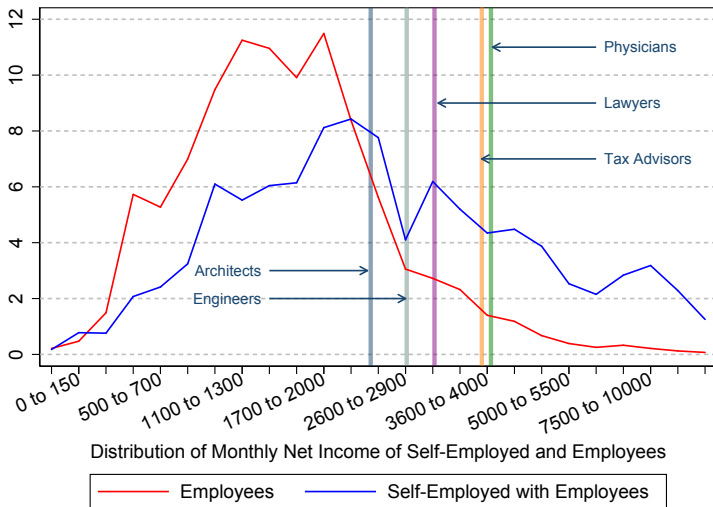# Does Regulation Trade-Off Quality vs. Inequality?

The Case of German Architects and Construction Engineers

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COMPIE Berlin, Sept 27, 2018

Self-employment and Income Inequality

Distribution of Monthly Net Income of Self-Employed and Employees

Legend: Employees (red line), Self-Employed with Employees (blue line). Labels: Physicians, Lawyers, Tax Advisors, Architects, Engineers.

Motivation

- Regulation of professions is a severe market intervention
- Regulation typically comes in two forms
    - Entry regulation
    - Price regulation
- Main argument for regulation is to guarantee a minimum quality standard due to asymmetric information
- Especially relevant for "credence goods"
    - Provider is an expert on the quality of the good or service
    - Customer is not able to verify all relevant aspects of the product
- Prices for credence goods are often fixed by law

Research question

- Changes in prices affect revenues of businesses
- Business owners reoptimize profit and may adjust
  - Product quality/quantity
  - Investments in (human) capital
  - Number of/Payments to employees
  - Incomes of business owners

After a policy reform that increased prices, which along which margin have business owners ajdusted?

Regulation and Self-employment (Architects)
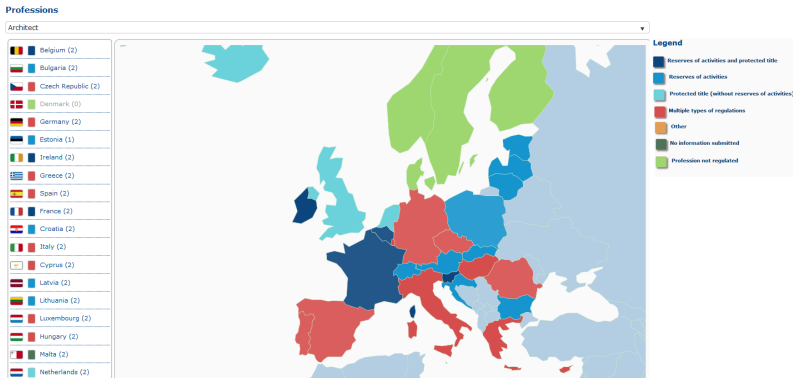
http://ec.europa.eu/growth/tools-databases/regprof/
index.cfm?action=map_complex&profession=12019

Architects and civil engineers in Germany

- Two of the most heavily regulated professions across the EU
- Germany has one of the most restrictive laws within the two professions in general, comprised of
  - Entry regulation (4 years of studies, 2 years of experience)
  - Protected titles
  - Registration as paid member in the regional chambers
  - Continued education
  - Strict price regulation
    → EC: violates Services Directive (Directive 2006/123/EC)

→ **How does price regulation affect income inequality?**
→ **How does price regulation affect service quality?**

Price regulation in Germany

- We can exploit a natural experiment in Germany
- The German Fee Scale for Architects and Engineers ("HOAI") is a binding price law that sets price ceilings and floors
- Violations fined with 250.000 Euro or up to two years

