CHAPTER 4:

Does the Form of Regulation Matter?

An Empirical Analysis of Regulation & Land Productivity Growth

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Scholars have generally found that regulation has a negative impact on productivity growth.¹ However, few studies have examined the cumulative impact of regulation on agricultural productivity, and none has distinguished among different forms of regulation. Although different forms of regulation—particularly alternatives to traditional command-and-control regulation—have received extensive discussion in the literature in terms of their relative effectiveness in achieving regulatory objectives, their impacts on productivity have not been systematically examined.

In the previous chapters of this report, we have reviewed the literature studying regulation and productivity, introduced the Taxonomy of Regulatory Forms that can potentially be used to classify all regulations according to the forms they take, and presented an application of the taxonomy to agriculture-related regulation and the trends of different forms across agencies and over time. In this chapter, we conduct empirical analysis to assess whether different forms of regulation have different effects on productivity growth. Using data from 25 agricultural industries for the period of 1971-2017, we examine the relationship between growth in regulation and growth in land productivity. In particular, we attempt to answer two questions: (1) What is the relationship between growth in agriculture-related regulation and growth in agricultural productivity? (2) Does the relationship vary depending on the form of regulation?

¹ e.g., Wayne B. Gray, "The Cost of Regulation: OSHA, EPA and the Productivity Slowdown," *American Economic Review* 77, no. 5 (December 1987): 998-1006; Adam B. Jaffe and Karen Palmer, "Environmental Regulation and Innovation: A Panel Data Study," *Review of Economics and Statistics* 79, no. 4 (November 1997): 610-619; Meryem Saygili, "Pollution Abatement Costs and Productivity: Does the Type of Cost Matter?," *Letters in Spatial and Resource Sciences* 9 (September 2014): 1-7; Bentley Coffey, Patrick A. McLaughlin, and Pietro Peretto, "The Cumulative Cost of Regulations." Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, April 2016; John W. Dawson and John J. Seater, "Federal Regulation and Aggregate Economic Growth," *Journal of Economic Growth* 18, no. 2 (January 2013): 137-177. See more discussions in Chapter 1 of this report.

Our findings suggest that growth in total regulation has a negative relationship with land productivity growth (i.e., yield growth), and the relationship differs depending on the form of regulation. Growth in some forms of regulation (e.g. command-and-control, entry-and-exit) are negatively associated with yield growth, while others (e.g. transfer, information-based) have a positive association.

The chapter is structured as follows. Section I describes the measures of agricultural productivity growth and regulation we use in the empirical analysis. Section II discusses the baseline model for examining the relationship between productivity growth and regulation growth. Section III explains the data sources and the approaches we use to construct key variables. Section IV presents results from the baseline model. Section V walks through a series of robustness checks of the baseline results. Section VI summarizes the findings and discusses implications as well as limitations of the analysis. The appendix includes additional illustrative tables and full regression results.

I. Land Productivity and Regulation

A. Measuring agricultural productivity growth

Productivity measures how much output a production process generates given a certain level of inputs. It is typically calculated as the ratio of output to inputs. Depending on what inputs are considered, there are various measures of agricultural productivity. The most comprehensive measure is multi-factor productivity, or total factor productivity (TFP), which considers the contribution of all inputs including land, labor, capital, and intermediate goods.² Although there is not a uniform approach for measuring TFP,³ the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) estimates agricultural TFP in the U.S.⁴ and other countries.⁵ The U.S. productivity accounts provide estimates of TFP growth at the national and state levels, giving a comprehensive measure of productivity growth in U.S. agriculture.

However, computation of TFP at a more disaggregated level requires additional data. Existing estimates of agricultural TFP are mostly focused on the sectoral level. Sub-sectoral (e.g., industry or commodity-specific) productivity estimates are not usually available due to data limitations.⁶ Given that many farms

² Sun Ling Wang, Paul Heisey, David Schimmelpfennig, and Eldon Ball, "Agricultural Productivity Growth in the United States: Measurement, Trends, and Drivers," Economic Research Service, U.S. Department of Agriculture, ERR-189, July 2015.

³ Arymala Prasad and Zhoudan Xie, "Agricultural Productivity and the Impact of Regulation," The George Washington University Regulatory Studies Center, Transatlantic Agriculture & Regulation Working Paper Series: No. 2, 2017.

⁴ Economic Research Service, U.S. Department of Agriculture (ERS), "Agricultural Productivity in the U.S.," last modified April 4, 2018, https://www.ers.usda.gov/data-products/agricultural-productivity-in-the-us/.

⁵ ERS, "International Agricultural Productivity," last modified October 15, 2018, https://www.ers.usda.gov/data-products/international-agricultural-productivity/.

