A Testament to Revolution?

Estimating Intergenerational Persistence of Wealth in France, 1791-1870 - Results from the *Département de la Nièvre*

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Department of Economic History
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Eighteenth Winter School on Inequality and Social Welfare Theory

The Economics Literature - Traditional Model of Social Mobility

The economics literature traditionally conceptualises inter-generational mobility at the individual level between two generations and models it as an **AR-1 process**:

$$y_{t+1} = \beta y_t + \epsilon_t \tag{1}$$

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- All advantages disappear over a few generations (expected correlation coefficient between grandparents' outcomes and a grandchild's is only β^2.)
- By assumption, for any child's outcome it holds that it is fully determined by that very outcome of the parent.
- Fails to capture family endowment and the fact that underlying status can be expressed in different forms of capital.[1]

Towards a Multi-generational Model

Taking a multi-generational view changes the results significantly. Persistence seems to be much higher than expected.

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- Link data across several generations;
- Rare surnames approach.

Multiple Generations indicate higher Persistence

- **England**
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  - No *Gentlemanly Capitalism*[5][1]

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This paper presents two approaches to investigate multi-generational status persistence:

- Digitisation of the *Tables des Successions et Absences*

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- Results from a multi-outcome approach

The Social Mobility Effects of the French Revolution

Marxist and *Marxisant* perspectives

- Marxist tradition: French Revolution as a *bourgeois revolution* - a dynamic capitalist elite replacing an idle aristocracy.
- Jaurès [7], Mathiez [8], Lefebvre [9], or Soboul [10]

Revisionist Views

- Cobban [11] fails to identify a *revolutionary bourgeoisie*.
- Forster [12]: *Ancien régime* elites suffer from cumulative effects of the Revolution.
- Beck [13]: Nobility in voter lists is richer but less numerous than expected.
- Piketty [14] and Blaufarb [15]: Revolution was no economic revolution.

Relevant Literature

Social Mobility in France in the 19th Century - The *Enquête TRA*

- Records from the birth, death, marriage, and probate registers of all individuals with a surname starting with the combination of letters *Tra-*.

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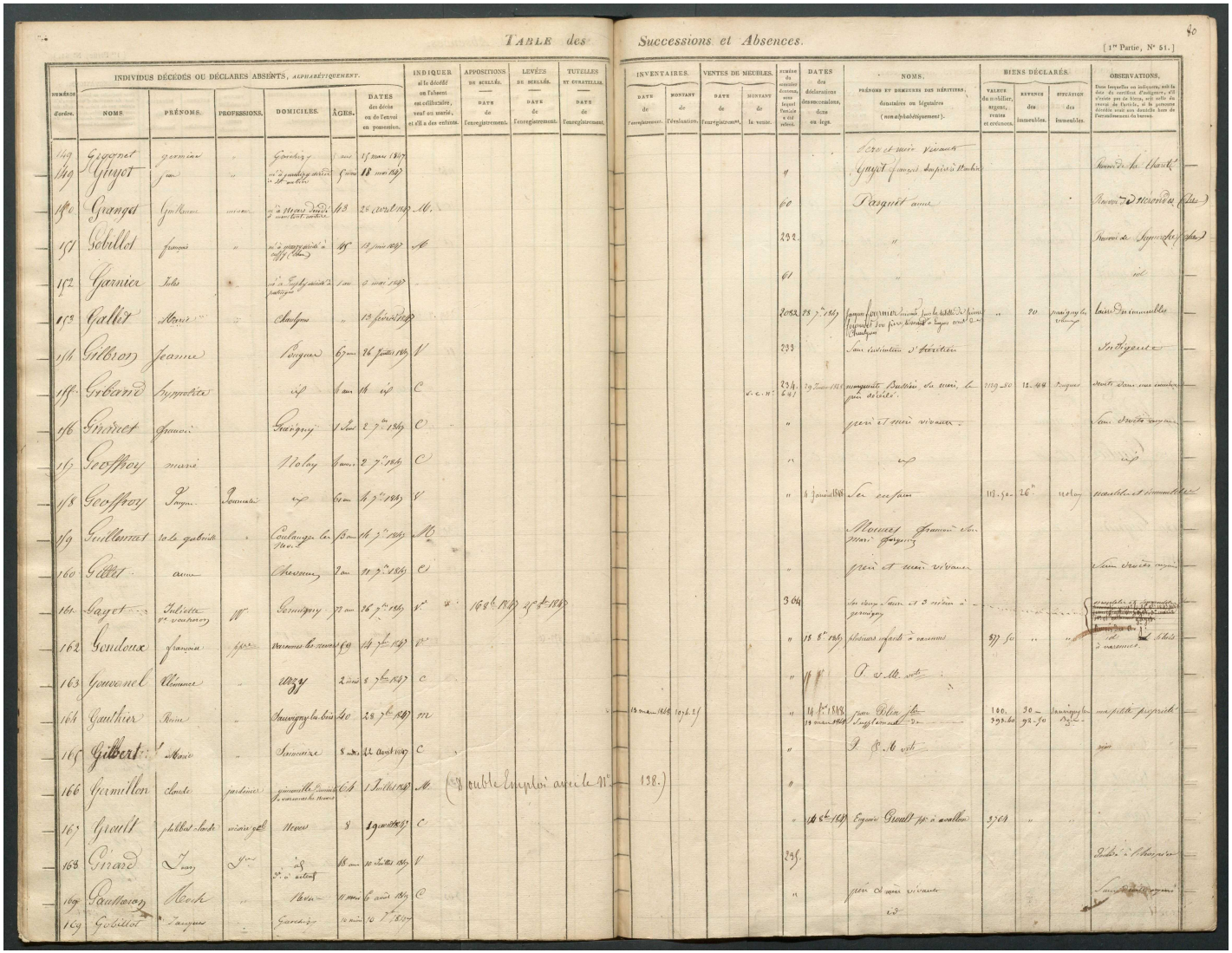
- **Danish Virgin Islands:** Galli et al. (2024) [22]

The *Tables des Successions et Absences*



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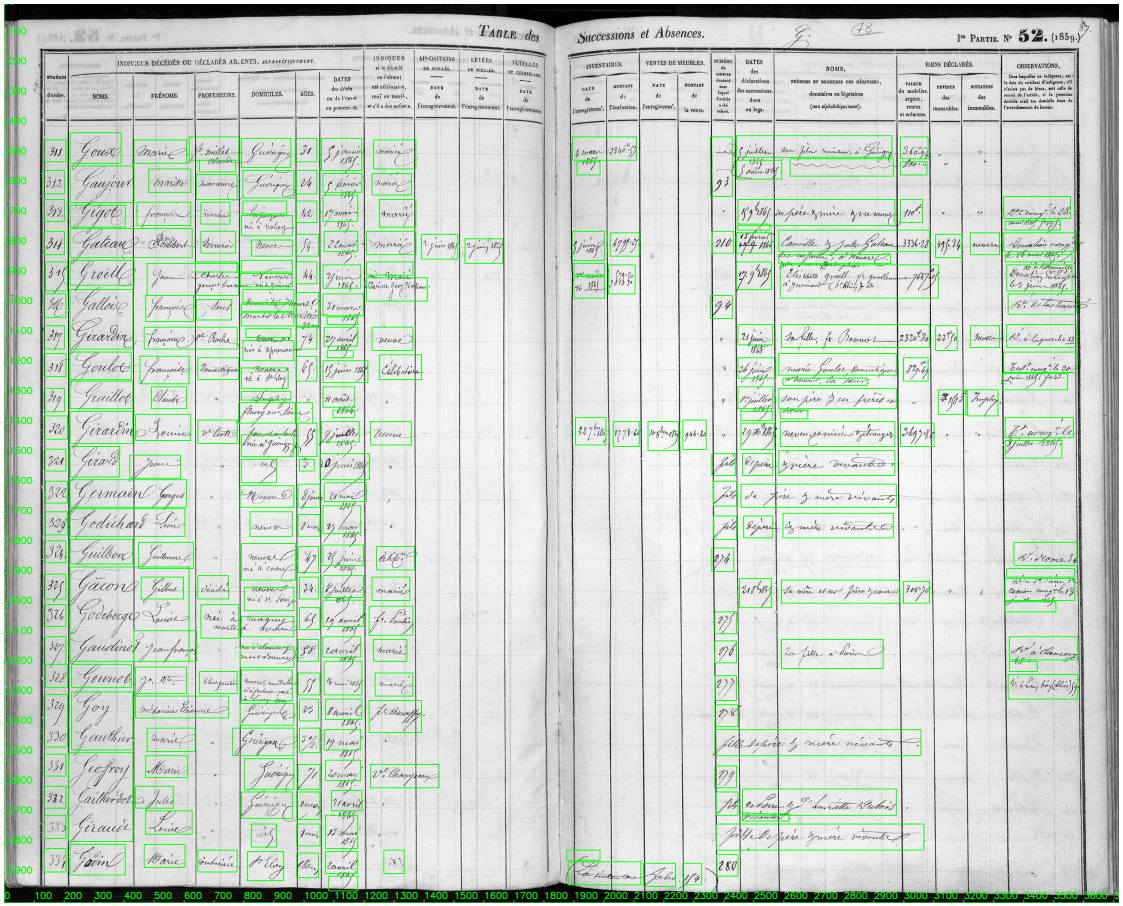
- etc.

