Measuring Regulation

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We conceptualize regulation as pressure on firms to restrict their behavior.
Challenges in measuring regulation

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Some challenges in measuring regulation:

- **Sources**: Regulation can come from various sources
  
  Federal, state, local, judicial, industry privately-enforced...
Challenges in measuring regulation

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- **Sources**: Regulation can come from various sources
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- **Direction**: Regulation versus deregulation
  - If Rule 2 says some industries may not need to comply with Rule 1, then Rule 2 is *deregulation*
Challenges in measuring regulation

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- **Direction**: Regulation versus deregulation
  
  If Rule 2 says some industries may not need to comply with Rule 1, then Rule 2 is *deregulation*.

- **Enforcement**: Not all rules are equally enforced
  
  Speeding is illegal, but patrol officers usually ignore motorists who are 5-10 miles per hour over the legal limit.
Existing measures of industry regulation

Existing measures focus on the supply side of regulation:

- Industry-specific federal regulator head-counts, budgets or enforcement action counts; word counts in regulations
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- **RegData**: Counting the restrictive words in Code of Federal Regulations, such as *shall, must, may not*, etc. (Al-Ubaydli and McLaughlin (2017))
Existing measures focus on the supply side of regulation:

- Industry-specific federal regulator head-counts, budgets or enforcement action counts; word counts in regulations
- **RegData**: Counting the restrictive words in Code of Federal Regulations, such as *shall, must, may not*, etc. (Al-Ubaydli and McLaughlin (2017))

Limitations of RegData:

- **Sources**: Only measures federal regulation
- **Enforcement**: More words may not translate to more stringent regulation
- **Direction**: Cannot distinguish regulation from deregulation
An example of RegData failing to identify deregulation

Energy Policy Act (EPAct) of 2005

- Oil & Gas Extraction
- Control Industries
Instead of focusing on the supply side, we explore whether an industry’s response to regulation may better reflect the direction and intensity of regulation.
Our measure of industry regulation

Instead of focusing on the supply side, we explore whether an industry’s response to regulation may better reflect the direction and intensity of regulation.

Intuition:

- Assume that firms spend resources on regulation-related tasks to reduce risks of legal liability or penalties from regulatory infractions.
- Under this assumption, a profit-maximizing firm responds to regulation by spending resources until the marginal benefit of such spending (in reducing penalties and liability) equals the marginal cost \( (\text{Becker (1968)}) \).
- \textit{Ceteris paribus}, more stringent regulations with stricter enforcement will induce firms to spend more on regulation-related tasks.
Construct a new measure — **Regulation Index**

- We construct an indicator of regulation intensity based on the percentage of an industry’s labor costs paid for performing *regulation-related* tasks.
  
  Why labor? 68% of the total direct regulatory costs are from labor costs devoted to compliance.

- Regulation Index covers over 270 industries for each year in 1990-2017.
Overview

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Validate the Regulation Index

- Using case studies, we examine how our Regulation Index changes after major industry-specific or firm-ownership-specific regulatory shocks.

  - Energy Policy Act (EPAct) of 2005 on oil & gas industry
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  - Dodd-Frank Act of 2010 on financial industry
  - Sarbanes-Oxley Act (SOX) of 2002 on publicly-traded firms
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- We compare treated industries or firms with carefully constructed controls

- We demonstrate the strength of our measure by comparing with RegData
Data

Task data for each occupation:

- O*Net 23.1 Database — a dictionary of occupations
- Obtain task statements and task-importance weights for each occupation
Data

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Occupational employment and wages for each industry:
- Occupational Employment Statistics Data
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Other industry-level measures:
- RegData US 3.1 (QuantGov); Outsourced legal spending (BEA Input Table); Lobbying spending (CRP)
Constructing the Regulation Index: Which labor tasks are regulation related?

Step 1: Identify “regulation-related” tasks:

- **Textual analysis:** A task is “regulation-related” if its statement includes the following keywords:
  - **Keywords:** Compliance, Complied, Complies, Comply, Complying, Safety, Codes, Law, Laws, Lawsuit, Lawsuits, Legal, Legalities, Legality, Legislate, Legislated, Legislates, Legislating, Legislation, Legislature, Ordinance, Ordinances, Regulatory, Regulation, Regulations, Statute, Statutes, Statutory.
  - This yields 1,024 tasks

- Human screening: We ask five USC law students to manually read through them to identify false positives
  - We took a majority vote to rule out false positives
  - This reduces the number of “regulation-related” tasks to 833
Constructing the Regulation Index: Which labor tasks are regulation related?