⁶ Alejandro Nin, Channing Arndt, Thomas W Hertel, and Paul V Preckel, "Bridging the Gap Between Partial and Total Factor Productivity Measures Using Directional Distance Functions," *American Journal of Agricultural Economics* 85, no. 4 (November 2003): 928-942.

are diversified with multiple-commodity production,⁷ it is technically difficult to allocate the use of each input precisely to the production of each commodity.⁸ For example, if a farm has three operators and produces four commodities in a year, how much labor should we count toward each commodity, in the absence of comprehensive data that indicate how employees allocate their time? Such data challenges limit our capability to conduct industry-level analyses using TFP.

Alternatively, a more straightforward and widely used measure is single factor productivity, or partial factor productivity, which refers to output per unit of a single input such as labor, land, or capital. An advantage of single factor productivity is that it is self-explanatory and requires less data and computation power. The standard measures of single factor productivity in agriculture are land productivity (e.g., yield per acre) and labor productivity (e.g., output per worker). Land productivity is more commonly used as a measure of commodity-level productivity, as it is relatively easy to attribute the use of land to different commodity crops compared to labor.

For the reasons considered above, we use growth in crop yield as a measure of agricultural productivity growth. It reflects a useful aspect of productivity growth and is suitable for an industry-level analysis.⁹

B. Measuring regulation

As discussed in Chapter 1, the biggest challenge to incorporating regulation as an explanatory variable in economic analysis is finding a valid measure of the cumulative amount of regulation.¹⁰ Measures of regulation used in the existing literature are mostly limited to government agencies' regulatory spending, or some measure of the amount of regulatory text—such as the word or page volume of a regulation. Several studies use spending by regulatory agencies to estimate the cumulative impact of regulation on various outcomes such as income growth and entrepreneurship,¹¹ economic freedom,¹² and state-level agricultural productivity.¹³ However, government spending to develop and enforce regulations may not correlate well with the economic costs of those regulations, which are largely borne by producers and

https://ag.purdue.edu/commercialag/Documents/Resources/Agricultural-

 $Policy/General \% 20 Farm \% 20 Policy/2015_08_31_Langemeier_A gricultural_Productivity_Growth.pdf.$

⁷ Robert A. Hoppe, "Structure and Finances of U.S. Farms: Family Farm Report, 2014 Edition," U.S. Economic Research Service, Department of Agriculture, EIB-132, December 2014.

⁸ Nin et al. 2003.

⁹ As with all measures, these should be interpreted with caution. Changes in production tend to first occur on the most marginal land, so events that could lead to reduced production of a particular crop often remove the lowest yielding land from the equation, resulting in a *higher* average yield when calculated across a large geography.

¹⁰ Maeve P. Carey, "Methods of Estimating the Total Cost of Federal Regulations," Congressional Research Service Report No. R44348, January 2016, https://fas.org/sgp/crs/misc/R44348.pdf.

¹¹ Noel D. Campbell, Kirk C. Heriot, and Andres Jauregui, "State Regulatory Spending: Boon or Brake for New Enterprise Creation and Income?" *Economic Development Quarterly* 24, no. 3 (2010): 243-250.

¹² Noel D. Campbell, Alex Fayman, and Kirk C. Heriot, "Including U.S. State Government Regulation in the Economic Freedom of North America Index," *The Journal of Private Enterprise* 25, no. 2 (2010): 165-186.

¹³ Levi A. Russell, John M. Crespi, and Michael R. Langemeier, "Agricultural Productivity Growth and Regulation," Draft of First Submission *Public Choice*, August 2015,

consumers and not reflected in fiscal budgets.¹⁴ For example, certain forms of regulation involving stringent requirements may require little regulatory spending to develop and enforce.¹⁵

A more widely used set of measures quantifying the total amount of regulatory activity is the page or word count of regulations. The number of pages in the Federal Register is one of the first proxy measures popular among scholars and practitioners, as the Federal Register documents agencies' daily regulatory actions.¹⁶ However, the page count in the Federal Register is by no means an accurate measure of regulation since it includes both proposed and final rules, as well as items other than rulemakings such as notices of public meetings and availability of guidance documents.¹⁷ One alternative measure is the number of pages in the *Code of Federal Regulations* (CFR). Dawson and Seater use it to examine regulatory impacts on aggregate economic growth.¹⁸ However, CFR page counts can still be an inaccurate measure, since a disproportionate number of diagrams or tables on certain pages of the CFR makes pages less comparable with each other.¹⁹ For that reason, word count is considered to be a more precise measure. A relevant example is the Mulligan and Shleifer study using the number of kilobytes of unannotated state statutes to quantify the amount of law.²⁰ Yet similar concerns arise about whether a longer or shorter regulation implies more or less regulatory burden.