First Step: Text Line Detection

We use a fine-tuned version of Doc-UFCN [25] to detect text lines:



Second Step: Handwritten Text Recognition

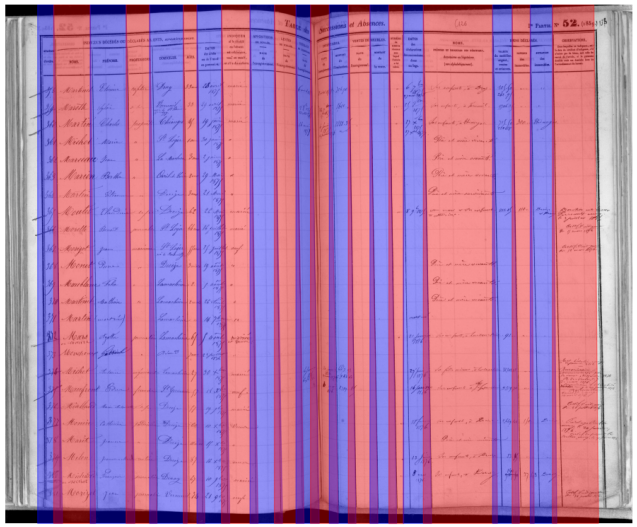
Handwritten Text Recognition

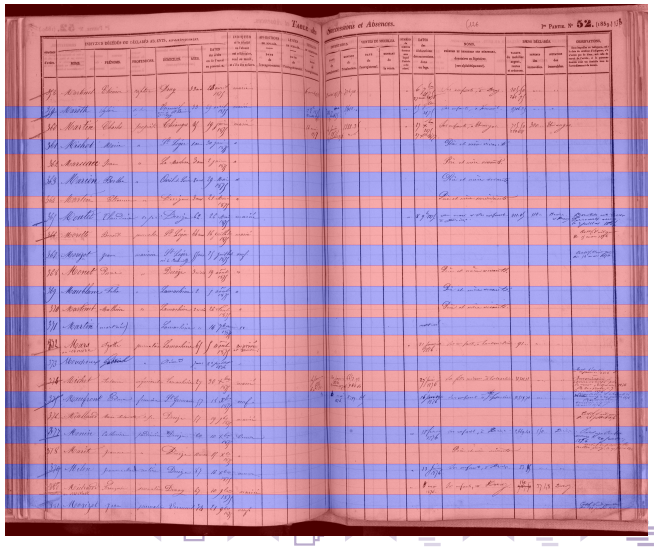
- We use TrOCR [26], a pre-trained transformer-based OCR model.

Third Step: Page Segmentation

To segment the page into columns and rows, we use a combination of:

- Doc-UFCN

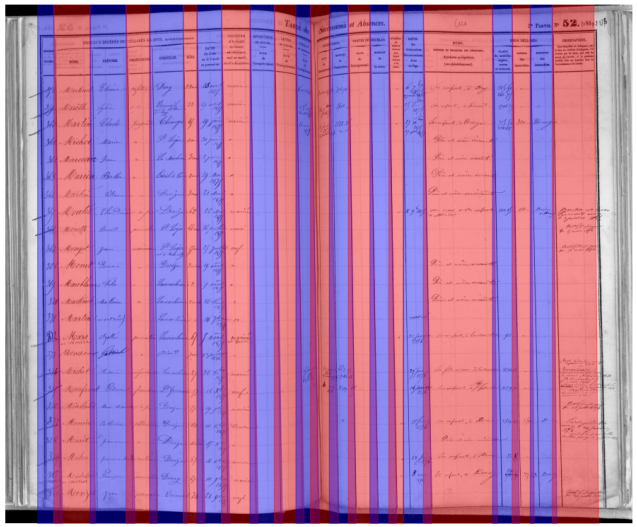


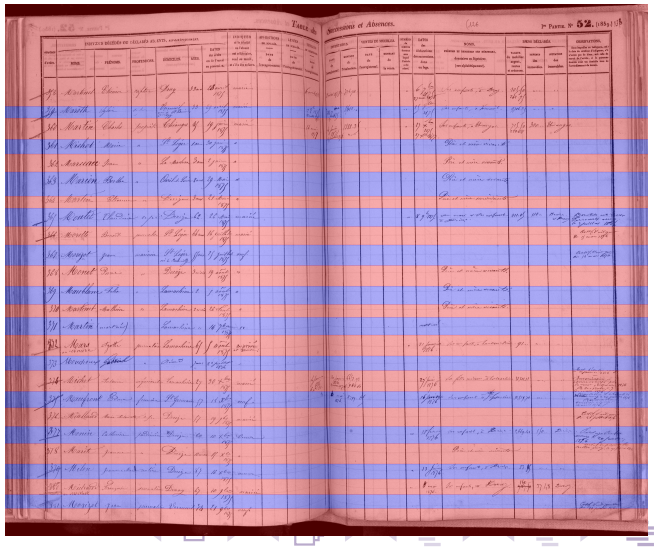


Third Step: Page Segmentation

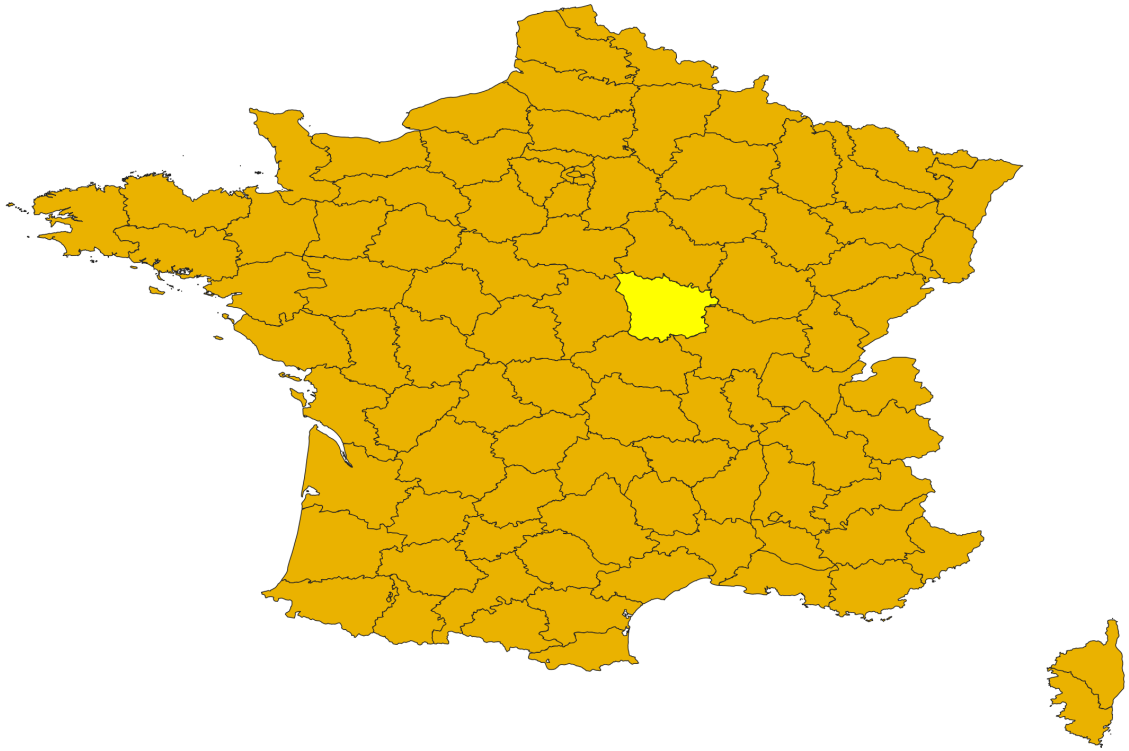
To segment the page into columns and rows, we use a combination of:

- Doc-UFCN
- Computer Vision (Hough Line Transform)





Nièvre Pilot Study



Evaluation Line Detection | Evaluation Column Detection | Evaluation Row Detection

