The Name of the Rule: Institutional Differences and Development of Ideas in Late Middle Ages

Tuna Abay and Marius Grünewald

Department of Economics,
European University Institute

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Introduction

Research Question

How did early democratic institutions in Europe affect the production and diffusion of Ideas?

The mechanism

- Population choose to live in places with higher amenities and intrinsic productivity
- Democratic institutions itself can be considered as an amenities
- More populated places have bigger market size that incentivize the adoption of printer
- Cities with printer and high population attract more author and creates new ideas
- New ideas turn into the economic and population growth

Data Results

- Free cities are more populuous.
- Free cities have higher and earlier adoption rates.
- Free cities attract more (productive) authors and print more.
- Adopters have higher population than non-adopters.
- Free cities grow faster.

Historical Background

The Holy Roman Empire (HRE)

- A political entity, that exists between 862-1806, comprises many kingdoms and republics.
- The empire is led by an Emperor with cities having their own rulers, ruling class or a council.

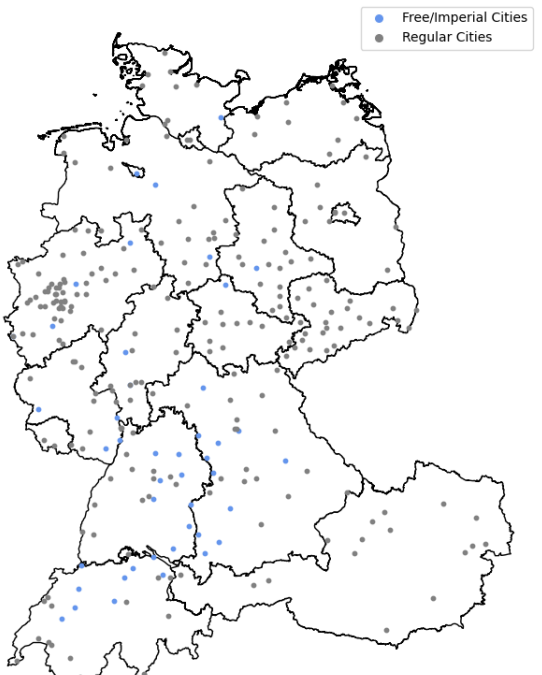
Free-Imperial Cities

- Self-governance through the council (Appointed or elected).
- Jurisprudence/Procurement.
- Economic rights: Exchange rate, seigniorage, money supply
- However, very city-specific in the details.

Printing Machine

- Invented by Gutenberg in Mainz in around 1440-1450.

Historical Background



The Literature

Self-Governing and Free cities

Beloc et al. (2008), Guiso et al. (2016), Jacob (2010).

Economic Divergence and Political Institutions in the HRE

Bosshart and Dittmar (2023), Schaff (2023)

Printing and Growth

Mokyr(2005), Dittmar (2011), Dittmar and Seabold (2023)

Pre-Modern Growth

Galor and Weil (2000)

Institutions and Growth

Acemoglu et al.(2005), Acemoglu et al. (2019), Becker et al. (2025)

Data and Facts

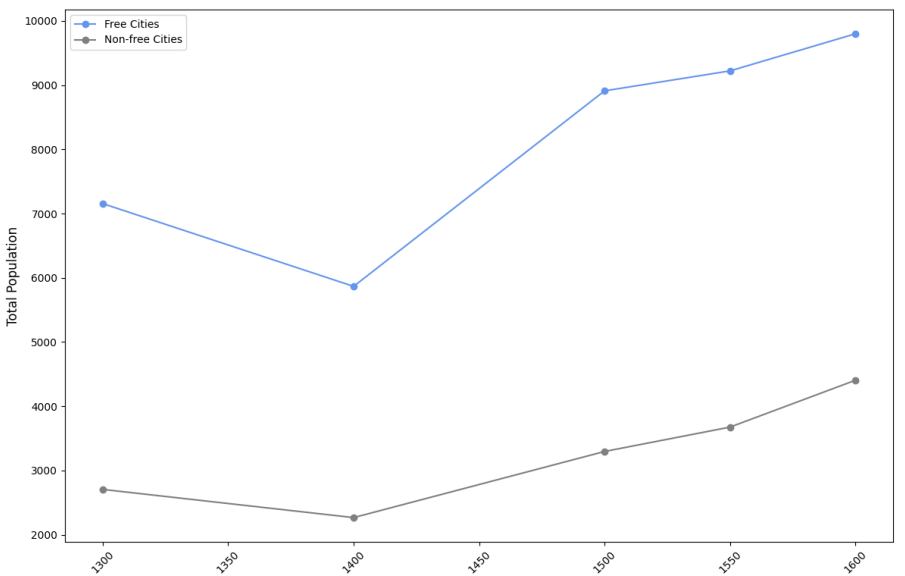
Data sources

- Printing Data: Universal Short Title Catalogue
- Population Data: Buringh (2021)
- Data on German citites: Jacob (2010), Becker et al. (2025)
- Biographic Data: de la Croix (2021)