RegData developed by the Mercatus Center at George Mason University provides a more precise measure—"regulatory restrictions" by counting the number of command words (i.e., "shall," "must," "may not," "required," and "prohibited") in the CFR.²¹ The underlying idea is that these command words reflect the extent to which regulations constrain or expand regulated entities' legal choices.²² Further, RegData's estimates of the applicability of regulatory text in a CFR part²³ to specific industries have

¹⁴ Susan Dudley and Melinda Warren, "Regulator's Budget: More for Homeland Security, Less for Environmental Regulation," The George Washington University Regulatory Studies Center, May 2018, https://regulatorystudies.columbian.gwu.edu/fy-2019-regulators-budget-more-homeland-security-less-environmentalregulation.

¹⁵ Prasad and Xie 2017.

¹⁶ Maeve P. Carey, "Counting Regulations: An Overview of Rulemaking, Types of Federal Regulations, and Pages in the Federal Register," Congressional Research Service Report No. R43056, October 2016; Clyde Wayne Crews, Jr., "Ten Thousand Commandments: An Annual Snapshot of the Federal Regulatory State," *Competitive Enterprise Institute*, 2011, https://cei.org/issue-analysis/ten-thousand-commandments-2011; Bentley Coffey, Patrick A. Mclaughlin, and Robert D. Tollison, "Regulators and Redskins," *Public Choice* 153, no. 1-2 (2011): 191-204.

¹⁷ Carey 2016.

¹⁸ Dawson and Seater 2013.

¹⁹ Omar Al-Ubaydli and Patrick A. Mclaughlin, "RegData: A Numerical Database on Industry-specific Regulations for All United States Industries and Federal Regulations, 1997-2012," *Regulation & Governance* 11, no. 1 (2017): 109-123.

²⁰ Casey B. Mulligan and Andrei Shleifer, "The Extent of the Market and the Supply of Regulation," *The Quarterly Journal of Economics* 120, no. 4 (November 2005): 1445-1473.

²¹ Patrick A. McLaughlin and Oliver Sherouse, "RegData US 3.1 Annual (dataset)," QuantGov, accessed December 21, 2018. https://quantgov.org/regdata-us/.

²² Al-Ubaydli and Mclaughlin 2017.

²³ "Part" is a unit of the CFR. The CFR is structured into 50 titles according to subject matter categories, and then broken down into chapters, parts, sections, and paragraphs (*see* https://www.archives.gov/files/federalregister/tutorial/tutorial_060.pdf). See more discussion in Chapter 3.

enabled an emerging body of industry-specific empirical studies on the effects of regulation in the U.S. For example, Goldschlag and Tabarrok use regulatory restrictions to examine the relationship between federal regulation and patterns in the creation of business startups and the pace of job reallocation.²⁴ Similarly, other studies examine the relationship of regulatory restrictions with manufacturing investment,²⁵ value added to GDP by industries,²⁶ consumer prices,²⁷ and industry productivity growth.²⁸ Although it is questionable whether every regulatory restriction in the CFR has the same effect on the economy, this approach provides an innovative and informative measure of regulation that addresses some of the problems with previous measures.

Nevertheless, aggregate measures of regulation developed thus far have not quantified separate forms of regulation. As discussed in Chapter 1 of this report, there are good theoretical reasons to believe that different forms of regulation have heterogeneous effects, but empirical studies have not compared forms in a systematic way due to the lack of data. To remedy this problem, we create a new dataset classifying a large number of CFR parts by their forms following the qualitative coding procedure described in Chapter 3. We then combine it with the RegData restrictions to construct a new measure of restrictions for different forms of regulation. Section III discusses the specific approach we employ to construct the variable.

II. Model

The baseline econometric model consists of three specifications. First, we examine the relationship between growth in total regulation and growth in crop yield. Given that crops have specific growing seasons and regulations usually require some time (typically from several months to a couple of years) for implementation and compliance, regulations are likely to have lagged effects on crop yield.²⁹ Hence, we lag the regulation variables by a year in the model. We then examine the relationship between growth in different regulatory forms and yield growth. Regulatory forms are defined in the Taxonomy of Regulatory Forms introduced in Chapter 2. We perform the analysis for all the second-tier and selected third-tier forms. Third, we add each industry's exposure to natural disasters into the model as a control variable.

²⁴ Nathan Goldschlag and Alex Tabarrok, "Is Regulation to Blame for the Decline in American Entrepreneurship?" *Economic Policy* 33, no. 93 (January 2018): 7-44.

²⁵ Brandon Pizzola, "Business Regulation and Business Investment: Evidence from US Manufacturing 1970–2009," *Journal of Regulatory Economics* 53, no. 3 (May 11, 2018): 243-255.

²⁶ Bentley, McLaughlin, and Peretto 2016.

²⁷ Dustin Chambers, Courtney A. Collins, and Alan Krause, "How Do Federal Regulations Affect Consumer Prices? An Analysis of the Regressive Effects of Regulation," *Public Choice* 180, no. 1 (2019): 57-90.

²⁸ John Fernald, Robert E. Hall, James H. Stock, and Mark W. Watson, "The Disappointing Recovery of Output after 2009," National Bureau of Economic Research, Working Paper 23543, June 2017, accessed October 9, 2019, doi: 10.3386/w23543.

