Regulatory Studies Center

THE GEORGE WASHINGTON UNIVERSITY

Does the Form of Regulation Matter?

An Empirical Analysis of Regulation and Land Productivity Growth

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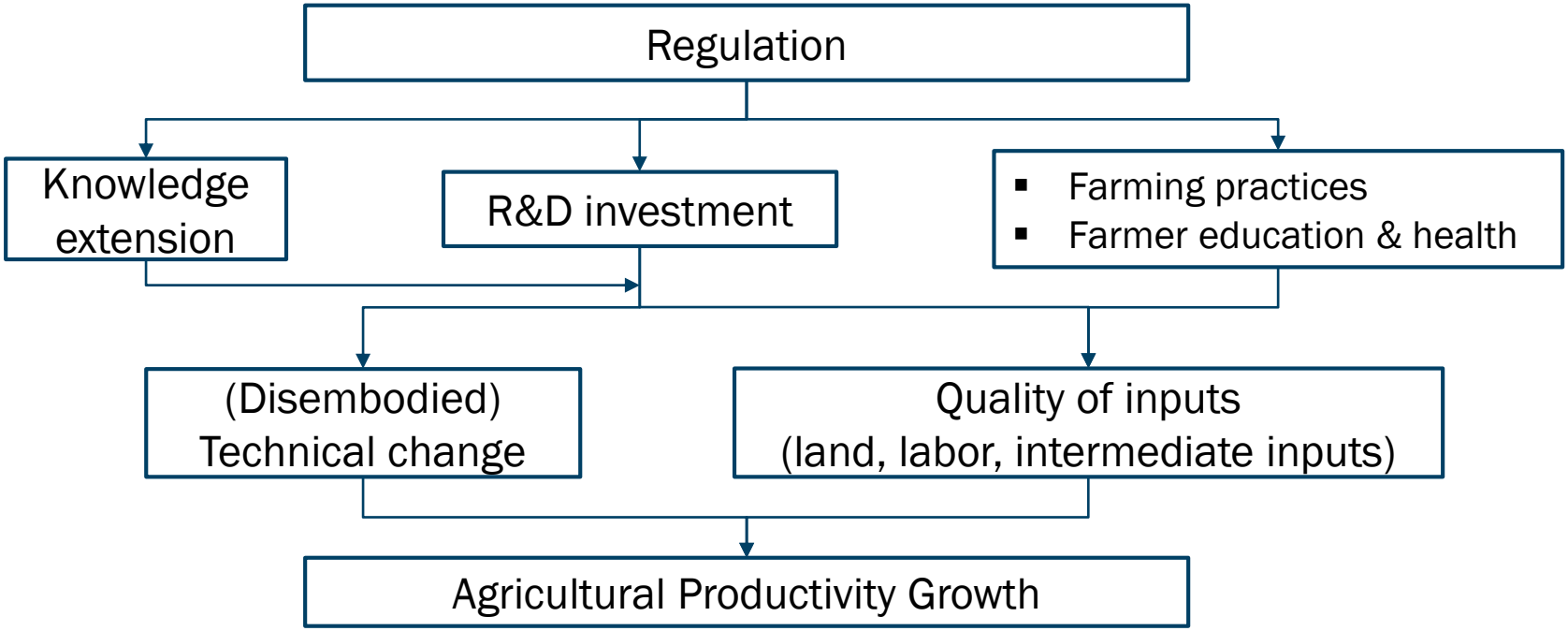
Regulation & Agricultural Productivity



- Limited and inconclusive empirical evidence on the overall impact of regulation on productivity growth
- No systematic analysis of different forms of regulation

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Research Questions

- What is the relationship between growth in agriculture-related regulation and agricultural productivity growth?
- Does the relationship vary depending on the form of regulation?