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Examples of “regulation-related” tasks

- **Monitor** construction activities to ensure that environmental **regulations** are not violated.
  
  —*Construction and Building Inspectors*

- **Monitor** establishment activities to ensure adherence to all state gaming **regulations** and company policies and procedures.
  
  —*Gaming Surveillance Officers & Gaming Investigators*

- **Review** and **analyze** new, proposed, or revised **laws**, **regulations**, policies, and procedures to interpret their meaning and determine their impact.
  
  —*Financial Examiners*

- **Inspect** food processing areas to ensure compliance with government **regulations** and **standards** for sanitation, safety, quality, and waste management standards.
  
  —*Food Scientists and Technologists*
Constructing the Regulation Index: How much of an occupation is regulation related?

Step 2: Compute regulatory-task intensity (RTI) for each occupation:

- O*Net database also provides an importance measure for each task for each occupation
- We average regulation-related tasks within occupation, weighted by their importance
- We focus on the RTIs of the top 20 occupations with the highest RTIs
Top 20 occupations with highest RTIs

<table>
<thead>
<tr>
<th>Occupation</th>
<th>RTI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legal-Related Occupations</strong></td>
<td></td>
</tr>
<tr>
<td>Lawyers</td>
<td>0.45</td>
</tr>
<tr>
<td>Paralegals and Legal Assistants</td>
<td>0.51</td>
</tr>
<tr>
<td>Law Clerks</td>
<td>0.36</td>
</tr>
<tr>
<td>Title Examiners, Abstractors, and Searchers</td>
<td>0.24</td>
</tr>
<tr>
<td>Legal Secretaries</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Compliance-Related Occupations</strong></td>
<td></td>
</tr>
<tr>
<td>Compliance Officers</td>
<td>0.36</td>
</tr>
<tr>
<td>Financial Examiners</td>
<td>0.41</td>
</tr>
<tr>
<td>Agricultural Inspectors</td>
<td>0.23</td>
</tr>
<tr>
<td>Construction and Building Inspectors</td>
<td>0.49</td>
</tr>
<tr>
<td>Food Scientists and Technologists</td>
<td>0.33</td>
</tr>
<tr>
<td>Health and Safety Engineers, Except Mining</td>
<td>0.43</td>
</tr>
<tr>
<td>Urban and Regional Planner</td>
<td>0.22</td>
</tr>
<tr>
<td>First-Line Supervisors of Police and Detectives</td>
<td>0.30</td>
</tr>
<tr>
<td>Fire Inspectors and Investigators</td>
<td>0.29</td>
</tr>
<tr>
<td>First-Line Supervisors of Fire Fighting</td>
<td>0.21</td>
</tr>
<tr>
<td>Police and Sheriff’s Patrol Officers</td>
<td>0.29</td>
</tr>
<tr>
<td>Transit and Railroad Police</td>
<td>0.28</td>
</tr>
<tr>
<td>Nuclear Engineers</td>
<td>0.22</td>
</tr>
<tr>
<td>Parking Enforcement Workers</td>
<td>0.23</td>
</tr>
<tr>
<td>Gaming Surveillance Officers &amp; Gaming Investigators</td>
<td>0.21</td>
</tr>
</tbody>
</table>
Step 3: Compute Regulation Index for each industry:

- OES data provides each industry’s labor costs paid to each occupation in each year

- **Regulation Index**: Percentage of labor costs paid for performing regulation-related tasks

\[
\text{Regulation Index}_i = \frac{\sum_j RTI_j \times emp_{i,j} \times wage_{i,j}}{\sum_j emp_{i,j} \times wage_{i,j}} \times 100
\]
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  \[
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  \]

Summary statistics:

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation Index</td>
<td>4371</td>
<td>0.17%</td>
<td>0.33%</td>
<td>0%</td>
<td>3.42%</td>
</tr>
</tbody>
</table>
## Top 20 industries with highest Regulation Index in 2016