Data and Facts

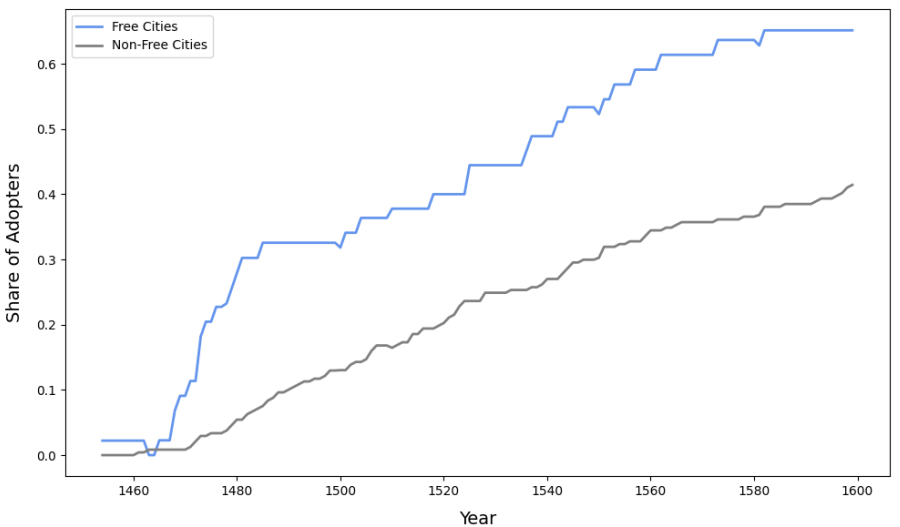
Facts

Fact 1: Free cities have higher population

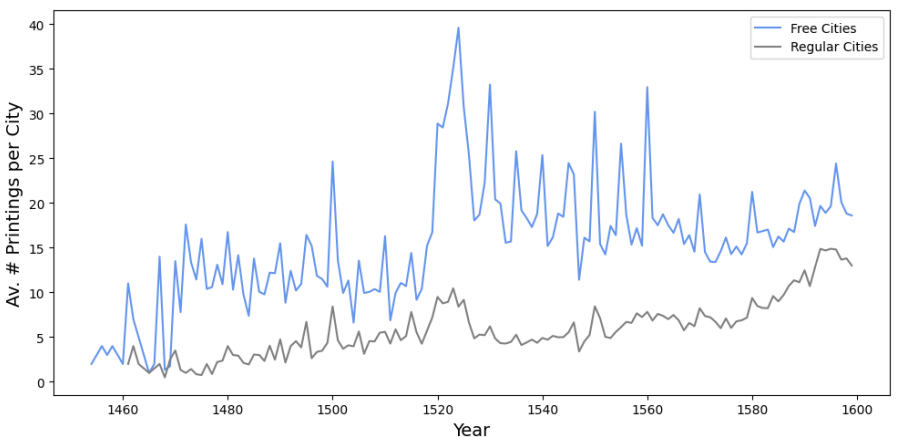


Population by city status from 1300-1600

Fact 2: Free cities adopt more and ealier

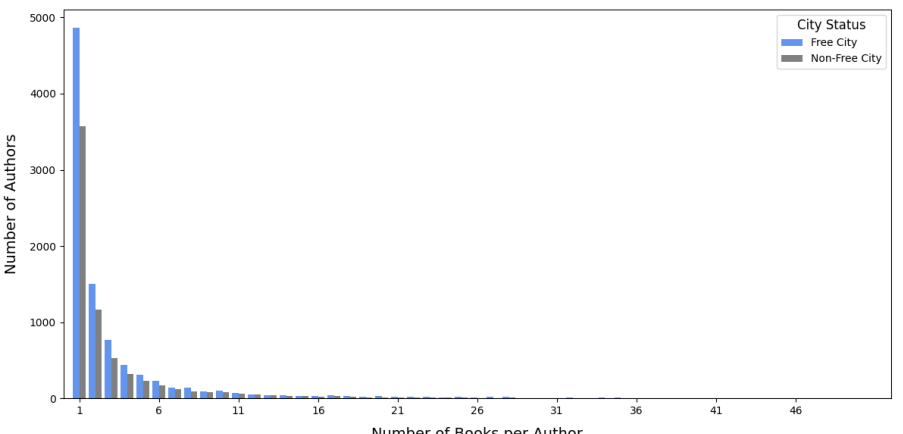


Fact 3: Higher printing intensity for free cities

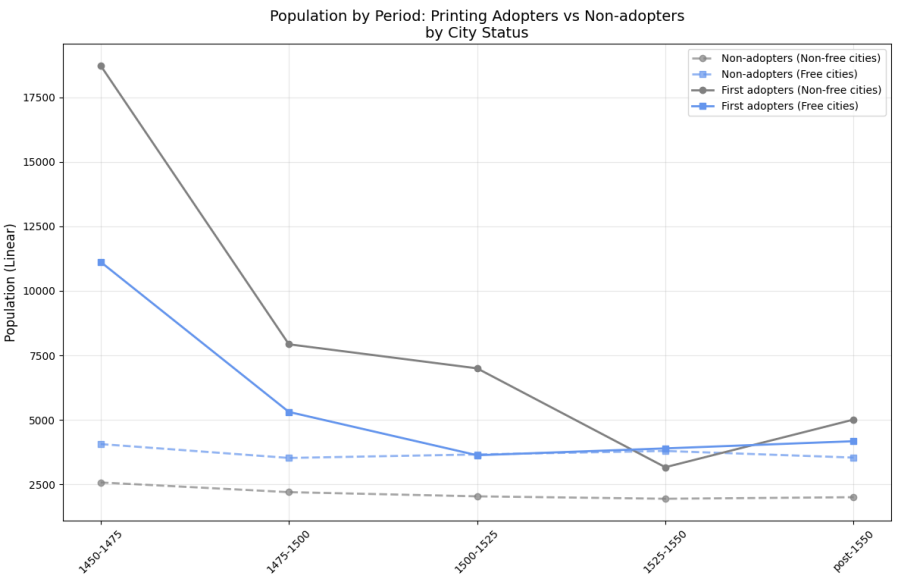


Conditional on adoption, more printings in free cities

Fact 3b: Higher author intensity in free cities



Fact 4: Adopters have higher population than Non-adopters



The Model

Can we rationalize these facts with the help of a model? Malthusian World:
Households:

- Chose consumption and location.
- Inelastically supply labour.
- Location-specific Amenities

Firms:

- Monopolistic Competition
- Variety-specific fixed costs increasing with rank in variety index

Printers:

- Endogenous entry depending on demand
- More authors with higher population

The Model

- There are N cities indexed by $c \in \mathcal{N}$. Within a location
- Agents are endowed with a unit of labor that is supplied inelastically
- Agents choose where to live and how much to consume of each good available in a location

$$\max_{c \in \mathcal{N}, \{x_i\}_{i \in \cdot c} \geq 0} \left(\int_0^{I_c} x_{ci}^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} u_c \text{ s.t. } \int_0^{I_c} p_{ci} x_{ci} di \leq E_c, \tag{1}$$

In each location there are set of available varieties $\Omega_c \subseteq \bar{\Omega}$ among the potential varietites $\bar{\Omega}$.

The measure of available varieties $|\Omega_c| \equiv I_c$

Agent who choose to locate in location c has the following indirect utility function:

$$W_c = \frac{E_c}{P_c} u_c \tag{2}$$

The Model

Firms

- Firms compete monopolistically and use one unit of labor to produce the differentiated output x_i.
- There is a fixed operating cost f_i in terms of labor and it is variety-specific.
- We assume that the fixed cost is a continuous and increasing function of variety index such that $f_i = f(i)$, and $f'(i) > 0$.