Preview of Findings

- The empirical analysis suggests that growth in total regulation has a negative relationship with land productivity growth.
- The relationship differs depending on the form of regulation.
  - Command-and-control and entry-and-exit regulations
  - Information-based and transfer regulations

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Methodology

- Coverage: 25 crop production industries (6-digit NAICS)
  661 parts in Code of Federal Regulations (CFR)
- Timeframe: 1971-2017

- Measuring growth in agricultural productivity
  - Land productivity: crop yield per acre
- Measuring growth in regulation
  - Amount of regulation: restrictive word count
  - Form of regulation: A Taxonomy of Regulatory Forms

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A Taxonomy of Regulatory Forms

	First-Tier Form	Second-Tier Form	Third-tier Form	
1	Economic	Price	▪ Benchmarking (or yardstick) ▪ Price ceiling/floor	▪ Rate of return ▪ Revenue cap
		Quantity	▪ Obligation to serve ▪ Portfolio standards	▪ Rationing and quotas
		Entry & Exit	▪ Certification of need ▪ Licensing ▪ Rivalrous/exclusive permits	▪ Certification ▪ Antitrust
		Service Quality	▪ Product identity or grades ▪ Quality levels	
2	Social	Command-and-Control	▪ Monitoring, reporting and verification (MRV) ▪ Performance standards ▪ Means-based standards	▪ Permitting ▪ Pre-market notice ▪ Pre-market approval ▪ Prohibitions
		Market-based	▪ Bonds ▪ Marketable permits	▪ Subsidies ▪ Taxes and fees
		Information-based	▪ Hazard warning ▪ Labeling	▪ Other disclosure ▪ Contingency planning
3	Transfer	Transfer	▪ Monetary transfer ▪ Technology transfer	▪ User fees ▪ Knowledge transfer
4	Administrative	Administrative	▪ Definitions ▪ Government action	▪ Organizational

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Model 1: Total Regulation

$$YG_{i,t} = \beta_1 TRG_{i,t-1} + \beta_2 disaster_{i,t} + \mu_i + \gamma_1 trend_t + \gamma_2 trend_t^2 + \varepsilon_{i,t}$$

where:

- i is the ith 6-digit NAICS industry, t is the tth year
- $YG_{i,t}$ is the weighted average of the annual growth rate in yield of all crops relevant to industry i in year t
- $TRG_{i,t-1}$ is the annual growth rate of the restrictive word count in all CFR parts relevant to industry i in year $t-1$
- $disaster_{i,t}$ is industry i's exposure to natural disasters in year t.
- μ_i is the 6-digit NAICS industry fixed effects
- $trend_t$ is the time trend, and $trend_t^2$ is the time trend squared

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Model 2: Regulatory Form

$$YG_{i,t} = \beta_1 RFG_{i,t-1} + \beta_2 TRG_{i,t-1} + \beta_3 Disaster_{i,t} + \mu_i + \gamma_1 trend_t + \gamma_2 trend_t^2 + \varepsilon_{i,t}$$

where:

- $RFG_{i,t-1}$ is the annual growth rate of the restrictive word count in the CFR parts that take a particular regulatory form (e.g., command-and-control regulation) for industry i in year $t-1$.