<table>
<thead>
<tr>
<th>Industry</th>
<th>NAIC</th>
<th>Reg. Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and Gas Extraction</td>
<td>2111</td>
<td>1.89</td>
</tr>
<tr>
<td>Electric Power Generation, Transmission and Distribution</td>
<td>2211</td>
<td>1.16</td>
</tr>
<tr>
<td>Natural Gas Distribution</td>
<td>2212</td>
<td>1.15</td>
</tr>
<tr>
<td>Pipeline Transportation of Natural Gas</td>
<td>4862</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Securities and Commodity Exchanges</td>
<td>5232</td>
<td>3.21</td>
</tr>
<tr>
<td>Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)</td>
<td>5331</td>
<td>1.70</td>
</tr>
<tr>
<td>Insurance Carriers</td>
<td>5241</td>
<td>1.67</td>
</tr>
<tr>
<td>Management of Companies and Enterprises</td>
<td>5511</td>
<td>1.33</td>
</tr>
<tr>
<td>Other Financial Investment Activities</td>
<td>5239</td>
<td>1.26</td>
</tr>
<tr>
<td>Nondepository Credit Intermediation</td>
<td>5222</td>
<td>1.03</td>
</tr>
<tr>
<td>Depository Credit Intermediation</td>
<td>5221</td>
<td>0.86</td>
</tr>
<tr>
<td>Insurance and Employee Benefit Funds</td>
<td>5251</td>
<td>0.85</td>
</tr>
<tr>
<td>Securities and Commodity Contracts Intermediation and Brokerage</td>
<td>5231</td>
<td>0.75</td>
</tr>
<tr>
<td>Activities Related to Credit Intermediation</td>
<td>5223</td>
<td>0.74</td>
</tr>
<tr>
<td>Other Investment Pools and Funds</td>
<td>5259</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>Pharma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmaceutical and Medicine Manufacturing</td>
<td>3254</td>
<td>0.89</td>
</tr>
<tr>
<td><strong>Professional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architectural, Engineering, and Related Services</td>
<td>5413</td>
<td>1.16</td>
</tr>
<tr>
<td>Business, Professional, Labor, Political, and Similar Organizations</td>
<td>8139</td>
<td>1.13</td>
</tr>
<tr>
<td>Social Advocacy Organizations</td>
<td>8133</td>
<td>1.10</td>
</tr>
<tr>
<td>Scientific Research and Development Services</td>
<td>5417</td>
<td>0.96</td>
</tr>
</tbody>
</table>
An overview of Regulation Index

Regulation Index for Private Industries

Aggregate Regulation Index coincides with total pages of CFR
Validation of Regulation Index — Correlations

<table>
<thead>
<tr>
<th>Regression Spec.:</th>
<th>Pooled OLS</th>
<th>Cross-Section Year FE</th>
<th>Time-Series Ind. FE + Year Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Panel A. Outsourced Legal Service</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reg.Index</td>
<td>1.54***</td>
<td>1.54***</td>
<td>0.19**</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.10)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>N</td>
<td>1,005</td>
<td>1,005</td>
<td>1,005</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.18</td>
<td>0.17</td>
<td>0.94</td>
</tr>
<tr>
<td><em>Panel B. Text-based RegData</em></td>
<td></td>
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</tr>
<tr>
<td>Reg.Index</td>
<td>0.65***</td>
<td>0.62***</td>
<td>0.05*</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.09)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>N</td>
<td>1,792</td>
<td>1,792</td>
<td>1,792</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.03</td>
<td>0.03</td>
<td>0.99</td>
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<tr>
<td><em>Panel C. Lobbying Spending</em></td>
<td></td>
<td></td>
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<tr>
<td>Reg.Index</td>
<td>1.63***</td>
<td>1.59***</td>
<td>−0.54</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.35)</td>
</tr>
<tr>
<td>N</td>
<td>2,267</td>
<td>2,267</td>
<td>2,267</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.06</td>
<td>0.07</td>
<td>0.71</td>
</tr>
</tbody>
</table>

- **Treated:** Oil & gas extraction industry (NAICS 2111)
  - Exemptions from Safe Drinking & Clean Water Act
  - Preempted state and local regulation
  - Exemptions from EPA regulation of hydraulic fracturing (unless using Diesel)
  - Streamlined environmental review of oil & gas leases on federal or Indian lands
Validation of Regulation Index — Case study I


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- **Control**: Use BEA Input-Output Table to find closely-related industries
  - Intuition: The control and treated groups are in the same production chain and are thus likely to be affected by other general regulations applied to the production chain
  - Petroleum and coal products manufacturing (NAICS 3241), natural gas distribution (NAICS 2212), and basic chemical manufacturing (NAICS 3251)

Panel A: Regulation Index

Panel B: RegData Measure
**Re-regulation Shock — Deepwater Horizon Oil Spill in 2010**

- **Treatment:** Oil & gas extraction industry (NAICS 2111)
  
  - In response, President Barack Obama signed an executive order creating a commission to study the spill.
  
  - The commission recommended new safety rules, accountability standards, and environmental regulations for drilling in US waters.
  
