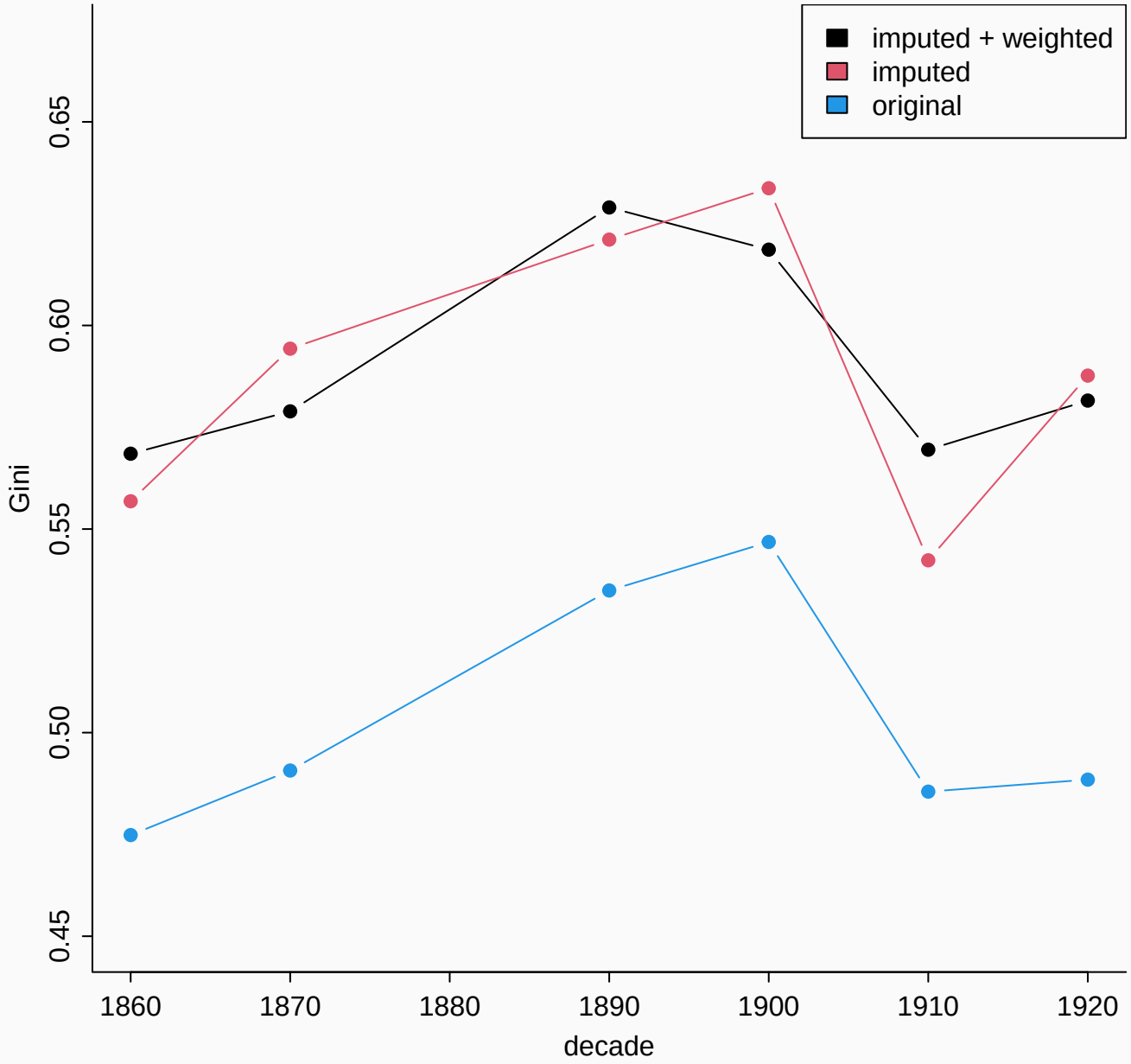
- Weighting necessary as current sample reflects work in progress, not actual sample design.
- In particular: rural, southern bias.
- Simple weighting scheme: rural/new urban/old urban (Soltow and Van Zanden 1998) for each decade.
    - new/old urban based on 1850-1920 population growth exceeding Dutch growth (100%).
- Calculate total tax units in each category for all of Netherlands, and drew w. replacement from empirical sample distribution within strata.