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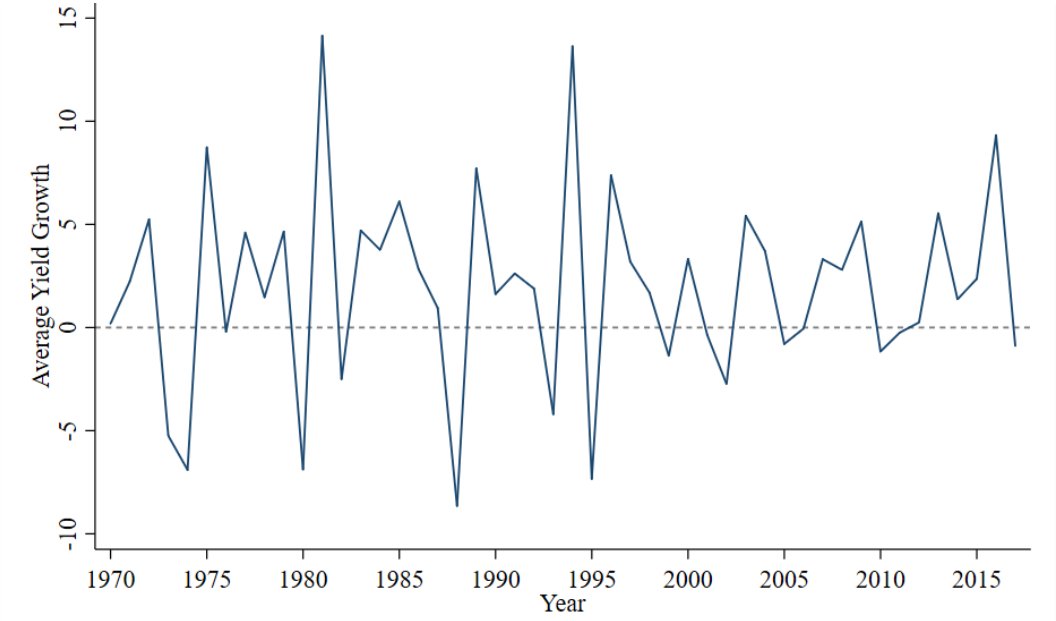
Data: Yield Growth

NASS Crop Yield Growth → Crop-Industry (6-digit NAICS) Crosswalk → Weighted average annual growth in yield for each industry

Average Yield Growth for All Industries, 1970-2017



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Data: Regulatory Form

RegData restrictive word count of relevant CFR parts → Classification of CFR parts by regulatory form → Restrictive word count distributed by form → Annual growth in regulatory restrictions by form and industry

Industry	Year	Relevant parts	Restrictive word count	Regulatory forms	Restrictions (total)	Restrictions 111	Restrictions 112	Restrictions 113
111110	2017	1 CFR 1	10	111	10 + 50 + 20 = 80	10 + 50/2 = 35	50/2 + 20/2 = 35	20/2 = 10
		1 CFR 2	50	111, 112				
		1 CFR 3	20	112, 113				

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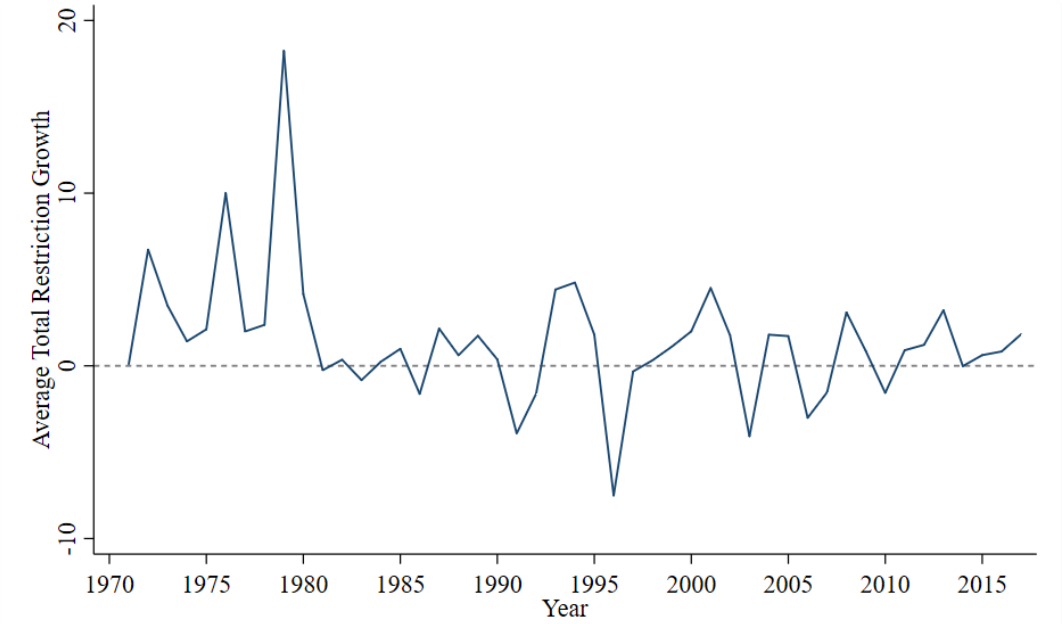
Data: Regulatory Form