Chargeable costs	Fee band I		Fee band II		Fee band III		Fee band IV		Fee band V	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
25,000	3,120	3,657	3,657	4,339	4,339	5,412	5,412	6,094	6,094	6,631
35,000	4,217	4,942	4,942	5,865	5,865	7,315	7,315	8,237	8,237	8,962
50,000	5,804	6,801	6,801	8,071	8,071	10,066	10,066	11,336	11,336	12,333
70,000	8,342	9,776	9,776	11,601	11,601	14,469	14,469	16,293	16293	17,727
100,000	10,790	12,644	12,644	15,005	15,005	18,713	18,713	21,074	21,074	22,928
150,000	15,500	18,164	18,164	21,555	21,555	26,883	26,883	30,274	30,274	32,938
200,000	20,037	23,480	23,480	27,863	27,863	34,751	34,751	39,134	39,134	42,578
300,000	28,750	33,692	33,692	39,981	39,981	49,864	49,864	56,153	56,153	61,095
500,000	45,232	53,006	53,006	62,900	62,900	78,449	78,449	88,343	88,343	96,118
750,000	64,666	75,781	75,781	89,927	89,927	112,156	112,156	126,301	126,301	137,416
...										

Natural experiment

- In 2009, prices were exogenously increased by about 10%
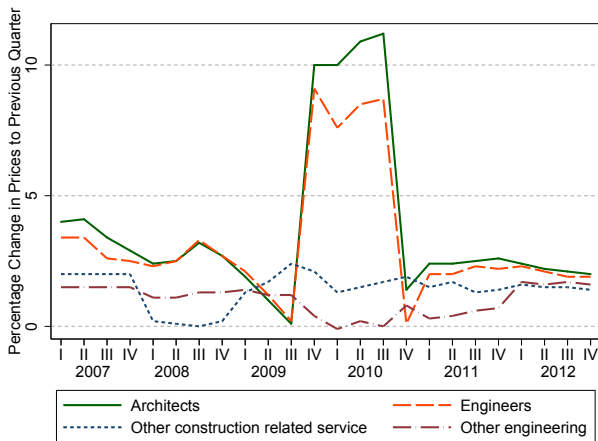
Unexpected Reform
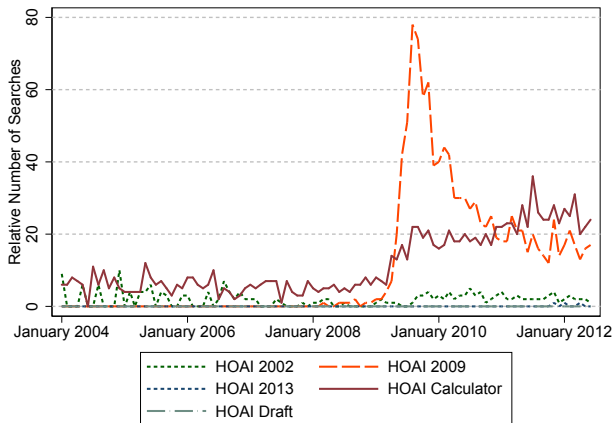
Data

1. Data from the German microcensus

- Representative household survey in Germany
- Time period: 2006 to 2012
- Sample is restricted to
  - Architects and HOAI engineers
  - Other engineers → forming the control group
- Final sample consists of $39,357$ observations

2. Official office ranking of the BauNetz Media GmbH

Descriptive statistics on the German microcensus

	Architects		Other Engineers		Working Population	
	Pre	Post	Pre	Post	Pre	Post
Self-Employed (%)	57.5	53.5	7.9	7.6	11.8	11.8
Hours Worked	43.0	41.8	41.1	41.3	35.9	36.2
Firm size	5.4	5.7	11.8	11.9	10.3	10.3
Cont. Educ. (y/n)	31.4	30.3	33.4	33.3	21.0	21.2
Cont. Educ. (in h)	13.4	14.7	15.7	20.3	10.7	13.9
Observations	1,781	1,535	19,392	15,131	800,063	618,322