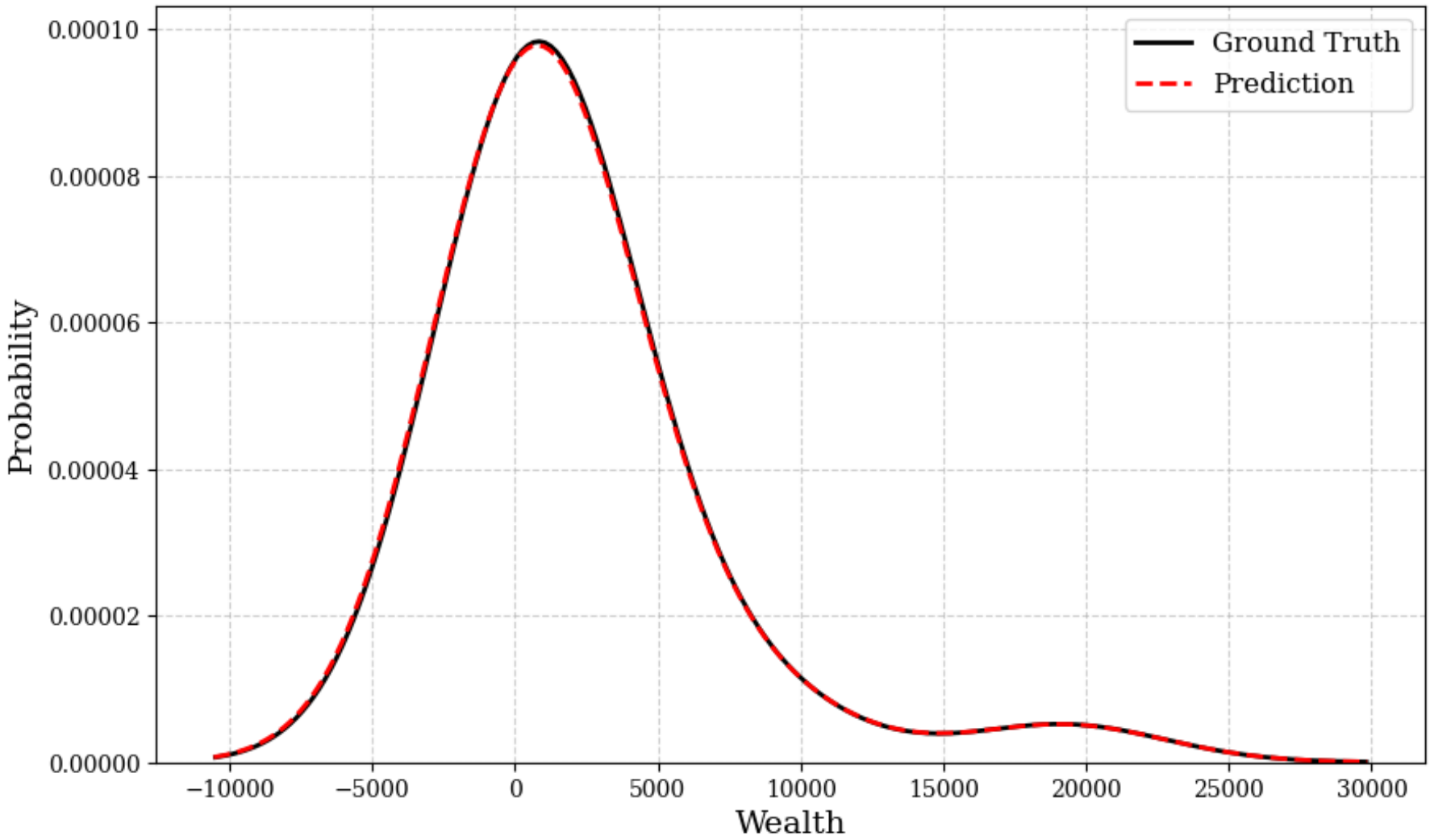
End-to-End: Median Result

Variable	Ground Truth	Prediction
Age	4 mois	4 mois
Article Number	48	48
Date of Death	17 aout 1866	17 aout 1860
Seals Apposition	Michot	Michot
Declarations Date	17 Xbre	17 10bre
Income from Buildings	143	143
Building Situation	Asnois	asnois.
Furniture Value	361/0	361.5
Wealth Estimation	1230	1230
First Name	Gilbert	Gilbert
Furniture Sale Date	5 8er 1849	5 8e. 1849
Furniture Valuation	258.55	258.55
Trusteeships	27 arvil 1850	27 avril 1850
Marital Status	ep. Marie	ep. Marie
Inventory Date	26 fevrier	26 Fevrier
Inventory Value	714.9	714.9
Location of Death	Revenue C	Revenier
Heirs' Names	Devoucout, antoine	Devoncous, metoine
Dubious Base Number	225	225
Observations	Sans Droits acquis	Sans Edriot et acquis
Profession	mineur	Mineur
Residences	Alluy	Allay
Surname	Louvrier	Louvrier

Note: Comparison of transcription for each variable, showing the observation with median error.

Distribution of CER

Handwritten Text Recognition - Wealth



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We have digitised...

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Results using *Enquête TRA* Data

Estimates for β using individual links by period:

- Arrondel & Grange (2006) [16]: 0.3 (1800-1938);

Clark and Cummins (2014) [2] find a β for England 1858-2012 of 0.70 - 0.75 using rare surname groups.

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- **1845-1870:** July Monarchy and Second Empire.

Latent Factor Model of Social Mobility

Why are results for direct correlations so different from surname group results?

Conventional Model:

- $w_{i,t+1} = \beta w_{it} + u_t$

For any subgroup the following holds:

- $\overline{w}_{ikt+1} = \beta_A \overline{w}_{ikt}$

For surname groups the estimated β seems to be higher.

Latent Factor Model of Social Mobility

Measured wealth as function of underlying social status and random component *e*:

- $w_{it} = x_{it} + e_{it}$

Status evolves according to an AR-1 process:

- $x_{it+1} = bx_{it} + u_{it}$

We get biased estimates:

- $\beta_A = \frac{\overline{w}_{ikt+1}}{\overline{w}_{ikt}} = \frac{\overline{x}_{ikt+1}}{\overline{x}_{ikt}+\overline{e}_{ik}}$

For surname groups we may get an unbiased estimate of β, since in such cases in the limit $\overline{e}_{ik} = 0$.

Wealth Variable

Based on Clark and Cummins (2015) [4], I use log wealth normalised by the average wealth of a surname group with average social status:

$$w_{kt} = \frac{1}{n_{kt}} \sum_{j=1}^{n_{kt}} ln(wealth_{ktj}) - \overline{ln(wealth_{Martin,t})} \tag{2}$$

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- A rare surname is a surname appearing less than 50 times in any of the generations.
- The surname *"Martin"* is the most frequent surname in my sample appearing 2995 times in the sample. It has also been the most common surname between 1891 and 2000 according to *INSEE* [27].

Regression Specification - Rare Surnames

Regression Specification

$$w_{k,t+1} = \beta w_{k,t} + v_t \tag{3}$$

- Where k is a rare surname group;
- $t+1$ is the "parents' generation" and t is the "children's generation";
- β is the intergenerational elasticity of wealth.

Summary of the Data

Table 1: **Summary of the Data**

Period	Deaths	Non-missing wealth	Surnames	Rare Surnames
1791-1818	18,603	12,822	2,380	1,922
1819-1844	106,752	50,419	9,779	9,269
1845-1870	172,615	66,478	13,697	13,187

Persistence Coefficients

Table 2: Coefficients of Persistence

	1791-1818 & 1819-1844	***1819-1844 & 1845-1870***
β	0.216^{***}	0.260^{***}
	(0.035)	*(0.012)*
N	1328	5380

* p $<$ 0.05, ** p $<$ 0.01, *** p $<$ 0.001

Discussion

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- Closer to the conventional estimates for France by Arrondel & Grange (2006) [16] and Bourdieu et al. (2019) [18] than to Clark and Cummins' rare surname-based estimates.

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  - Surname and wealth data is still very noisy. A lot of wealth data might still be missing.
  - Problem is not transcription but column assignment.
  - We are currently rerunning the transcription in a way that gives us more information on the location of a string on the page.

Next Steps

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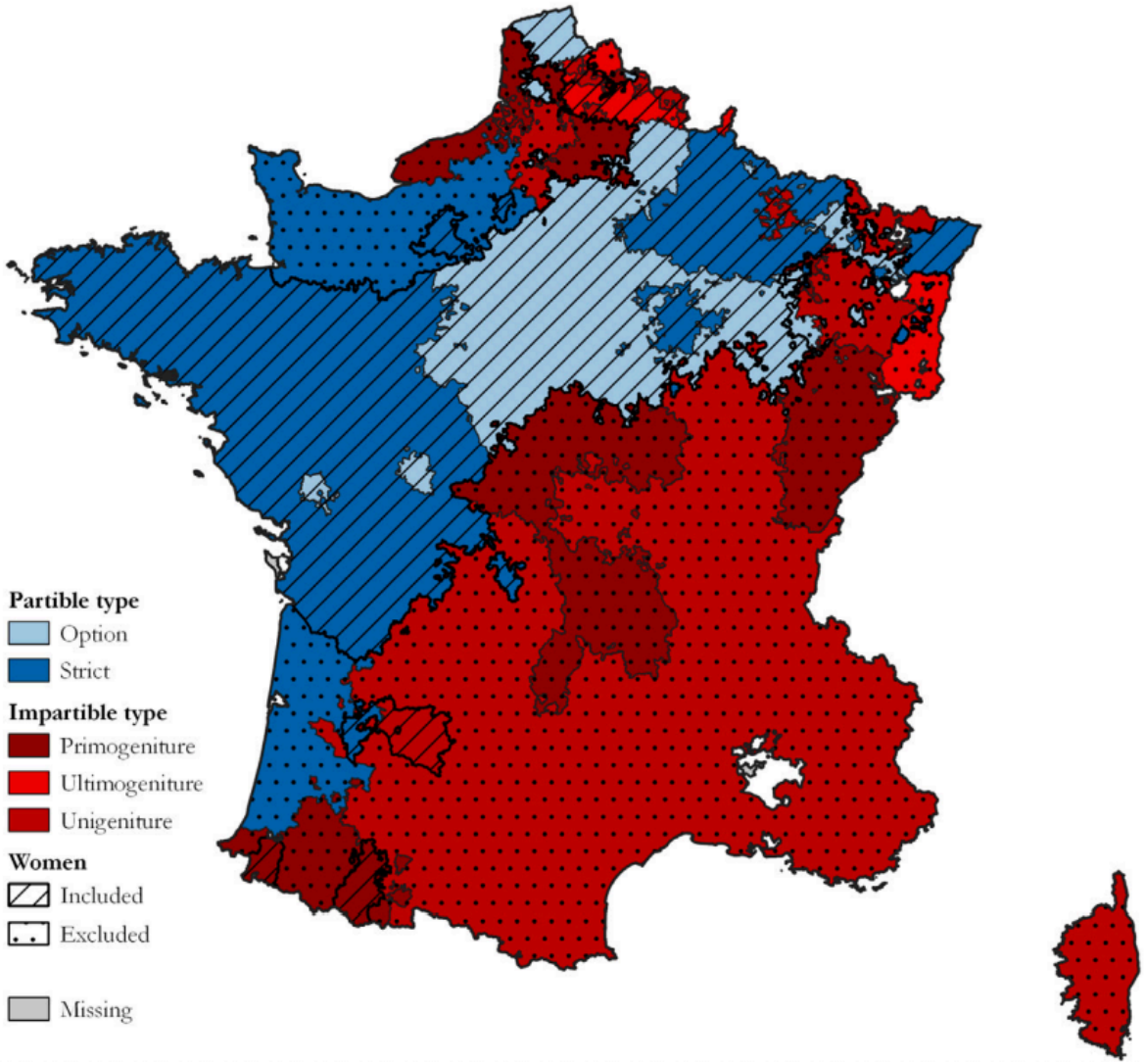
- Stratified rather than random sample.
- Focus on *départements* at the discontinuity of pre-Revolutionary inheritance customs (Gay, Gobbi and Goñi, 2024 [28])