²⁹ We also show regression results using both unlagged and lagged regulation variables, which support our claim on lagged regulatory effects.

A. Total regulation

The first econometric specification is as follows:

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

where *i* is the *i*th 6-digit NAICS industry,³⁰ *t* is the *t*th year, $YG_{i,t}$ (*yield_growth*_{*i*,*t*}) is the weighted average of the annual growth rate in yield of all crops related to industry *i* in year *t*, $TRG_{i,t-1}$ (*total_reg_growth*_{*i*,*t*-1}) is the annual growth rate of regulatory restrictions in all CFR parts relevant to industry *i* in year t - 1, μ_i is the 6-digit NAICS industry fixed effects (FE), *trend*_t is time trend, *trend*_t² is time trend squared, and $\varepsilon_{i,t}$ is the error term.

We convert crop yield and regulatory restrictions into growth rates to ensure that both variables are stationary. By including industry FE, we control for unobserved industry-specific, time-invariant characteristics that affect an industry's yield growth. The time trend variable controls for unobserved factors affecting yield growth that are a function of time; it is typically used to rule out possible spurious relationships between the dependent and independent variables if they have a common trend over time. For example, studies have used time trend as a proxy of technological change in estimating production functions.³¹ The time trend squared variable simply allows the function of time to be non-linear.

B. Regulatory form

In the second specification, we add the growth in regulatory restrictions for a specific regulatory form to the model:

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

where $RFG_{i,t-1}$ (*regform_growth*_{*i*,*t*-1}) is the annual growth rate of regulatory restrictions in the CFR parts that take a particular regulatory form as coded in the taxonomy (e.g., command-and-control regulation) for industry *i* in year t - 1.

We keep the total restriction growth in the specification to control for the effects of regulatory forms other than the form of interest (i.e., $RFG_{i,t-1}$) on yield growth.³² Here we use growth in total restrictions

³⁰ We use 6-digit NAICS industry as the unit of analysis in the econometric analysis, because most of the 6-digit NAICS industries come down to the commodity level, allowing us to precisely link each industry to relevant crops when we measure the yield growth for each industry.

³¹ Thomas F. Cooley and Edward C. Prescott, "Systematic (Non-Random) Variation Models: Varying Parameter Regression: A Theory and Some Applications," *Annals of Economic and Social Measurement* 2, no. 4 (October 1973): 463-473.

³² Since total restrictions also include the restrictions associated with the particular form of interest in the model, we test for multicollinearity on RFG_i and TRG_i and do not find any signs of multicollinearity: the VIF is slightly larger than 1 in all individual industries.

rather than growth in restrictions for all other forms, because it will keep all specifications for different regulatory forms identical except for $RFG_{i,t-1}$, which enables direct comparisons of coefficients on $RFG_{i,t-1}$ among forms. However, we conduct a robustness check replacing the total restriction growth with other restriction growth to examine the sensitivity of results.

C. Controlling for disaster risk

A potentially important factor that is not controlled for by industry FE and time trend is the effect of natural disasters on yield growth. Since different commodity crops are cultivated in different regions, it is very likely that yield growth of different industries is affected differently by natural disasters. Although natural disasters are less likely to be correlated with most of the regulatory forms, an exception might be transfer regulation, which includes disaster assistance payment programs and crop insurance policies. Thus, controlling for disasters can reduce possible endogeneity in certain forms of regulation. The specification is as following:

$$YG_{i,t} = \beta_1 RFG_{i,t-1} + \beta_2 TRG_{i,t-1} + \beta_3 Disaster_{i,t} + \mu_i + \gamma_1 trend_t + \gamma_2 trend_t^2 + \varepsilon_{i,t}$$
(3)

where $Disaster_{i,t}$ is industry *i*'s exposure to natural disasters in year *t*.

In the next section, we discuss how we obtain the data and construct the variables in the econometric specifications.

III. Data

We employ a set of industry-year panel data, covering 25 crop production industries during the 1971-2017 period. The industries are defined by 6-digit code in the North American Industry Classification System (NAICS). Most of the industries are very specific, such as soybean farming and wheat farming, which allows us to link individual commodities to industries. In this section, we explain the process followed to construct three key variables in the econometric analysis: yield growth, growth in restrictions for regulatory forms, and disaster risk.

A. Crop yield

We obtain crop yield data from USDA's National Agricultural Statistics Service (NASS). The original yield data are at the commodity level (e.g. soybean, corn, rice). To convert them to industry level, we create a crosswalk to link individual commodities to 6-digit NAICS codes based on the definitions in the 2017 NAICS Manual (Appendix A).³³ Since many 6-digit NAICS industries are very specific, such as soybean farming (111110) and wheat farming (111140), they are only linked to one or two commodities.

³³ Executive Office of the President, Office of Management and Budget, *North American Industry Classification System*, 2017, https://www.census.gov/eos/www/naics/2017NAICS/2017_NAICS_Manual.pdf.