Notes: All numbers are weighted by survey weights provided by the microcensus.
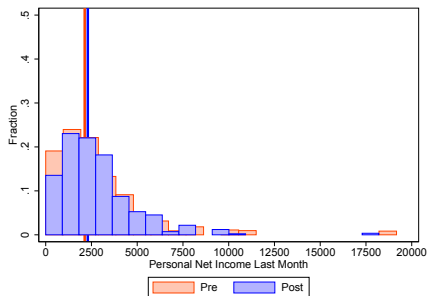Post includes the years 2010 to 2012.
Source: Own calculations based on the scientific use file of the German microcensus (2006-2012)

Income distribution pre- and post-reform

Income distribution for architects and construction engineers
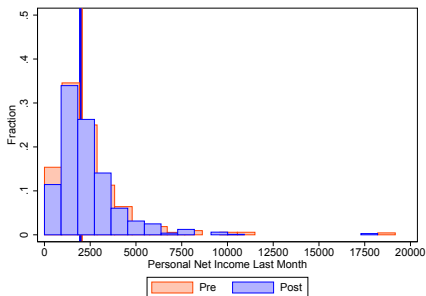
(a) Not Self-Employed

(b) Self-Employed

Estimation strategy

We specify DD models of the following general form

$$\mathbb{E}[y_{igt}|\mathbb{1}_g^{\text{treat}}, \mathbb{1}_t^{\text{post}}, X_{igt}] = T(\gamma\mathbb{1}_g^{\text{treat}} + \vartheta\mathbb{1}_t^{\text{post}} + \omega\mathbb{1}_g^{\text{treat}}\mathbb{1}_t^{\text{post}} + X_{igt}\xi)$$

- ▸ $T(\cdot)$ is a transformation function
- ▸ y_{igt} is our outcome of interest
- ▸ $\mathbb{1}_g^{\text{treat}}$ is an indicator equal to 1 if a unit was treated
- ▸ $\mathbb{1}_t^{\text{Post}}$ is an post-reform indicator
- ▸ X_{igt} is a vector of controls

Under the common-trends assumption, ω measures the causal impact of the price reform

1. Effect of price regulation on income

Sample	I Self-Employed	II Self-Employed	III Workers	IV Self-Employed
Treated × Post	0.091** (0.045)	0.080* (0.044)	0.002 (0.021)	
Treated	-0.222*** (0.030)	-0.139*** (0.030)	-0.215*** (0.015)	-0.096** (0.041)
Post	0.015 (0.031)	0.054 (0.052)	0.129*** (0.009)	
Regulated × Placebo Post				-0.076 (0.057)
Placebo Post				0.158*** (0.056)
Year Indicators		✓	✓	✓
State Indicators		✓	✓	✓
Other Controls		✓	✓	✓
Observations	4,633	4,092	29,279	2,329
Adjusted R^2 (%)	1.6	18.6	34.6	20.6

Control variables: Indicators of year, federal state, nationality, children, gender, marital status, educational and vocational qualification, tenure and its square.
Inference: Robust standard errors

2. Effect of price regulation on income inequality

| Quintiles | Model I: No Controls, Sample: Self-Employed | | | | |
	Lowest	Second Lowest	Mid	Second Highest	Highest
ATT (in %)	0.8	-4.1*	-1.9	1.1	4.1
	(1.4)	(2.3)	(1.8)	(2.1)	(2.8)

| Quintiles | Model II: Full Set of Controls, Sample: Self-Employed | | | | |
	Lowest	Second Lowest	Mid	Second Highest	Highest
ATT (in %)	-0.1	-5.1	-0.7	1.5	4.4
	(1.2)	(3.0)	(1.7)	(2.1)	(3.2)

| Quintiles | Model III: Full Set of Controls, Sample: All | | | | |
	Lowest	Second Lowest	Mid	Second Highest	Highest
ATT (in %)	0.7	-1.1	-0.8	3.1***	-2.0
	(0.6)	(1.1)	(1.0)	(1.4)	(1.6)

Control variables: Indicators of year or linear time trend, federal state, nationality, children, gender, marital status, educational and vocational qualification, tenure and its square.
Inference: Standard errors obtained by the Delta-method

▸ MLogit

3. Effect of price regulation on …

- Hours worked
  - No significant effect

- Propensity to be self-employed
  - Small negative effect (significant at 10%)