Inheritance Customs in *Ancien Régime* France [28]

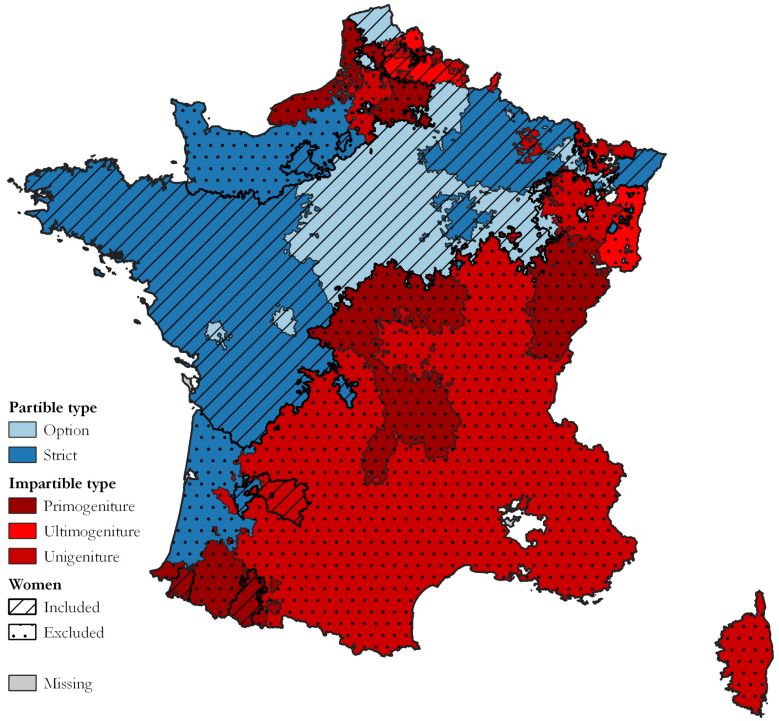


laws regulating inheritance [are key to the perpetuation of noble wealth].[...] [T]o serve the purpose of avoiding the dispersion of patrimonies, some sort of impartible inheritance system is required.

Alfani, 2023, p.76 [29]

Introduction of the *Code Napoléon*

A tapestry of local inheritance customs [28]...



...is replaced by equal partition.

Basis for an identification strategy?

Compliance with the Napoleonic Code

The Multi-outcome Model

Any continuous outcome y, not just wealth, can be modelled as depending on underlying social status s,

$$y_{i,t} = \eta \cdot s_{i,t} + \epsilon_{i,t} \tag{4}$$

which in turn evolves according to the AR-1 process in equation:

$$s_{i,t+1} = \gamma s_{it} + e_{i,t+1} \tag{5}$$

γ is the coefficient of interest - the inter-generational persistence of status. [30][2]

From Outcomes to Status

Over-representation

We can measure the persistence of *status* γ by looking at relative representation:

$$\tilde{s}_{k,t} = \frac{\text{Representation of surname group among elite outcome}}{\text{Representation of surname group among general population}} \quad (6)$$

Derivation

Sources

Three *Ancien Régime* Elite Surname Groups

- *Ancien Régime* Nobility

Two Elite Outcome Groups

Sources

Three *Ancien Régime* Elite Surname Groups

- *Ancien Régime* Nobility
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Two Elite Outcome Groups

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- Political Elites (Parliament and Cabinet)

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- Political Elites (Parliament and Cabinet)
- Members of the *Légion d'Honneur*

Sources - The Nobility

- ***Ancien Régime* Nobility**
  Extracted from the *Dictionnaire de la Noblesse* by La Chesnaye des Bois [31]
  7,839 unique surnames

Critiques

Sources - The Nobility

- ***Ancien Régime* Nobility**
  Extracted from the *Dictionnaire de la Noblesse* by La Chesnaye des Bois [31]
  7,839 unique surnames
- ***Nobility***
  Defined as individuals whose surnames features the particle *"de"*.
  Approach used by Beck (1981) [13] and Piketty, Postel-Vinay, and Rosenthal (2006) [23]

Critiques

Sources - Elite Outcomes

- **Political Elites**
  Members of successive *parliaments* - 17,684 unique surnames
  Members of cabinets - 462 unique surnames

Generations

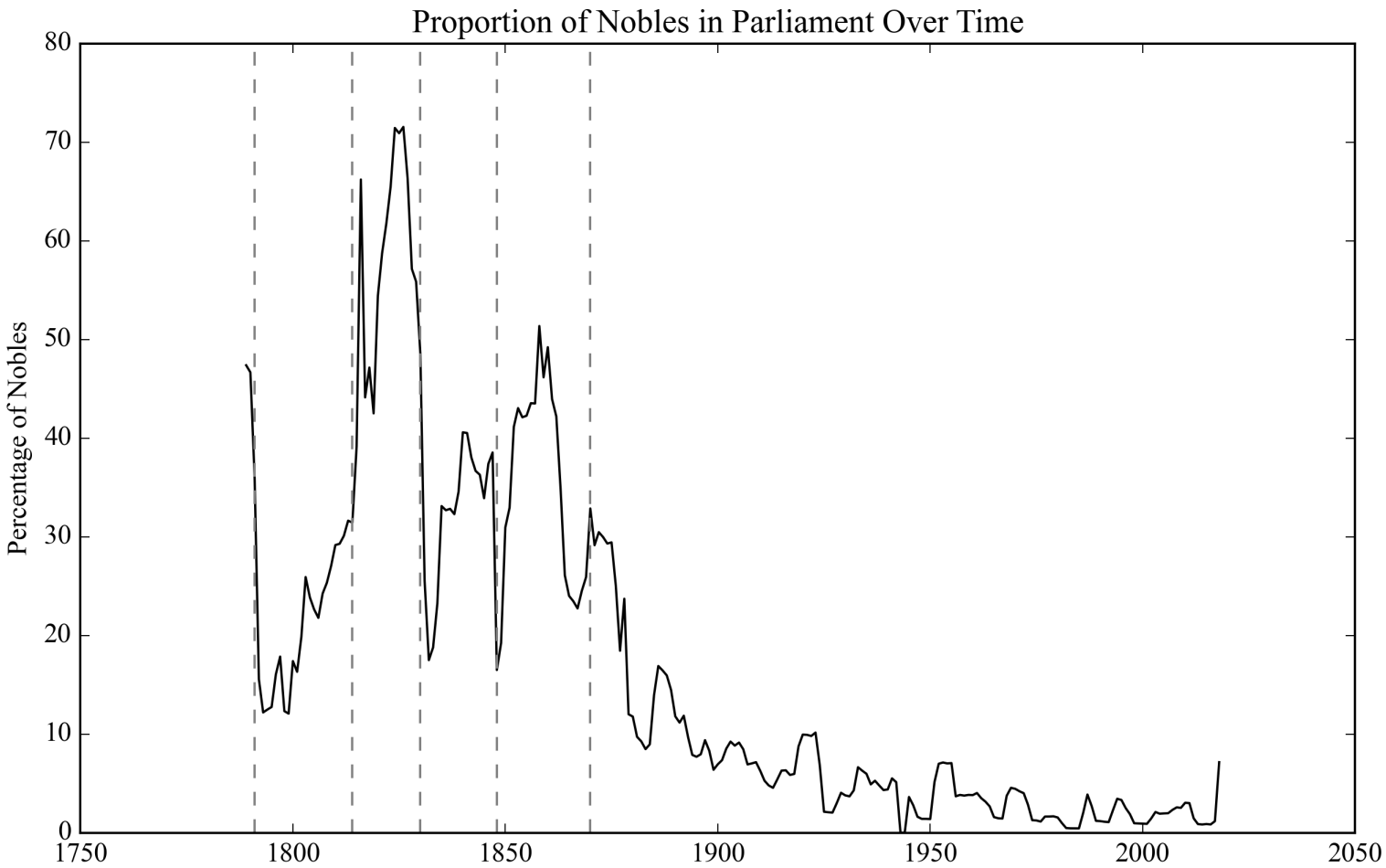
Sources - Elite Outcomes

- **Political Elites**
  Members of successive *parliaments* - 17,684 unique surnames
  Members of cabinets - 462 unique surnames
- **Members of the *Légion d'Honneurs***
  Scraped from the *Base Léonore* - 109,175 unique surnames