  - Obama then signed another executive order to promote environmental stewardship of the ocean, coasts, and the Great Lakes in light of the oil spill.
  
  - According to the Bureau of Ocean Energy Management, the new rules were “the most aggressive and comprehensive reforms to offshore oil and gas regulation and oversight in U.S. history.”
Re-regulation Shock — Deepwater Horizon Oil Spill in 2010

Panel A: Regulation Index

Panel B: RegData Measure
Regulation Shock — Dodd-Frank Act of 2010

- **Treated:** Financial industry (NAICS 52)
  - QRM rules tightened mortgage underwriting and documentation requirements
  - Federal Reserve limits leveraged loans by banks
  - CFPB regulates consumer lending markets
  - Derivatives push-out rule
  - Higher capital requirements for SIFIs

- **Control:** Real estate industry
Dodd-Frank Act of 2010 (Finance vs. Real Estate)

Panel A: Regulation Index

Panel B: RegData Measure
Changes in Regulation Index before and after Dodd-Frank (by Sub-sectors of Finance)
Validation of Regulation Index — Case study IV

Regulation Shock — Sarbanes-Oxley Act of 2002

- **Treated:** Publicly-listed firms
  - SOX is mainly applicable to publicly traded firms
  - Mandated stricter internal controls and enhanced reporting for off-balance sheet transactions
  - Executives must personally certify accuracy of financial statements and adequacy of internal controls
  - Various exemptions for small public firms (less than $75 million public float)

- **Control:** Privately-held firms’ establishments matched by industry, size, and state

\[
Reg. Index_{e,t} = \beta Public_{e,t} \times Post SOX_t + \gamma Public_{e,t} \\
+ FE_e + FE_{EmpBin \times Ind \times Year} + FE_{State \times Year} + \epsilon_{e,t}
\]

Note: We use the BLS-OES microdata to run this establishment-level analysis
## Regulation Shock — Sarbanes-Oxley Act of 2002

<table>
<thead>
<tr>
<th></th>
<th>Public</th>
<th>Public × Post SOX</th>
<th>Establishment FE</th>
<th>State × Year FE</th>
<th>EmpBin × Ind × Year FE</th>
<th>Observations</th>
<th>Adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
<td>Large Firms</td>
<td>Small Firms</td>
<td>Only HQ-State</td>
<td>All Firms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>−0.019</td>
<td>−0.100**</td>
<td>0.042</td>
<td>−0.069</td>
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<td></td>
<td>(0.031)</td>
<td>(0.050)</td>
<td>(0.037)</td>
<td>(0.065)</td>
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</tr>
<tr>
<td>(2)</td>
<td>0.022**</td>
<td>0.034***</td>
<td>0.005</td>
<td>0.061***</td>
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<td>(0.010)</td>
<td>(0.012)</td>
<td>(0.014)</td>
<td>(0.023)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Observations</td>
<td>201,478</td>
<td>180,638</td>
<td>174,046</td>
<td>165,554</td>
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<tr>
<td>Adjusted $R^2$</td>
<td>0.886</td>
<td>0.892</td>
<td>0.892</td>
<td>0.893</td>
<td></td>
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</tbody>
</table>
Validation of Regulation Index — Case study IV

Regulation Shock — Sarbanes-Oxley Act of 2002

Differences in Regulation Index (between Public and Private Firms)
How to interpret Regulation Index

The Regulation Index is an indicator of regulatory intensity for an industry.

It is not a comprehensive measure of costs of regulation. It may not capture:

- Regulation mandating capital expenditures, for example for new pollution abatement equipment
- Prohibitions that lead to a business line being completely eliminated rather than regulated or modified
- Barriers to entry such as licensing requirements for new entrants
Conclusion

We propose a new measure of regulation at the industry level

Our measure improves the current measures by

1. reflecting broader sources of regulation
   - e.g., federal, state, local, judicial and industry
     privately-enforced regulations

2. better identifying the impact of regulation on industry

3. better distinguishing regulation from deregulation
Total Pages Published in the Code of Federal Regulations (1950-2017)

Source: Federal Register Statistics
Updated: January 30, 2019
Measuring regulation through industry’s “burden”

We measure regulation through industry’s labor costs

Why labor costs?

- Labor costs can be a good indicator: A survey of direct regulatory costs by National Association of Manufacturers (NAM) in 2014 shows that 68% of the total costs are from labor costs devoted to compliance

![Estimates of Direct Regulatory Costs on Manufacturers (in Billions of 2014 Dollars)](image_url)