Does Regulation Trade-Off Quality vs. Inequality?
The Case of German Architects and Construction Engineers

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(joint with Kristina Strohmaier, University of Tuebingen)

COMPIE Berlin, Sept 27, 2018
Self-employment and Income Inequality

Distribution of Monthly Net Income of Self-Employed and Employees

- Physicians
- Lawyers
- Tax Advisors
- Architects
- Engineers

Employees
Self-Employed with Employees
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 adjusted?
Regulation and Self-employment (Architects)

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

<table>
<thead>
<tr>
<th>Chargeable costs</th>
<th>Fee band I</th>
<th>Fee band II</th>
<th>Fee band III</th>
<th>Fee band IV</th>
<th>Fee band V</th>
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<tbody>
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<td>Min</td>
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<td>21,555</td>
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<td>39,981</td>
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<tr>
<td>500,000</td>
<td>45,232</td>
<td>53,006</td>
<td>53,006</td>
<td>62,900</td>
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<td>750,000</td>
<td>64,666</td>
<td>75,781</td>
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<td>89,927</td>
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<td>...</td>
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</table>
Natural experiment

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

<table>
<thead>
<tr>
<th></th>
<th>Architects</th>
<th>Other Engineers</th>
<th>Working Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Self-Employed (%)</td>
<td>57.5</td>
<td>53.5</td>
<td>7.9</td>
</tr>
<tr>
<td>Hours Worked</td>
<td>43.0</td>
<td>41.8</td>
<td>41.1</td>
</tr>
<tr>
<td>Firm size</td>
<td>5.4</td>
<td>5.7</td>
<td>11.8</td>
</tr>
<tr>
<td>Cont. Educ. (y/n)</td>
<td>31.4</td>
<td>30.3</td>
<td>33.4</td>
</tr>
<tr>
<td>Cont. Educ. (in h)</td>
<td>13.4</td>
<td>14.7</td>
<td>15.7</td>
</tr>
<tr>
<td>Observations</td>
<td>1,781</td>
<td>1,535</td>
<td>19,392</td>
</tr>
</tbody>
</table>

*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

\[ \mathbb{E}[y_{igt}|1_{t}^{treat}_{g}, 1_{t}^{post}, X_{igt}] = T(\gamma_{t}^{treat}_{g} + \theta_{t}^{post} + \omega_{t}^{treat}_{g}1_{t}^{post} + X_{igt}\xi) \]

- \( T(\cdot) \) is a transformation function
- \( y_{igt} \) is our outcome of interest
- \( 1_{t}^{treat}_{g} \) is an indicator equal to 1 if a unit was treated
- \( 1_{t}^{post} \) is an post-reform indicator
- \( X_{igt} \) is a vector of controls

Under the common-trends assumption, \( \omega \) measures the causal impact of the price reform
## 1. Effect of price regulation on income

<table>
<thead>
<tr>
<th>Sample</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated × Post</td>
<td>0.091**</td>
<td>0.080*</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.044)</td>
<td>(0.021)</td>
<td></td>
</tr>
<tr>
<td>Treated</td>
<td>-0.222***</td>
<td>-0.139***</td>
<td>-0.215***</td>
<td>-0.096**</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.030)</td>
<td>(0.015)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Post</td>
<td>0.015</td>
<td>0.054</td>
<td>0.129***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.052)</td>
<td>(0.009)</td>
<td></td>
</tr>
<tr>
<td>Regulated × Placebo Post</td>
<td></td>
<td></td>
<td></td>
<td>-0.076</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.057)</td>
</tr>
<tr>
<td>Placebo Post</td>
<td></td>
<td></td>
<td></td>
<td>0.158***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.056)</td>
</tr>
</tbody>
</table>

|                     | ✓               | ✓               | ✓               | ✓               |
| 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

<table>
<thead>
<tr>
<th>Quintiles</th>
<th>Model I: No Controls, Sample: Self-Employed</th>
<th>Model II: Full Set of Controls, Sample: Self-Employed</th>
<th>Model III: Full Set of Controls, Sample: All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest</td>
<td>Second Lowest</td>
<td>Lowest</td>
</tr>
<tr>
<td>ATT (in %)</td>
<td>0.8</td>
<td>-4.1*</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>(1.4)</td>
<td>(2.3)</td>
<td>(0.6)</td>
</tr>
<tr>
<td></td>
<td>Second Lowest</td>
<td>Mid</td>
<td>Second Lowest</td>
</tr>
<tr>
<td>ATT (in %)</td>
<td>-1.9</td>
<td>1.1</td>
<td>-1.1</td>
</tr>
<tr>
<td></td>
<td>(1.8)</td>
<td>(2.1)</td>
<td>(1.1)</td>
</tr>
<tr>
<td></td>
<td>Highest</td>
<td>Highest</td>
<td>Highest</td>
</tr>
<tr>
<td>ATT (in %)</td>
<td>4.1</td>
<td>4.1</td>
<td>-2.0</td>
</tr>
<tr>
<td></td>
<td>(2.8)</td>
<td></td>
<td>(1.6)</td>
</tr>
</tbody>
</table>

*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
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

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

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

(c) Placebos-in-space

(d) RMSPE-Ratio