Generations

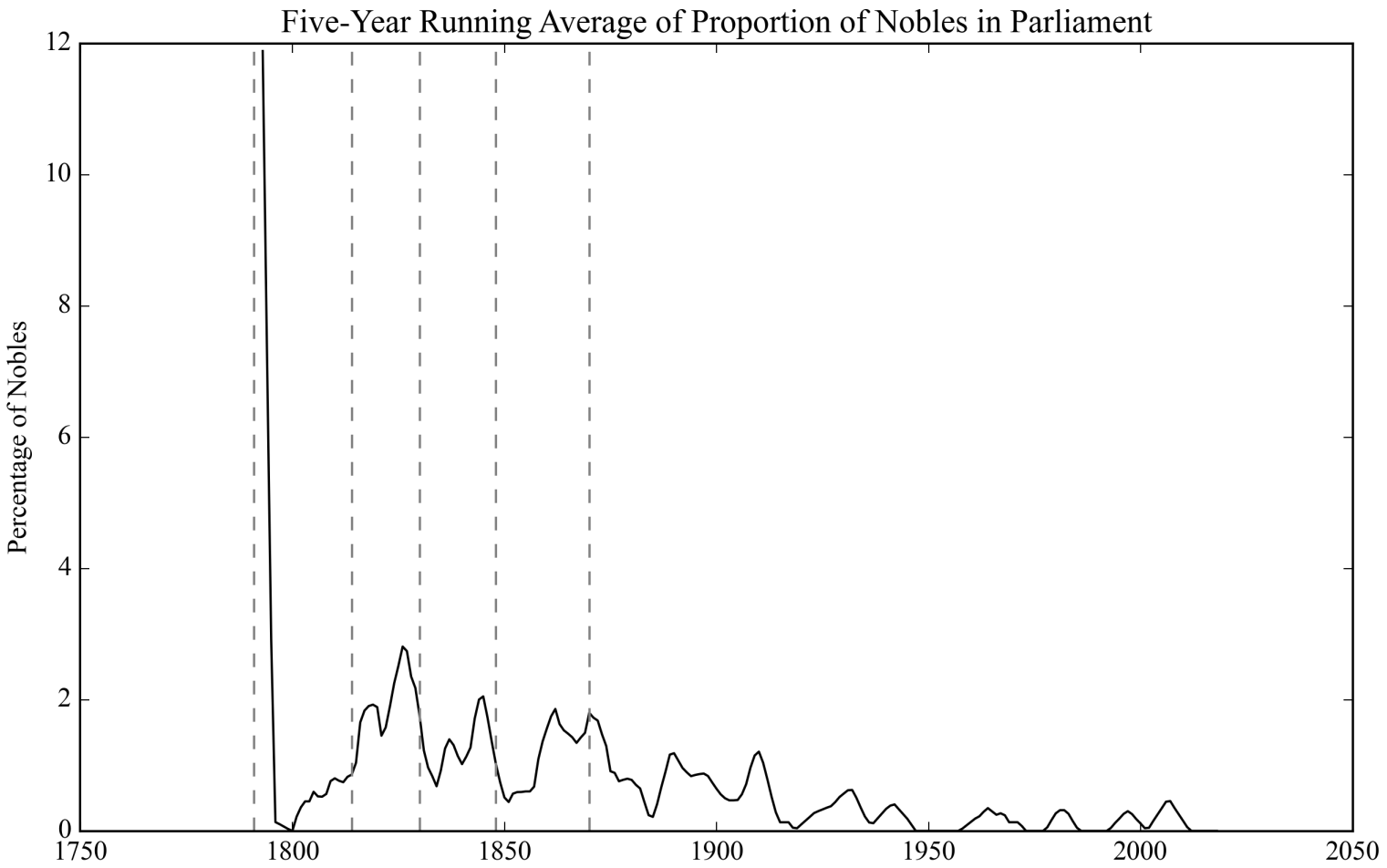
Nobles in Parliament

Share of Individuals in *parliament* with *de* particle



Nobles in Parliament

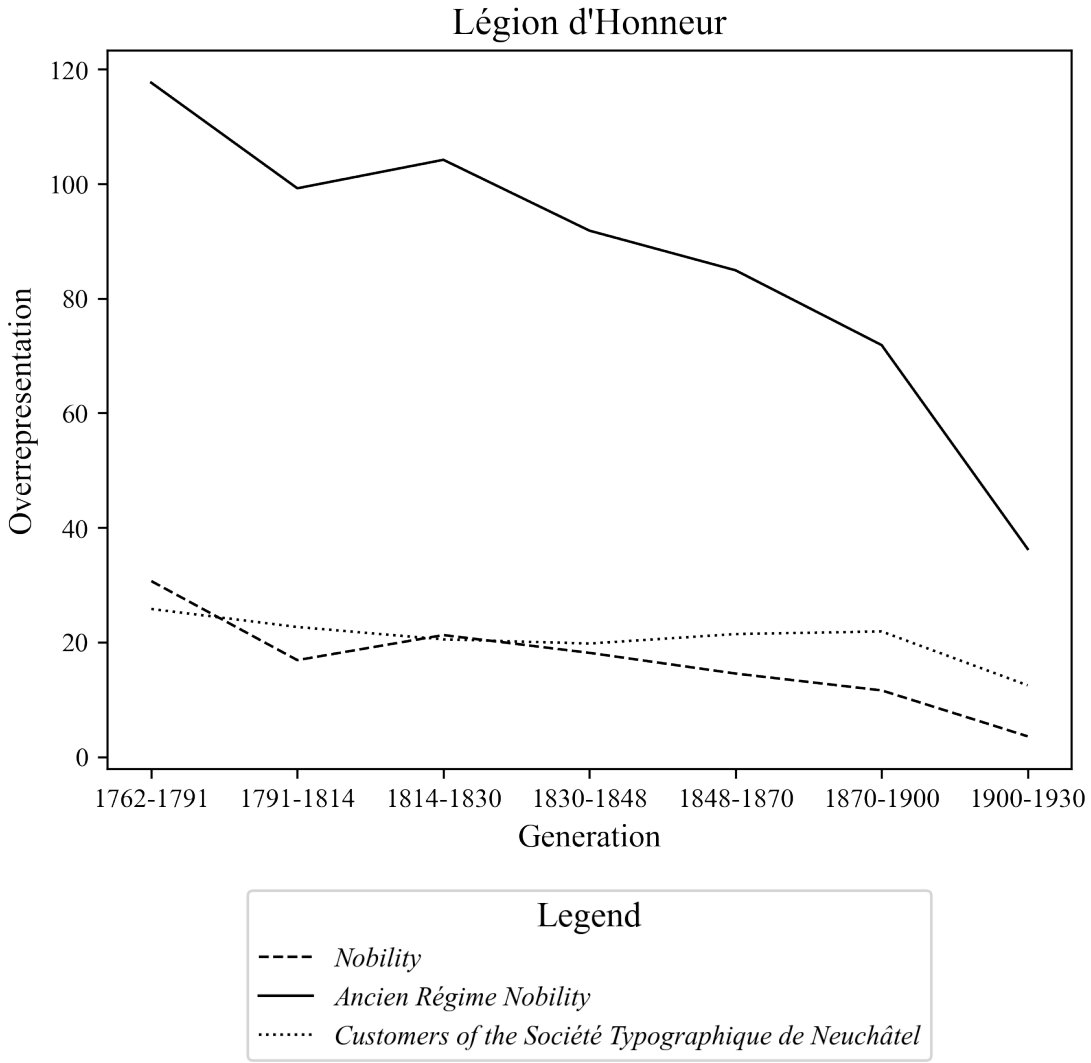
Share of *Ancien Régime* nobility in *parliament*



Over-representation in Politics

Robustness Checks

Over-representation in the *Légion d'Honneur*



Shares in the *Légion d'Honneur*

Persistence Coefficients

Table 3: Coefficients of Persistence

	***Ancien Régime* Nobility**	***Nobility***	**STN**
Political Elites	0.823^{***} *(0.116)*	0.649^{**} *(0.229)*	0.959^{***} *(0.111)*
Légion d'Honneur	0.869^{***} *(0.062)*	0.738^{***} *(0.110)*	0.895^{***} *(0.071)*

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

How to tie the two parts together?

- Selection into different elite outcomes - converting underlying capital into different forms of social/cultural capital - can be part of the response to shocks.

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- Selection into different elite outcomes - converting underlying capital into different forms of social/cultural capital - can be part of the response to shocks.
- The persistence of wealth gives us part of the story - this can be complemented by looking at multiple outcomes.
- Can give us a fuller picture of how wealth and social/cultural capital interact.

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Marxist and *Marxisant* perspectives

- Marxist tradition: French Revolution as a *bourgeois revolution* - a dynamic capitalist elite replacing an idle aristocracy.

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- Piketty [14] and Blaufarb [15]: Revolution was no economic revolution. Back

Enquête TRA

- Records from the birth, death, marriage, and probate registers of all individuals with a surname starting with the combination of letters *Tra-*.