Others are broader, such as citrus (except orange) groves (111320) and tree nut farming (111335), which link to multiple commodities.

Yield is measured in unit of crops per acre of land, such as bushels per acre and tons per acre. The unit is not uniform across commodities because of different conventional measures for different commodities used by USDA.³⁴ Thus, we calculate the annual growth of yield at the commodity level first, and then use a weighted average to aggregate the yield growth of the relevant commodities into the industry level. Using a weighted average rather a simple average takes into account the relative importance of commodities within an industry. The calculation is as following:

$$yield_growth_{i,t} = \sum_{j=1}^{n} \omega_{j,t} \cdot yield_growth_{j,t}$$

where *j* is the *j*th commodity linked to industry *i*, *yield_growth*_{*j*,*t*} is the annual growth rate in the yield of commodity *j* in year *t*, $\omega_{j,t}$ is the weight equal to the ratio of commodity *j*'s production (measured in dollars) to the total production of all the *n* commodities linked to industry *i* in year *t*.



The constructed variable shows that the average annual growth in crop yield is 1.97 percent (Figure 1). The largest increase is 14.15 percent in 1981, and the largest decrease is -8.64 percent in 1988. The fluctuation becomes smoother in the period after 2000. Figure 2 shows the average annual yield growth for each industry during the period of 1971-2017. All the industries achieved a positive average annual

³⁴ Economic Research Service, U.S. Department of Agriculture (ERS), "Weights, Measures, and Conversion Factors for Agricultural Commodities and Their Products," last modified June 1, 1992, https://www.ers.usda.gov/publications/pubdetails/?pubid=41881.

growth in relevant crop yield, except for sugarcane farming which experienced an average annual decrease of -0.12 percent.



B. Regulatory form

As described in detail in Chapter 3, we conduct qualitative coding to identify the regulatory forms corresponding to parts in the CFR. To link CFR parts to industries, we rely on the relevance estimates in RegData 3.1. The relevance estimates indicate the probability of a CFR part being relevant to a given industry, so it is a continuous rather than a dummy variable. However, during the qualitative coding process, we also find that some of the relevance estimates may not accurately reflect a CFR part's applicability to an industry.³⁵ Therefore, we only use these estimates to identify the sample CFR parts relevant to an industry, rather than using it as an indicator to measure changes of regulation for the industry over time. In particular, we consider a CFR part to be relevant to an industry for the entire period it existed as long as it has a relevance value equal to or larger than 0.2 to the industry in any year. This is also consistent with our sample selection threshold. As a result, we identify 661 unique CFR parts relevant to the 25 crop production industries.³⁶

Next, since in our dataset a CFR part has up to five regulatory forms, we divide the number of restrictive words (i.e., restrictions) in a part in a given year by the number of forms it takes (i.e., we assume a part

³⁵ *See* Chapter 3 of this report.

³⁶ The original sample we coded for forms includes 709 CFR parts, as described in Chapter 3, because it also includes parts estimated to be relevant to animal production industries.

with 100 restrictions and 5 forms to have 20 restrictions per form). Since it is technically difficult (and perhaps impossible) to identify which portion of the text in a CFR part is associated with a particular form, we assume that the restrictions in a part are equally distributed across its forms. We acknowledge that this assumption may seem arbitrary and create some uncertainty in the results, so we also conduct robustness checks using an alternative approach that distributes all the restrictions in a part to every form it takes (i.e., we assume a part with 100 restrictions and 5 forms to have 100 restrictions per form).

To estimate restrictions for each regulatory form at the industry level, we sum up the restrictions in the industry-relevant CFR parts that take a given regulatory form in a given year. The following example illustrates our approach:

Industry	Year	Relevant parts	Restrictions	Regulatory forms	Total restrictions	Restrictions for form 111	Restrictions for form 112	Restrictions for form 113
		1 CFR 1	10	111	10 + 50 + 20	10 + 50/2	50/2 + 20/2 -	
111110	2017	1 CFR 2	50	111, 112	10 + 30 + 20 - 80	10 + 30/2	30/2 + 20/2 =	20/2 = 10
		1 CFR 3	20	112, 113	- 80	- 55	55	

Table 1: An Example of Distributing Restrictions by Form

Finally, we calculate the annual growth in total restrictions and in restrictions for each regulatory form by industry and year. Over all the 25 industries, the average annual growth in total relevant restrictions is 1.44 percent, and the average growth does not vary substantially by industry. Total restrictions presented a continuous increasing trend before 1980, and started to fluctuate afterwards.