- Firm size (measured by the number of employees)
  - Significant increase in the number of employees per firm
  - Firm size increased by 0.3 employees on average

- Continued education
  - No effect on the propensity to enroll in continued education
  - Training hours decreased by around five hours per year

4. Effect of price regulation on service quality

- ► Main challenge: how to measure architectural service quality?
- ► Official office ranking of the BauNetz Media GmbH to measure quality from a comprehensive perspective
    - ► Ranking is published every second month by BauNetz Media GmbH on its website
    - ► Time period: 2006-2012
    - ► Ranking is based on the number, length and level of detail of publications made in professional journals
- ► Number of pages of each report is converted into a score
- ► Final score is the weighted sum of points, where the weighting factor depends on the journal quality
- ► Germany has an average score of 8 (EU average: 14 points)

4. Effect of price regulation on service quality

- Estimation based on the Synthetic Control Method (Abadie and Gardeazabal, 2003)
- Idea is that a weighted average of the available control units (donor pool) is able to reproduce the trajectory of the treated unit in absence of treatment
  - Use other EU countries as donor pool
  - The outcome for the treated unit Germany is compared to the outcome of the synthetic control unit to identify the causal effect
- Under certain conditions (e.g., no spillover, no anticipation, convex hull) the SCM treatment effect in t is given by

$$\hat{\omega}_t^* = y_{Germany,t} - \sum_{c=1}^{C} w_c^* y_{ct} \quad \text{for} \quad t > 2009,$$

4. Effect of price regulation on service quality
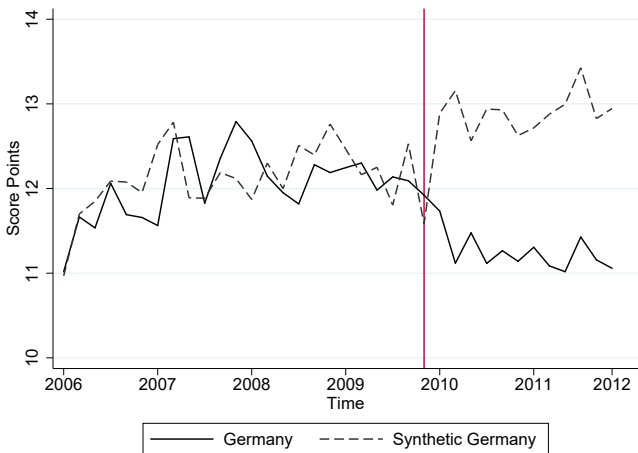
Concluding remarks

- We study the case of exogenous increases of fixed prices for architects and construction engineers in Germany
- Incomes of self-employed architects and construction engineers increased significantly by 8% due to the reform
- Full share of the price hike ended up in the owners' pockets
- Price regulation seems to be beneficial for those at the higher end of the income distribution
- Evidence that the price increase did not have the expected positive quality effects
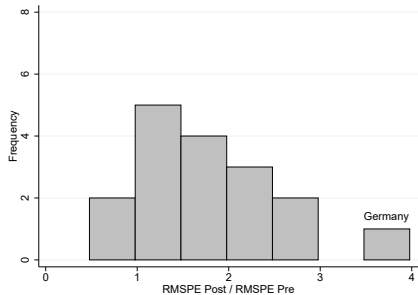
2. Effect of price regulation on income inequality

- Difference-in-differences model in a multinomial framework:
  1. Divide income distribution of self-employed with positive personal net income into quintiles J
  2. Estimate multinomial logit models with maximum likelihood
- Middle income class serves as base category
- The ATT at the time of treatment conditional on $X_{i,1,1}$ is

$$E_j[y_{i11}^{\text{factual}}|1, 1, X_{i11}] - E_j[y_{i,1,1}^{\text{counterfactual}}|1, 1, X_{i11}]$$
$$= P_{ijt}(\gamma_j + \vartheta_j + \omega_j + X_{i11}\xi_j) - P_{ijt}(\gamma_j + \vartheta_j + X_{i11}\xi_j)$$

Synthetic Control Method: Inference

(c) Placebos-in-space

(d) RMSPE-Ratio