Enquête TRA Results

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- 56,110 individuals in total

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Enquête TRA Results

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Enquête TRA Results

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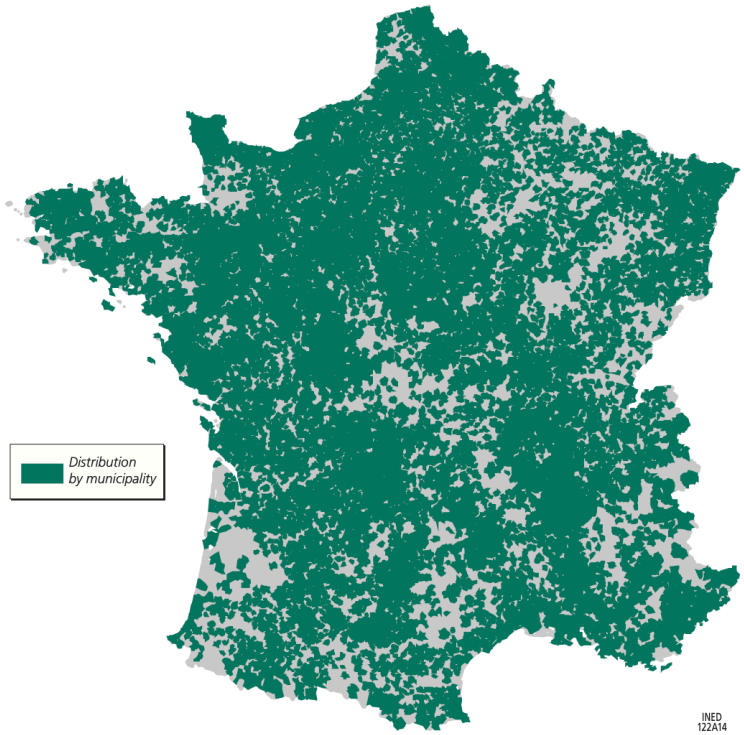
  - Bourdieu et al. (2019) [18]

Enquête TRA Results

Municipalities with at least one *TRA* family, 1803-1902



Source: TRA sample, 1803-1902; authors' calculations.

Bourdieu, Kesztenbaum, Postel-Vinay (2014)

Back

Results from Bourdieu et al. (2019)

Table 4: **Intergenerational Wealth Elasticities from Bourdieu et al. (2019) [18]***

Period	N obs	Only > 0 wealth	Incl. zero wealth
18481869	1,059	0.349	0.367
		(0.042)	(0.034)
18701894	2,178	0.299	0.383
		(0.032)	(0.024)
18951913	1,716	0.374	0.415
		(0.034)	(0.026)
All periods	7,782	0.320	0.355
		(0.018)	(0.013)

* Using the *Enquête TRA data*

Back

A rough sketch of the pipeline:

- **Scrape** (Selenium/chromedriver)

Back

A rough sketch of the pipeline:

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A rough sketch of the pipeline:

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- **Page Segmentation** (Doc-UFCN)

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A rough sketch of the pipeline:

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- **HTR/OCR** (TrOCR)

Back

What does a high CER/WER mean?

For one specific measure of wealth, we get a CER of 45% and a WER of 150%.

- This is based on only two observations.
- In one case, we transcribe *"87. 78"* instead of *"87.78"*. This results in a CER of 40% and a WER of staggering 200%. Two *words* - *"87."* and *"78"* - out of one - *"87.78"* - in the reference string are incorrectly transcribed.
- Both of these cases can be corrected by employing very simple post-correction algorithms

Evaluation - Text Line Detection

Table 5: Text-line Metrics

Metric	Value
Pixel Level	
Intersection over Union (IoU)	0.78
Precision	0.92
Recall	0.84
F-score	0.88
Object Level	
Average Precision @[.5]	0.93
Average Precision @[.75]	0.75
Average Precision @[.95]	0.01
Average Precision @[.5,.95]	0.62

Column Segmentation

Table 6: Column Assignment Metrics

	Accuracy (%)	
Metric	**Hough Transform**	**Doc-UFCN**
Mean	95.2	81.7
Median	100.0	77.3
Min	81.0	63.6
Max	100.0	100.0
Std. Dev.	6.3	14.9

Note: This is the percentage of columns where all text-lines that are in that column are assigned to it, and no incorrect text-lines.

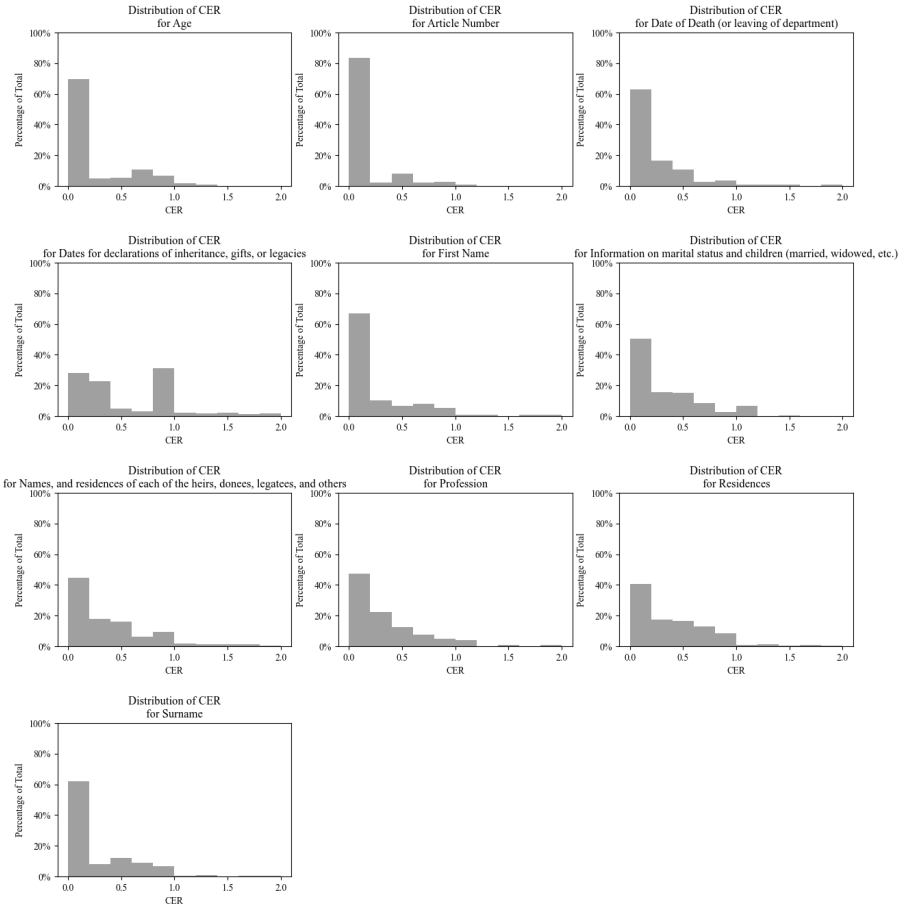
Row Segmentation

Table 7: Row Assignment Metrics

	Accuracy (%)
Metric	**Hough Transform & Doc-UFCN**
Mean	85.6
Median	83.7
Min	61.9
Max	100.0
Std. Dev.	11.7

Note: This is the percentage of rows where all text-lines that are in that row are assigned to it, and no incorrect text-lines.

Handwritten Text Recognition - End-to-end



Back

Table 8: Word Error Rate (WER) and Character Error Rate (CER) for all Pages with Correctly Recognized Rows and Columns

Variable	Mean		Median		
	WER	CER	WER	CER	Observations
Age	0.073	0.048	0.000	0.000	48
Date of Death	0.513	0.165	0.333	0.091	62
Value of furniture, money, annuities and debts	0.864	0.658	1.000	0.667	22
First Name	0.342	0.101	0.000	0.000	60
Heirs, donees, legatees	0.656	0.574	0.750	0.150	49
Observations	0.774	0.493	0.800	0.414	14
Profession	0.569	0.196	0.000	0.000	51
Surname	0.285	0.113	0.000	0.000	65

What does a high CER/WER mean?

Sources - Critiques of using the *de* particle

Critique of using the *de* particle as indicator of the nobility by Daumard (1988) [32] and Coulmont (2019) [33]:

> *"La particule, en France, n'a jamais été un signe de noblesse et elle n'abuse que les ignorants." [32, p. 90]*

Back

If we assume that for both elite k and the population as a whole:

$$s_k \sim \mathcal{N}(\mu_k, \sigma^2) \tag{7}$$

$$s_{pop} \sim \mathcal{N}(0, \sigma^2) \tag{8}$$

The probability of a member of elite k to belong to outcome j is related to status as follows:

$$\beta_{tj} s_k = \Phi^{-1}(1 - \pi_{pop,tj}) - \Phi^{-1}(1 - \pi_{k,tj}) \tag{9}$$

Where Φ^{-1} is the inverse cumulative normal distribution and β_{tj} is the propensity of status to have an influence on the selection into a specific outcome j .[30][2]

Averaging over different outcomes, we can thus write:

$$f(\pi'_{k,tj}) = \beta_{tj} \cdot s_{k,t} + \epsilon_{ktj} \tag{10}$$

for $t_2 > t_1$:

$$\frac{\overline{f(\pi')}_{k,t_2}}{\overline{f(\pi')}_{k,t_1}} = \frac{\overline{\beta}_{t_2} \cdot s_{k,t_2} + \overline{\epsilon_{k,t_2}}}{\overline{\beta}_{t_1} \cdot s_{k,t_1} + \overline{\epsilon_{k,t_1}}} \tag{11}$$

If the error terms are small, this can be written as:

$$\frac{\overline{f(\pi')}_{k,t_2}}{\overline{f(\pi')}_{k,t_1}} \approx \frac{\overline{\beta}_{t_2} \cdot s_{k,t_2}}{\overline{\beta}_{t_1} \cdot s_{k,t_1}} \approx \frac{\overline{\beta}_{t_2}}{\overline{\beta}_{t_1}} \cdot \gamma^{t_2 - t_1} \tag{12}$$