C. Disaster risk

We define the disaster risk of an industry as its relevant commodities' exposure to natural disasters in a given year. We use data on the geographical distribution of crop cultivations from NASS and declarations of natural disasters in the Federal Emergency Management Agency (FEMA) database. First, we collect data on area planted for each commodity at the state and county level over the study period from NASS and calculate the percentage of area planted in a state or county in the total area planted of the commodity over the U.S. Then we multiply the percentage by the number of natural disasters in the state or county according to FEMA declarations, and sum all states or counties up for a commodity. The calculation is as follows:

$$disaster_{j,t} = \sum_{k=1}^{m} \frac{area_{k,t}}{total_area_{j,t}} \cdot disaster_{k,t}$$

where *j* is the *j*th commodity linked to industry *i*, *k* is the *k*th state or county where commodity *j* was planted, $disaster_{j,t}$ is the disaster risk for commodity *j* in year *t*, $disaster_{k,t}$ is the number of natural disasters declared in state or county *k* in year *t*, $area_{k,t}$ is the area planted of commodity *j* in state or county *k* in year *t*, $total_area_{j,t}$ is the total area planted of commodity *j* in the U.S. in year *t*.

Finally, we generate an industry-level measure of disasters by aggregating the commodity-level disaster risk using the same approach we use for yield growth:

$$disaster_{i,t} = \sum_{j=1}^{n} \omega_{j,t} \cdot disaster_{j,t}$$

where $\omega_{j,t}$ is the weight equal to the ratio of commodity *j*'s production (measured in dollars) to the total production of all the *n* commodities linked to industry *i* in year *t*.

The FEMA disaster declarations contain various incident types such as drought, fire, flood, snow, and storm since 1953. Therefore, it captures most of the possible extreme natural conditions that might affect crop production during our study period.³⁷ Figure 4 shows the total number of disasters declared in 50 states and the District of Columbia over the period of 1971-2017. Of these, severe storm, hurricane, and flood are the most frequently declared disasters. Year 2005 marks a peak due to a large number of hurricanes during the Atlantic hurricane season—known as the most active Atlantic hurricane season in recorded history.

³⁷ Note that FEMA declarations do not capture USDA disasters due to early frost or drought conditions. For example, the FEMA database does not cover agricultural droughts in the Midwest (such as in 1988 or 2012) or the ones in the Southeast in the early 1990s. In that sense, disaster declarations by the Secretary of Agriculture might be a better data source for identifying disaster risk for commodities. However, there is no archive of past declarations by the Secretary spanning the timeframe of interest.



Disaster declarations also present a disproportionate geographical distribution. Texas, Missouri, Kentucky, and Virginia have the most declarations, while Wyoming and Nevada have the least.³⁸ The geographical distribution of disasters and crop cultivation results in varied levels of disaster risks for different commodities and industries. Although county-level area planted data might be more precise for assessing how much a commodity was affected by natural disasters in a given year, county-level data are only available for field crops. Hence, we use state-level data in the baseline model and use county-level data in a robustness check. Still, state-level area planted data are only available for the crops associated with 19 of the 25 industries in our sample, and county-level data are only available for 12 industries.

Table 2 shows the summary statistics of the primary variables.

³⁸ The District of Columbia, Delaware, and Hawaii have even less declarations, but they are less comparable to the other states because of their substantially smaller geographical area.

Table 2: Summary Statistics

Variable	Description	Obs	Mean	S.D.	Min	Max
	Dependent Varia	able				
yield_growth	Annual growth rate in the yield of the crops associated with an industry in a year	962	1.98	13.74	-60.00	200.00
	Control Variab	ole				
disaster_state	Disaster risk an industry was exposed to in a year, calculated by state-level disaster data	715	27.09	38.59	0.00	502.76
disaster_county	Disaster risk an industry was exposed to in a year, calculated by county-level disaster data	553	0.26	0.32	0.00	2.52
	Total Regulation	on				
total_reg_growth	Annual growth rate in regulatory restrictions in all CFR parts relevant to an industry in a year	1,175	1.44	3.96	-9.51	21.27
	Second-tier Regulatory Form (Regform_	growth)			
Price		1,139	8.13	48.51	-100.00	352.63
Quantity		1,175	-2.99	15.04	-80.09	27.57
Entry-and-exit		1,175	3.28	7.24	-12.90	50.15
Service quality	Annual growth rate in regulatory	1,175	1.11	12.77	-54.78	83.42
Command-and-control	restrictions in the CFR parts that	1,175	2.92	6.56	-8.99	44.21
Market-based	for an industry in a year	1,175	5.30	14.49	-32.18	74.46
Information-based		1,175	3.03	13.27	-70.28	152.96
Transfer		1,175	0.05	6.25	-18.44	36.55
Administrative		1,175	1.07	8.20	-41.34	53.86
	Third-tier Regulatory Form (I	Regform_g	rowth)			
Licensing		1,175	3.54	9.24	-23.17	55.64
Certification		1,175	1.99	9.15	-27.48	84.40
Monitoring, reporting and verification	Annual growth rate in regulatory	1,175	1.88	4.81	-21.31	18.58
Performance standards	restrictions in the CFR parts that	1,175	4.66	19.00	-15.14	139.63
Permitting	take the particular regulatory form	1,175	4.02	6.85	-17.09	60.20
Pre-market notice and approval	for an industry in a year	1,118	4.70	30.99	-66.51	360.81
Means-based standards		1,175	9.43	39.37	-89.49	559.18
Prohibitions		1,165	68.30	664.88	-100.00	8870.00