Results

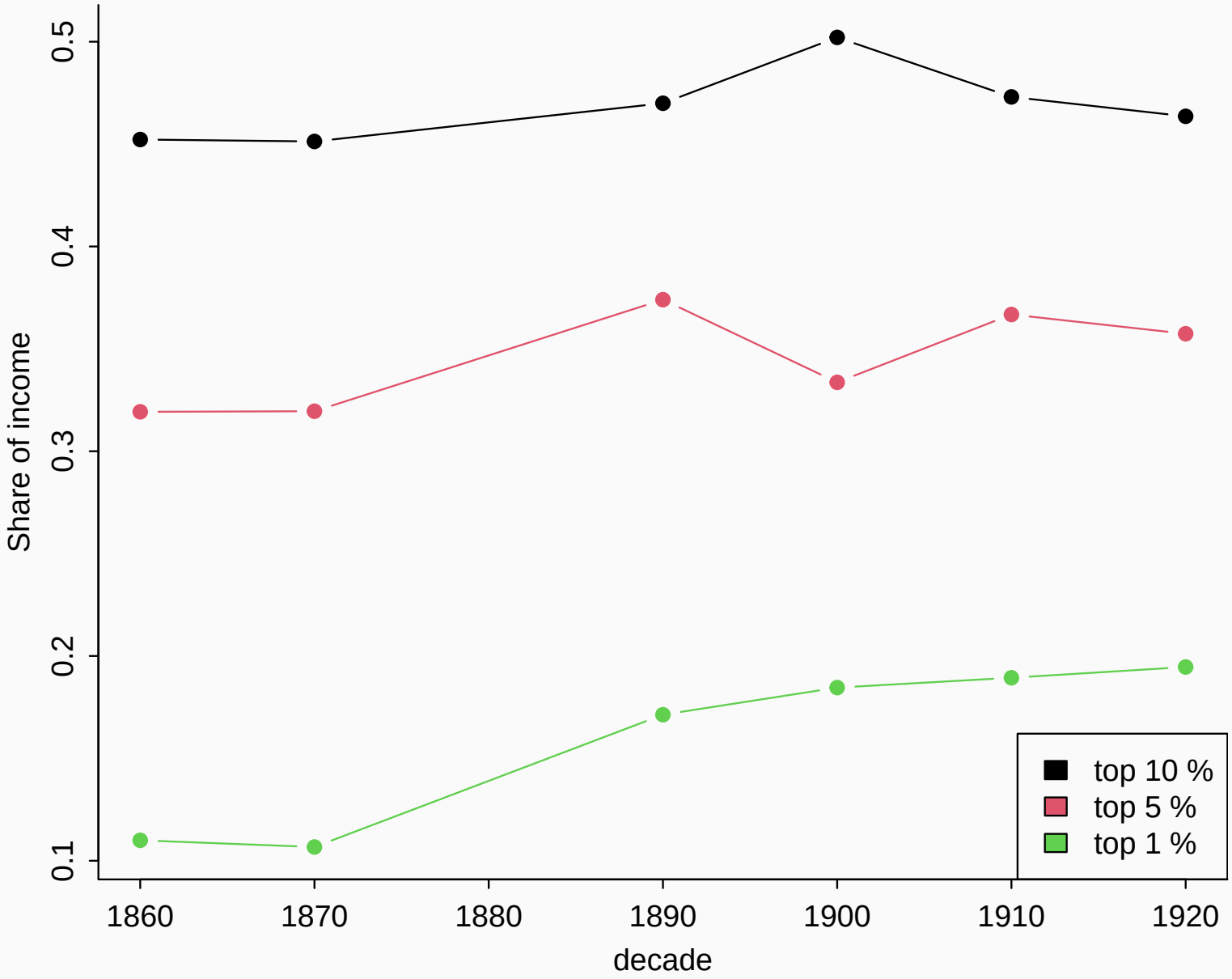
Results: Gini,1860–1920



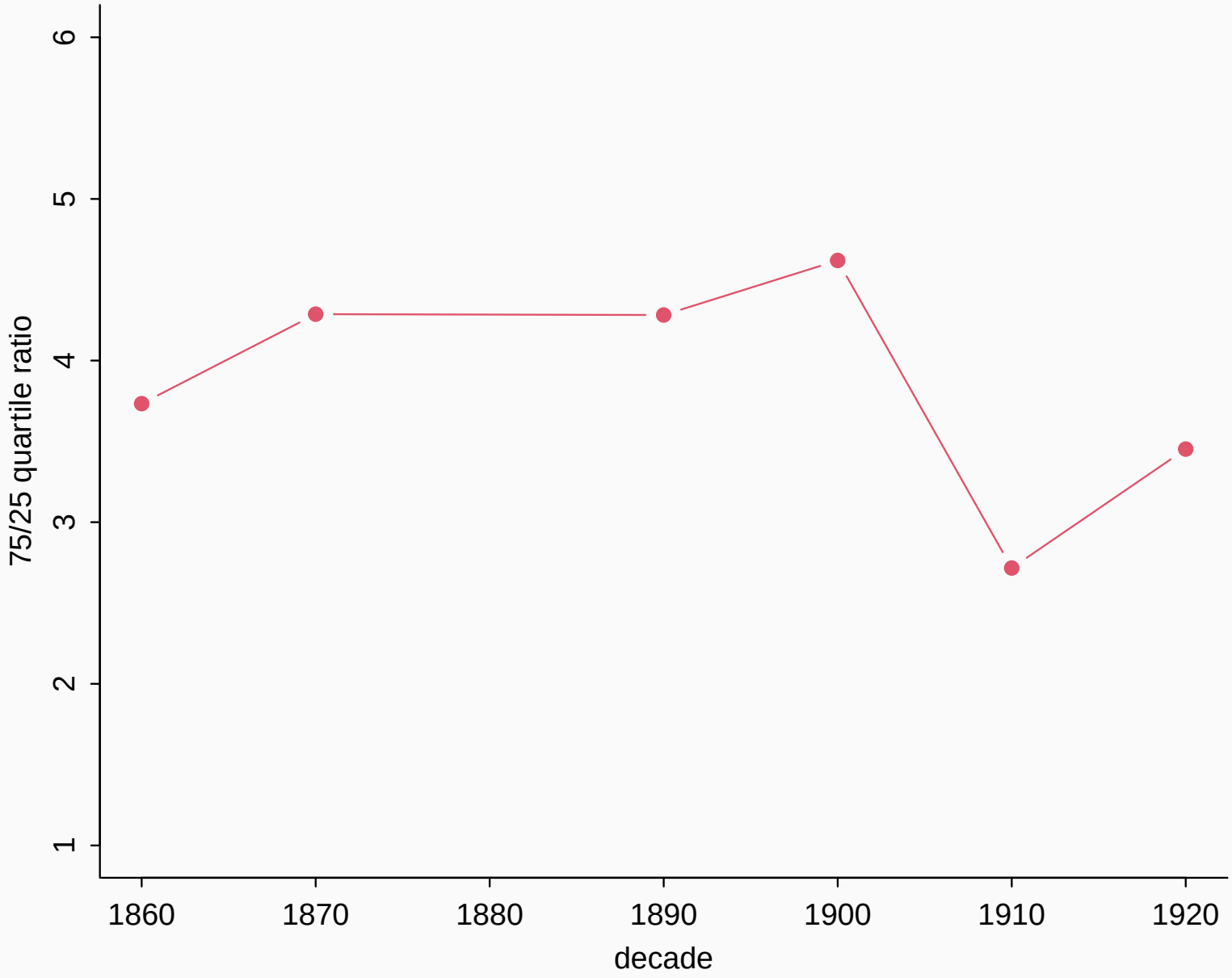
Results: Gini by method



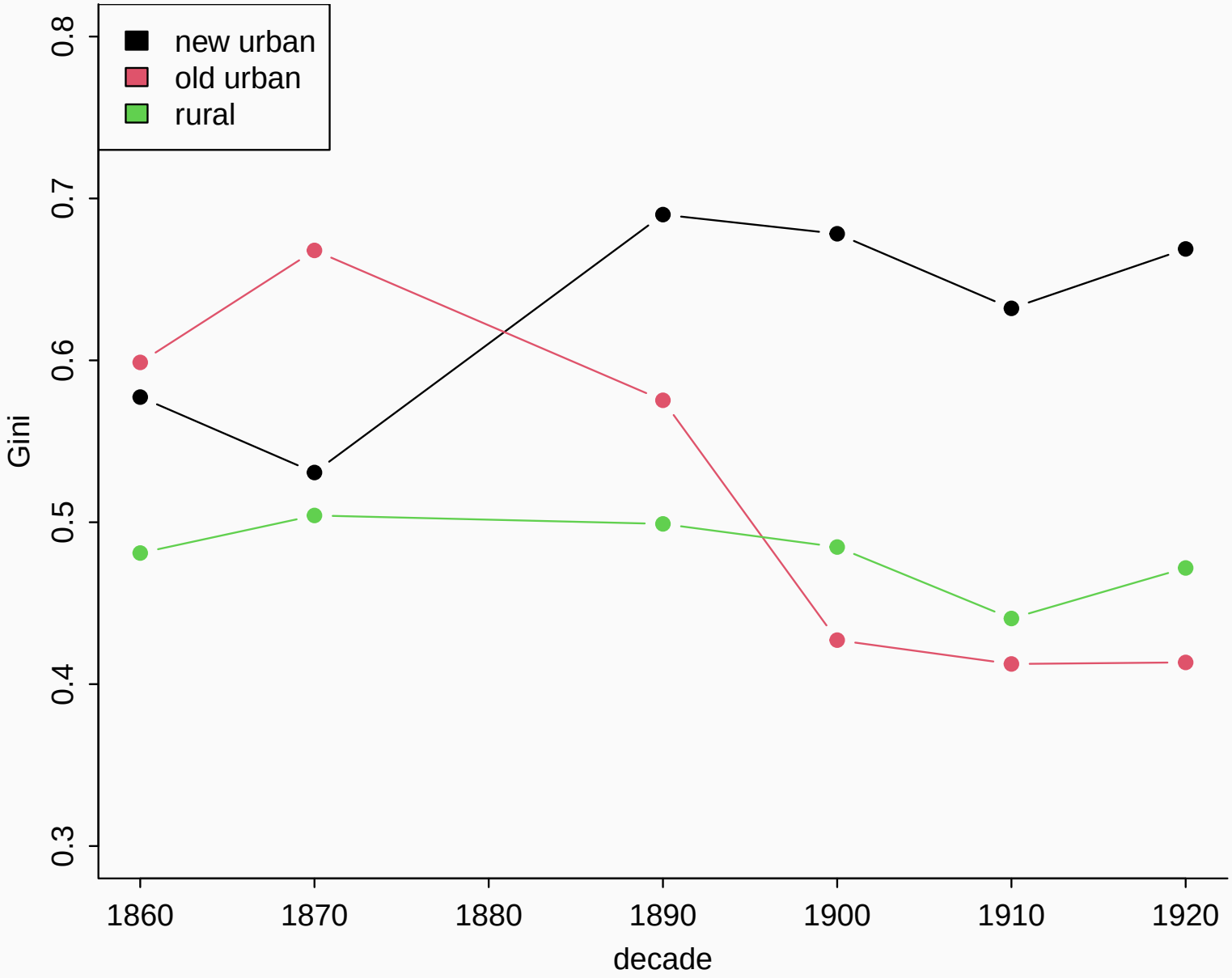
Results: Top 10%, 5%, and 1% income shares



Results: 75%/25% quintile ratio



Results Gini by type of settlement



Discussion

- New sources allow us to push income distributions back into nineteenth century.
- Rise of inequality at start of Dutch industrialisation.
- Pre-WW1 decline in inequality.
- Rising top incomes coinciding with compression in rest of income distribution.
- Speculation:
  - Not due to capital income (rising top 1% and 5%).
  - War, taxation, deglobalisation seem unlikely (timing).
  - Gains in middle, declining inequality in old cities suggests role for labour market and migration.