Firm profits are

$$\pi_i = p_i x_i - w x_i - w f_i \tag{3}$$

Since firms face a constant price elasticity demand and take E and P as given, we obtain the usual monopolistic pricing formula

$$p_i = \frac{\sigma}{\sigma - 1} w. \tag{4}$$

- $i^* = I$ is the cutoff firm that drives the profit zero on the real-line
- The zero profit condition for variety i^* gives the optimal demand.

$$x_i = (\sigma - 1) f_i^*, \quad \forall i. \tag{5}$$

- For simplicity assume $f(i) = ai$
- Labor market clearing condition gives the cutoff index i^* that is also the total measure of varieties I as

$$I = \sqrt{\frac{2L}{(2\sigma - 1)a}} \tag{6}$$

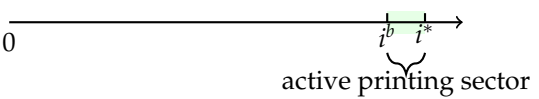
- Denote the index of printer i^b, then if $i^b > I$, the printer is not adopted.
- Thus adoption is increasing with population

The share of authors in a location is :

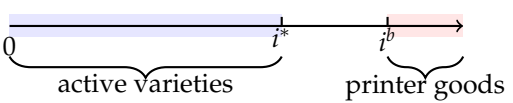
$$\alpha(L) = \begin{cases} 1 - ai^b \left(\frac{1}{2L} + (\sigma - 1)\sqrt{\frac{2}{a(2\sigma-1)L}} \right), & \text{if } i^b \leq I, \\ 0, & \text{if } i^b > I. \end{cases} \tag{7}$$

Share of authors $\alpha(L)$ and the total number of authors $\alpha(L)L$ are increasing in L.

(a) Panel a



(b) Panel b



(c) Panel c

Figure

assume the following form for amenities as in Allen and Arkolakis (2014,2025):

$$u_c = \bar{u} L^{\theta}, \tag{8}$$

- θ is negative: congestion or higher mortality increasing with population.
- $\bar{u}$: intrinsic amenities including the political structure: Free or regular governance.

The optimal population in a city c:

$$L_c = \left(\frac{D \bar{u}_c}{W} \right)^{\tilde{\sigma}}, \tag{9}$$

Population ratio between two places is a function of intrinsic amenities:

$$\frac{L_c}{L_{c'}} = \left(\frac{\bar{u}_c}{\bar{u}_{c'}} \right)^{\tilde{\sigma}} \tag{10}$$

And new ideas create economic growth which turn into the population growth in Malthusian era.

$$\frac{\dot{L_c}}{L_c} = g_c = \alpha(L)\beta + \bar{g}. \tag{11}$$

The Model

Extension

If we add intrinsic productivity differences, between locations, e.g., fertility of land, climate:

$$\frac{L_c}{L_{c'}} = \left(\frac{\bar{A}_c \bar{u}_c}{\bar{A}'_c \bar{u}_{c'}} \right)^{\tilde{\sigma}} \tag{12}$$

- Moreover a high per unit tax in a location would increase cutoof I so the adoption rate but decrease the welfare so the population.
- An advalorem tax would not change the adoption but decrease the population.
- We observe tax structures to some extent and use it to match better the free and non free city adoption amenities and productivity.

In this case productivity evolves with the new ideas of the authors:

$$\frac{\dot{A}}{A} = \alpha(L)\beta + \bar{g}. \tag{13}$$

And new ideas turn into the population growth such that the total welfare remains the same.

$$\frac{\dot{L_c}}{L_c} = g_c = \tilde{\sigma} \frac{\dot{A}}{A} \tag{14}$$

it can be captured from the population growth rates from the data.

Buildings, Taxes

Model Prediction and Stylized Facts

- Free cities have higher population, due to amenities.
- Free cities adopt earlier, the higher the population.
- Free cities have more books/authors, as more printers demand authors.
- Adopting cities are larger,as
  1. Higher population makes adoption more likely (selection).
  2. More ideas can increase city-specific productivity (response).
- In case of higher taxes in free cities, they adopt with lower population.