Therefore:

$$\gamma^{t_2-t_1} \approx \frac{\overline{f(\pi')}_{k,t_2}}{\overline{f(\pi')}_{k,t_1}} \cdot \frac{\overline{\beta_{t_1}}}{\overline{\beta_{t_2}}} \tag{13}$$

and

$$\gamma \approx \left(\frac{\overline{f(\pi')}_{k,t_2}}{\overline{f(\pi')}_{k,t_1}}\right)^{\frac{1}{t_2-t_1}} \cdot \left(\frac{\overline{\beta_{t_1}}}{\overline{\beta_{t_2}}}\right)^{\frac{1}{t_2-t_1}} \tag{14}$$

If the coefficient $\overline{\beta}_t$ is relatively stable over time, ($\overline{\beta}_1 \approx \overline{\beta}_2$):

$$\gamma \approx \left(\frac{\overline{f(\pi')}_{k,t_2}}{\overline{f(\pi')}_{k,t_1}}\right)^{\frac{1}{t_2-t_1}} \tag{15}$$

Back

Seven Generations

Generations		
t	Historical Context	Years
t_0	*Ancien Régime*	1762-1791
t_1	First Republic and First Empire	1792-1814
t_2	*Restauration*	1815-1830
t_3	July Monarchy	1831-1848
t_4	Second Republic and Second Empire	1849-1870
t_5	Third Republic/*Belle Époque*	1870-1900
t_6	Third Republic/*Belle Époque*/WWI	1901-1930

Back

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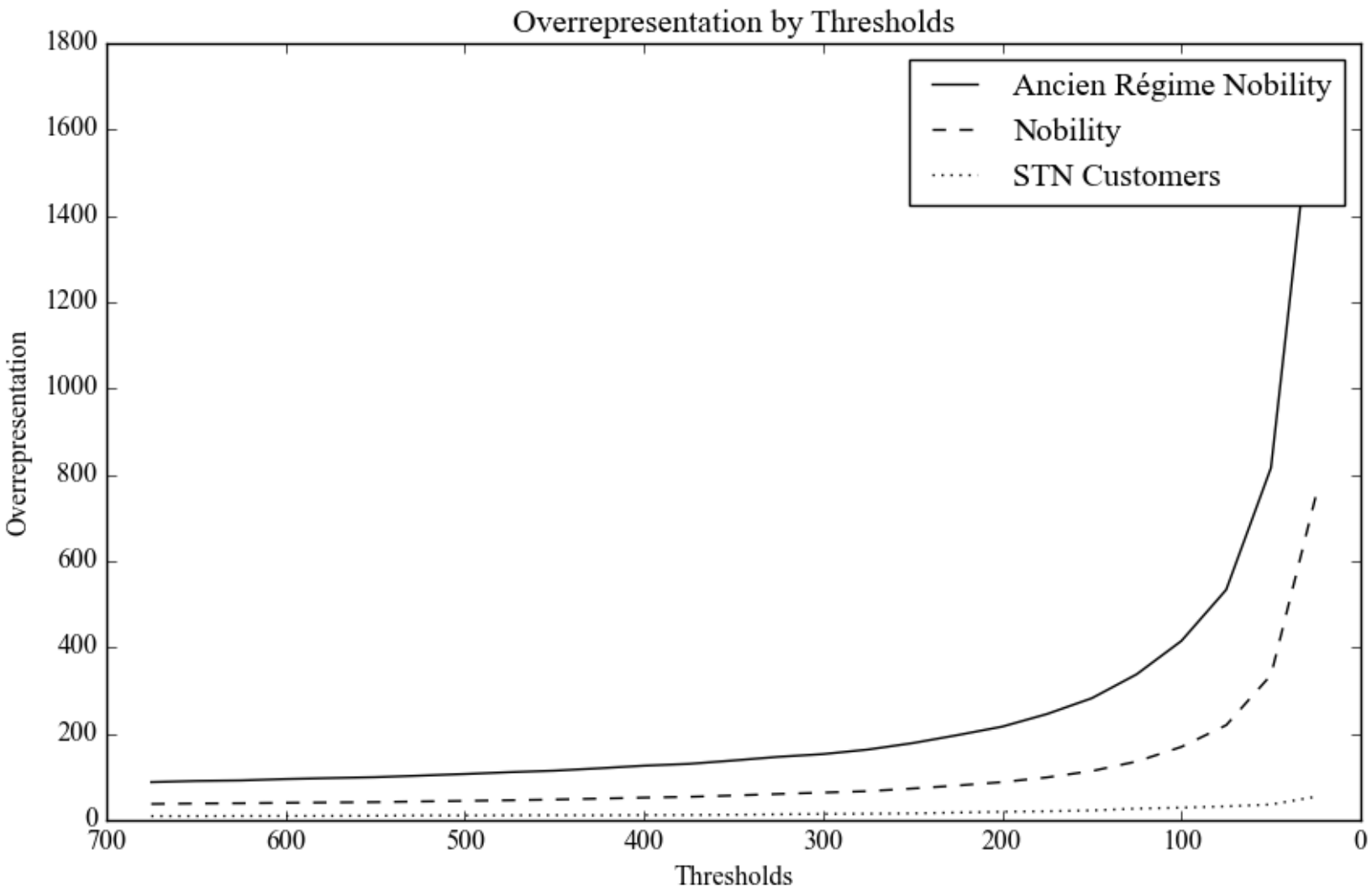
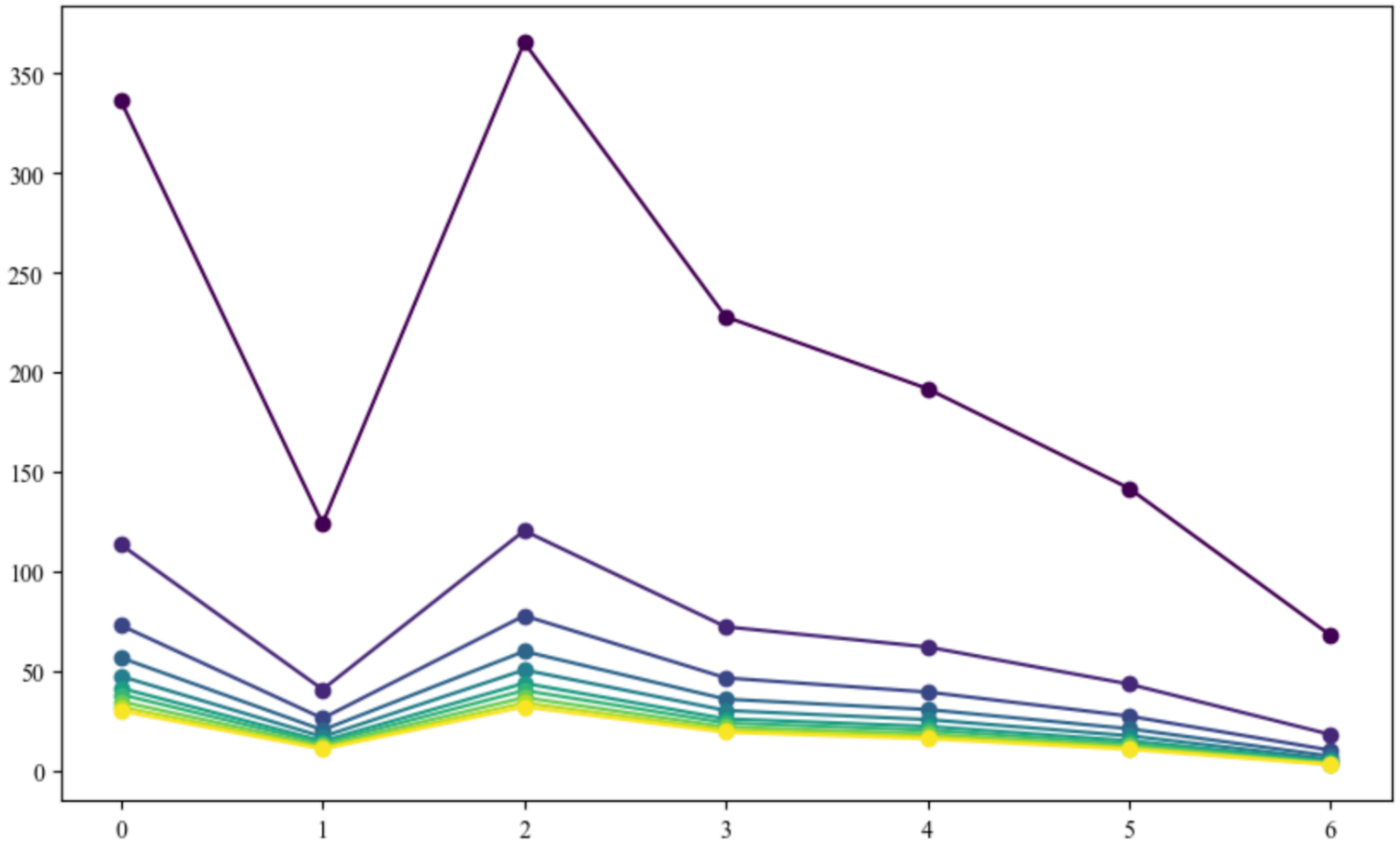
- 2,414 unique surnames.