RegData restrictive word count of relevant CFR parts → Classification of CFR parts by regulatory form → Restrictive word count distributed by form → Annual growth in regulatory restrictions by form and industry

Average Annual Growth in Total Regulatory Restrictions, 1970-2017



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Results: Total Regulation

Dependent Var: yield_growth	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	Industry FE + Time Trend
Growth in total regulatory restrictions	-0.2672**	-0.2895**	-0.2634***	-0.2863***	-0.3668***
Disaster risk					-0.0320***
Time		-0.1092		-0.0962	-0.0493
Time2		0.0020		0.0016	0.0012
Observations	928	928	928	928	685
R-squared	0.006	0.006	0.006	0.006	0.022
Prob > F	0.0213	0.1270	0.0050	0.0240	0.0002
Number of industries			25	25	19

Note: Constant estimates are omitted. *** p<0.01, ** p<0.05, * p<0.1.

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Results: Second-Tier Regulatory Forms

Dep. Var.: yield_growth	FE + Time Trend	FE + Time Trend (Control for Disaster)
Command-and-control	-0.3041***	-0.4081***
Entry-and-exit	-0.1363*	-0.1753**
Administrative	-0.1330***	-0.1319**
Service quality	-0.0331	0.0119

Dep. Var.: yield_growth	FE + Time Trend	FE + Time Trend (Control for Disaster)
Transfer	0.3490**	0.5073***
Information-based	0.0950**	0.0931**
Market-based	0.0124	-0.0449
Quantity	0.0098	0.0025
Price	0.0084	0.0109

Note: Coefficients on growth in regulatory restrictions for each regulatory form; other coefficients are omitted. *** p<0.01, ** p<0.05, * p<0.1.

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Results: Third-Tier Regulatory Forms

Entry-and-Exit Regulation

Dep. Var.: yield_growth	FE + Time Trend	FE + Time Trend (Control for Disaster)
Certification	-0.1076**	-0.1517***
Licensing	-0.0554	-0.0586

Command-and-Control Regulation

Dep. Var.: yield_growth	FE + Time Trend	FE + Time Trend (Control for Disaster)
MRV	-0.2272***	-0.3331***
Permitting	-0.0138	-0.1827***
Performance standards	-0.0438	-0.0465
Means-based standards	-0.0145	-0.0098
Pre-market notice & approval	-0.0015	-0.0030
Prohibitions	-0.0005	-0.0006**

Note: Coefficients on regulatory forms from industry FE + time trend specifications; other coefficients are omitted. *** p<0.01, ** p<0.05, * p<0.1.

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Robustness Checks

1) Using an alternative approach to distribute restrictive word counts by form
2) Adjusting restrictions for MRV
3) Using total word counts
4) Using expert judgment to exclude possibly irrelevant CFR parts

Overall, the relationships found in the baseline models are unaffected or even reinforced.

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Implications

- Not only more or less regulation, but regulatory form may have an impact on economic consequences.

- Command-and-control regulation may be costly and inflexible, and harm productivity growth.
  - MRV and permitting requirements may impose a substantial burden on productivity growth.
- Entry-and-exit regulation, and certification requirements in particular, may slow down productivity growth.

- Transfer regulation may enhance productivity growth.
- Information-based regulation may help regulated entities recognize the risks in their operations, eventually promoting productivity growth.

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Limitations & Future Research

- Measure of regulation
- Identifying industry-relevant regulations
- Relatively small sample size for certain regulatory forms
- Correlation rather than causation

- Broader application of the Taxonomy of Regulatory Forms

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An earlier draft of the Taxonomy of Regulatory Forms:
https://regulatorystudies.columbian.gwu.edu/taxonomy-regulatory-forms

A full report coming soon!