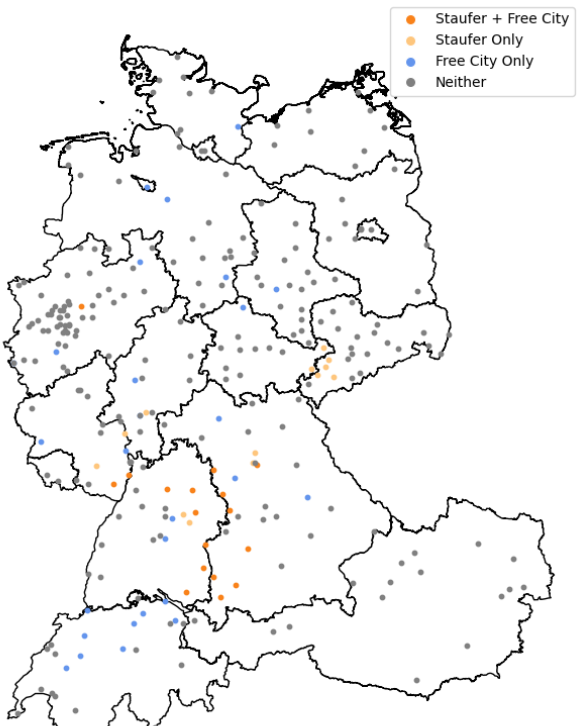
$$Y_{i,t} = \alpha + \beta \mathbf{Free}_{i,t} + \delta_t + X_{i,t}\gamma + u_{i,t} \tag{15}$$

	Total Books		Contemp. Authors		Contemp. Multi-Book Authors	
Free	3.717***	3.677***	0.121***	0.121***	0.056***	0.055***
	(0.376)	(0.377)	(0.018)	(0.018)	(0.011)	(0.011)
Population Bins	No	Yes	No	Yes	No	Yes
Observations	41719	41719	41719	41719	41719	41719
Adj. R^2	0.13	0.13	0.12	0.1	0.08	0.08
Unconditional Mean	2.391		0.113		0.048	

Control variables include: 1200 Population Bins, River Access, Trade Route, Bishop, Hansa, Baltic Sea Access, North Sea Access, University, Year FE, Log Distance to closest printer

Empirics

Regression



$$Y_{i,t} = \alpha + \beta \textbf{Free}_{i,t} + \delta_t + X_{i,t}\gamma + u_{i,t}$$
$$\textbf{Free}_{i,t} = \mu + \psi \textbf{Staufer}_i + \delta_t + X_{i,t}\gamma + \nu_{i,t}$$

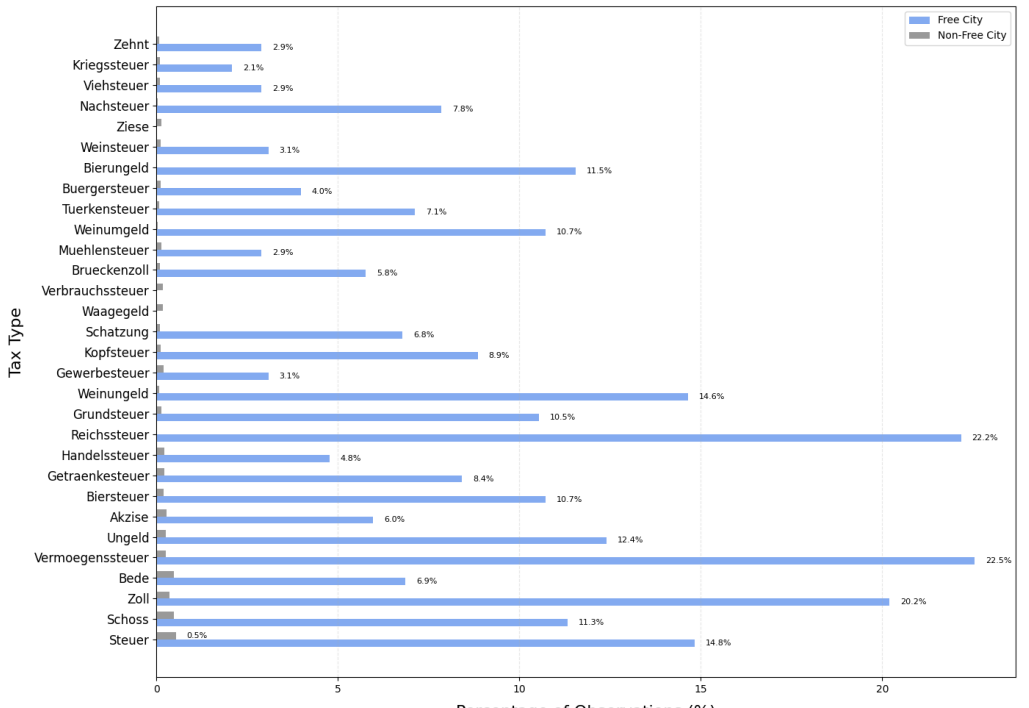
IV Regressions Results

	# Books Printed			# Multi-Book Authors		
Free City	5.662	5.3	5.024	0.103	0.106	0.106
	(4.071)	(4.167)	(4.237)	(0.103)	(0.081)	(0.081)
Staufer	0.46***	0.437***	0.432***	0.46***	0.437***	0.436***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
F-statistic	40.13	36.59	37.02	40.56	37.26	37.26
Log Population	No	Yes	Yes	No	Yes	Yes
# Taxes	No	No	Yes	No	No	Yes
Observations	41719	41719	41719	41719	41719	41719
Adj. R^2	0.14	0.14	0.15	0.11	0.09	0.09