Appendix

Impact of estimation procedure on Gini estimates

Dependent Variables:		gini		d(gini,1)
Model:	(1)	(2)	(3)	(4)
Variables				
Constant	0.4539***			
	(0.0337)			
source = incomemodel	-0.0369	-0.0223	0.0391	0.0195
	(0.0546)	(0.0541)	(0.0356)	(0.0348)
source = taxonlymodel	0.0257	0.0166	0.0156	-0.0007
	(0.0270)	(0.0433)	(0.0233)	(0.0300)
Fixed-effects				
dec		Yes	Yes	Yes
municipality			Yes	Yes
Fit statistics				
Observations	165	165	165	123
R^2	0.02291	0.04877	0.84090	0.29223
Within R^2		0.00556	0.02222	0.00392

Clustered (municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

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.

Allen, Robert C. 2019. “Class Structure and Inequality During the Industrial Revolution: Lessons from England’s Social Tables, 1688-1867: CLASS STRUCTURE AND INEQUALITY.” *The Economic History Review* 72 (1): 88–125. https://doi.org/10.1111/ehr.12661.

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.

References ii

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.

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.

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/10.1162/0033553036053513 5.

References iii

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

Van Zanden, Jan Luiten, and Arthur van Riel. 2004. *The Strictures of Inheritance: The Dutch Economy in the Nineteenth Century*. The Princeton Economic History of the Western World. Princeton, NJ etc.: Princeton University Press.