IV. Results

In this section, we present the results from the baseline specifications. In short, we find a statistically significant, negative relationship between total regulatory restriction growth and yield growth. The relationship differs depending on the form of regulation. In particular, growth in command-and-control, entry-and-exit, and administrative regulations shows a negative relationship with yield growth, while growth in transfer and information-based regulations demonstrates a positive relationship with yield growth.

A. Total regulation

In general, the growth in total regulatory restrictions in a year has a statistically significant, negative relationship with the growth in crop yield in the following year. As shown in columns (1), (3), (5) and (7) of Table 3, the results of baseline specification (1) show that a one percentage-point increase in regulatory restriction growth is associated with an approximately 0.28 percentage-point decrease in crop yield growth. The relationship is robust in OLS, industry FE, and industry FE with time trend specifications.

To verify the assumption of lagged effects of regulation, we also add total restriction growth with no lags to the specification. As seen in columns (2), (4), (6) and (8) of Table 3, results do not change for lagged restriction growth, the current year's restriction growth has no statistically significant relationship with productivity growth. This implies that specifications with the lagged restriction growth provide a better fit. We also run regressions that lag the restriction variable by two years, but this specification does not fit the data as well as the one-year lag.

As Table 2 shows, the average annual growth rate of crop yield is 2 percent, so a 0.28 percentage-point relationship between regulation growth and yield growth might not be so small. However, note that the R-squared in these regressions is low, which suggests that variables in the regression explain only a small portion of the variation in yield growth; many other factors not included in the regressions also affect yield growth.³⁹

³⁹ Examples include the quality of land, the quality and quantity of other inputs, and technical changes. See Chapter 1 for a discussion on drivers of productivity growth.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: yield_growth	OLS	OLS	OLS + Time Trend	OLS + Time Trend	Industry FE	Industry FE	Industry FE + Time Trend	Industry FE + Time Trend
L.total_reg_growth	-0.2672**	-0.2598**	-0.2895**	-0.2868**	-0.2634***	-0.2563***	-0.2863***	-0.2838***
	(0.021)	(0.025)	(0.023)	(0.024)	(0.005)	(0.009)	(0.008)	(0.008)
total reg growth		-0.0459		-0.0812		-0.0444		-0.0792
		(0.642)		(0.502)		(0.542)		(0.290)
time			-0.1092	-0.1437			-0.0962	-0.1299
			(0.431)	(0.358)			(0.235)	(0.124)
time2			0.0020	0.0025			0.0016	0.0022
			(0.454)	(0.373)			(0.308)	(0.200)
Constant	2.3720***	2.4270***	3.5709**	4.1276*	2.3667***	2.4202***	3.5044***	4.0494***
	(0.000)	(0.000)	(0.049)	(0.065)	(0.000)	(0.000)	(0.001)	(0.000)
Observations	928	928	928	928	928	928	928	928
R-squared	0.006	0.006	0.006	0.007	0.006	0.006	0.006	0.006
Prob > F	0.0213	0.0674	0.1270	0.2110	0.0050	0.0060	0.0240	0.0302
Number of industries					25	25	25	25

Table 3: Yield Growth and Total Restriction Growth

Robust p-value in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

B. Regulatory form

To examine whether the relationship between regulatory restriction growth and yield growth varies by the form of regulation, we run the baseline specification (2) for all second-tier and select third-tier regulatory forms as defined in the Taxonomy of Regulatory Forms in Chapter 2. Because the taxonomy is intended to cover all forms of regulation, some third-tier forms are not applicable to regulations affecting crop farming industries, such as rate of return, certificate of need, and taxes and fees. As a result, we have few or no CFR parts that take these forms in the sample. Therefore, we only focus on forms with a relatively high frequency (see Appendix B).

1. Second-tier forms

Second-tier regulatory forms include price, quantity, entry-and-exit, service quality, command-andcontrol, market-based, information-based, transfer, and administrative regulations. Chapter 2 specifies the definitions and examples of each form. Similar to total restriction growth, we run regressions in OLS, OLS with time trend, industry FE, and industry FE with time trend on restriction growth for each regulatory form. Table 4 presents the results for all second-tier forms from the industry FE with time trend specification (see all results in Appendix C-1). The results suggest that the relationship between regulatory restriction growth and yield growth differs by regulatory form. In particular, growth in restrictions associated with command-and-control, entry-and-exit, and administrative regulations have a statistically significant negative relationship with yield growth, while growth in restrictions associated with transfer and information-based regulations has a statistically significant positive relationship with yield growth. The results are consistent in OLS and other specifications.