Control variables include:
1200 Population Bins, River Access, Trade Route, Bishop, Hansa, Baltic Sea Access, North Sea Access, University, Year FE, Log Distance to closest printer

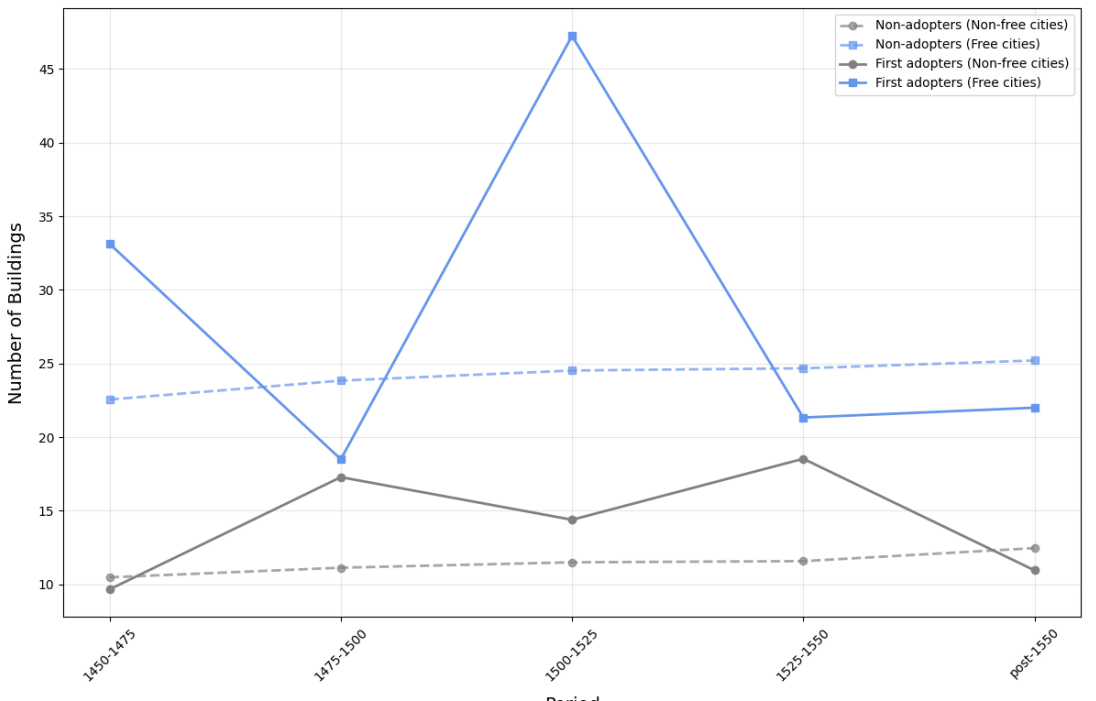
THANKS!

Taxes


Free City
Non-Free City
Zehnt
Kriegssteuer
Viehsteuer
Nachsteuer
Ziese
Weinsteuer
Bierungeld
Buergersteuer
Tuerkensteuer
Weinumgeld
Muehlensteuer
Brueckenzoll
Verbrauchssteuer
Waagegeld
Schatzung
Kopfsteuer
Gewerbesteuer
Weinungeld
Grundsteuer
Reichssteuer
Handelssteuer
Getraenkesteuer
Biersteuer
Akzise
Ungeld
Vermoegenssteuer
Bede
Zoll
Schoss
Steuer
2.9%
2.1%
2.9%
7.8%
3.1%
11.5%
4.0%
7.1%
10.7%
2.9%
5.8%
6.8%
8.9%
3.1%
14.6%
10.5%
22.2%
4.8%
8.4%
10.7%
6.0%
12.4%
22.5%
6.9%
20.2%
11.3%
0.5%
14.8%
Tax Type
0
5
10
15
20
Percentage of Observations (%)

Back

Buildings



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