Over-representation by Rare Surname Threshold

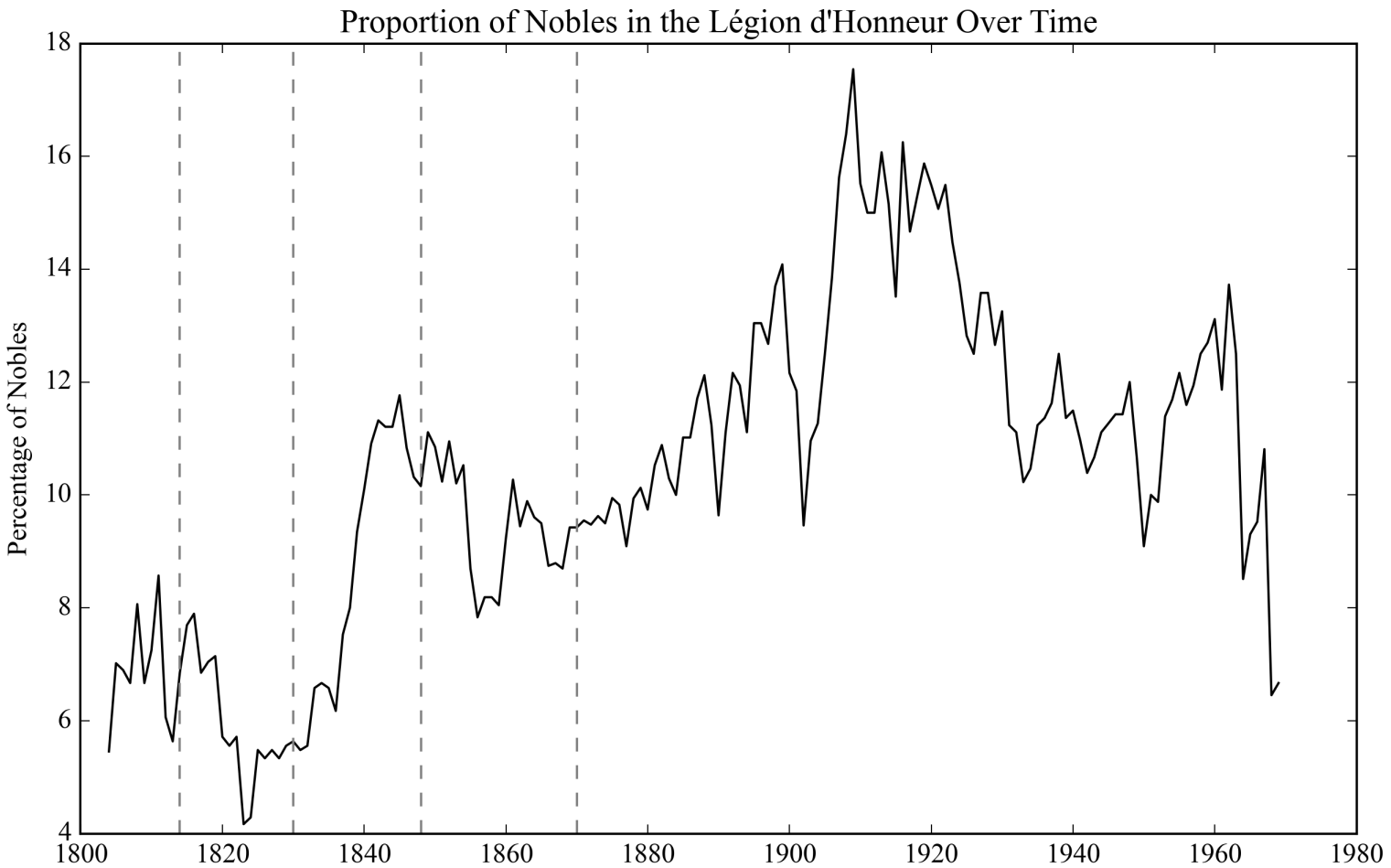


Over-representation by Rare Surname Threshold and Generation

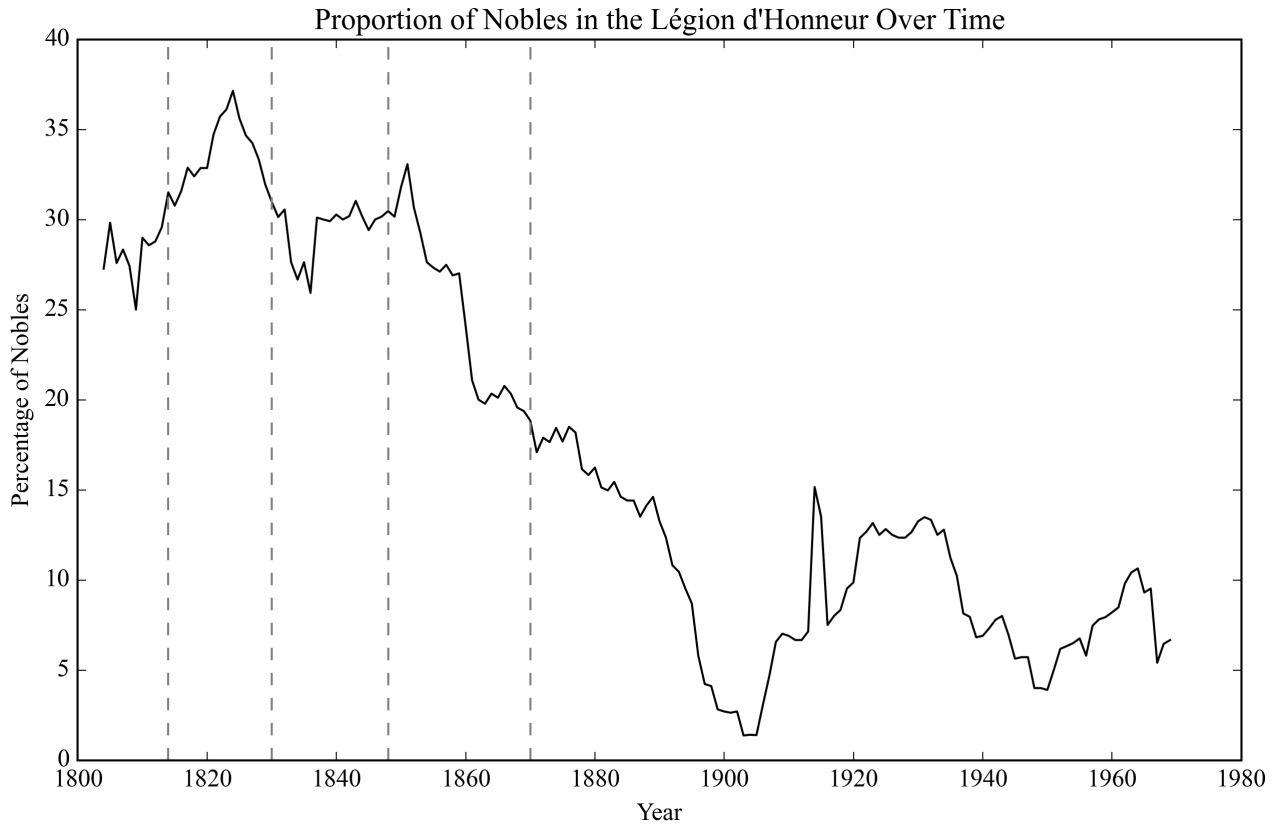


Back

Share of Individuals in the *Légion d'Honneur* with *de* particle



Share of *Ancien Régime* nobility in the *Légion d'Honneur*



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Compliance with the Code Napoléon

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- Overall, [32] concludes that compliance was remarkably high.

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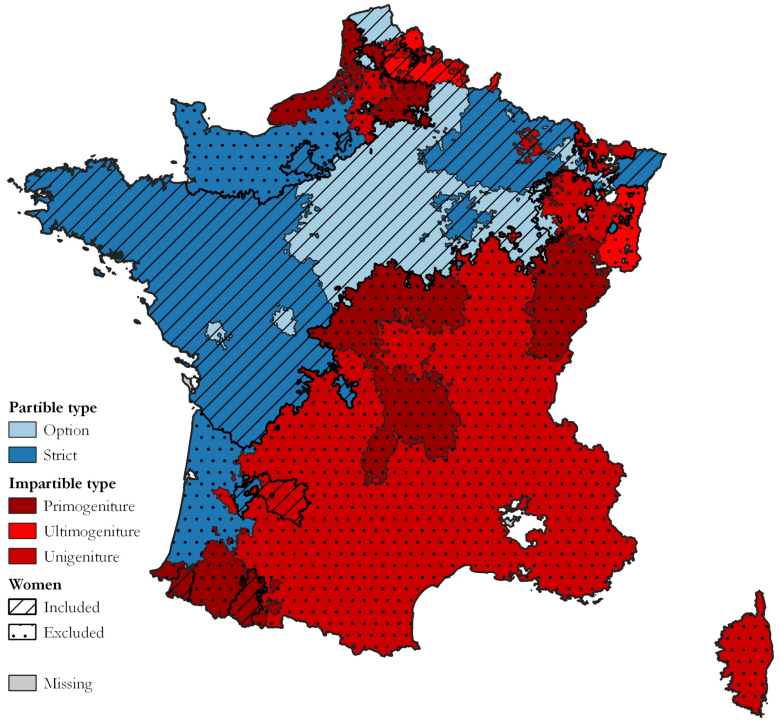
laws regulating inheritance [are key to the perpetuation of noble wealth].[...] [T]o serve the purpose of avoiding the dispersion of patrimonies, some sort of impartible inheritance system is required.

Alfani, 2023, p.76 [29]

A tapestry of local inheritance customs [28]...



...is replaced by equal partition.

Basis for an identification strategy?

Compliance with the Napoleonic Code

Focus on Imperial Nobility

- Ennoblement often due to military achievements;

Joachim Napoléon I^{er}, Murat

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- Potential source of random variation in the granting of titles;
- The famous *ship that did not sail* in Ottinger and Rosenberger's [38] study on the *American Origins of the French Revolution*.

Joachim Napoléon I^{er}, Murat