Column (5) of Table 4 shows that a one percentage-point increase in the growth of command-and-control regulatory restrictions is associated with approximately 0.3 percentage-point decrease in yield growth. Also, column (3) shows that a one percentage-point increase in the growth of entry-and-exit regulatory restrictions is associated with approximately 0.14 percentage-point decrease in yield growth. Although the coefficient on entry-and-exit restrictions is only marginally significant (p-value = 0.054) in the industry FE with time trend, it is statistically significant at the 0.05 or 0.01 level in all the other specifications. As shown in column (9), a one percentage-point increase in the growth of administrative regulatory restrictions is associated with approximately 0.13 percentage-point decrease in yield growth.

On the other hand, column (8) shows that a one percentage-point increase in the growth of restrictions for transfer regulation is associated with an approximately 0.35 percentage-point increase in yield growth. Also, column (7) indicates that a one percentage-point increase in the growth of information-based regulatory restrictions is associated with an approximately 0.09 percentage-point increase in yield growth.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable: yield_growth	Price	Quantity	Entry-and- Exit	Service Quality	Command- and-Control	Market- based	Information- based	Transfer	Administrati ve
L.regform_growth	0.0084	0.0098	-0.1363*	-0.0331	-0.3041***	0.0124	0.0950**	0.3490**	-0.1330***
	(0.395)	(0.632)	(0.054)	(0.425)	(0.005)	(0.828)	(0.012)	(0.021)	(0.006)
L.total_reg_growth	-0.2981***	-0.2962**	-0.1941**	-0.2875***	0.0809	-0.2978***	-0.2981***	-0.6845***	-0.2467**
	(0.006)	(0.012)	(0.014)	(0.007)	(0.406)	(0.009)	(0.006)	(0.007)	(0.010)
time	-0.0886	-0.0916	-0.0603	-0.0947	-0.1360	-0.0833	-0.1822*	-0.1170	-0.0815
	(0.284)	(0.232)	(0.445)	(0.244)	(0.107)	(0.409)	(0.087)	(0.150)	(0.300)
time2	0.0014	0.0016	0.0008	0.0016	0.0021	0.0015	0.0033	0.0018	0.0012
	(0.418)	(0.309)	(0.622)	(0.336)	(0.188)	(0.411)	(0.108)	(0.259)	(0.454)
Constant	3.5067***	3.4778***	3.6102***	3.5784***	4.4921***	3.2645**	4.0987***	4.4914***	3.6136***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.032)	(0.001)	(0.000)	(0.000)
Observations	918	928	928	928	928	928	928	928	928
R-squared	0.007	0.006	0.010	0.007	0.015	0.006	0.013	0.017	0.012
Prob > F	0.0292	0.0376	0.0478	0.0236	0.0386	0.0362	0.0036	0.0454	0.0278
Number of industries	25	25	25	25	25	25	25	25	25

 Table 4: Yield Growth and Restriction Growth for Second-tier Regulatory Forms (Industry FE + Time Trend Model)

Robust p-value in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Coefficients on the other regulatory forms are not statistically significant and very close to zero, so we cannot draw any conclusions on these forms.

Comparing the relative magnitude of the coefficients, a preliminary finding is that the negative relationship between total regulatory restriction growth and yield growth is mostly attributed to the growth in command-and-control regulation, entry-and-exit regulation, and administrative regulation. However, we also notice that the standard deviations of the restriction growth for different forms are very different, ranging from 6.25 to 48.51 (Table 2). So, a one percentage-point increase in a form may not be equivalent to a one percentage-point increase in another form, which would make the coefficients not directly comparable. Therefore, we also compare the R-squared values across different forms to examine which forms explain a larger proportion of the variation in yield growth. This is possible because in these specifications, everything is equal except the particular form of interest.

As shown in Table 5, although the R-squared values are generally small, they generate a consistent ranking of forms over all specifications. Among the forms that are negatively associated with yield growth, growth in command-and-control, administrative, and entry-and-exit regulations explains a larger proportion of the variation in yield growth than the other forms. Growth in transfer, and information-based regulations has a stronger association with yield growth in the positive direction.

	Sign of the		R-s	squared	
	Coefficient	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
Transfer	Positive	0.016	0.017	0.016	0.017
Command-and- Control	Negative	0.014	0.015	0.014	0.015
Information- based	Positive	0.012	0.013	0.012	0.013
Administrative	Negative	0.011	0.012	0.012	0.012
Entry-and-Exit	Negative	0.011	0.011	0.01	0.01
Price	Positive	0.007	0.007	0.007	0.007
Service Quality	Negative	0.007	0.007	0.007	0.007
Market-based	Positive	0.006	0.006	0.006	0.006
Quantity	Positive	0.006	0.006	0.006	0.006

Table 5: A comparison of Robust R-squared

The R-squared values are from regression results in Appendix C-1. The OLS specification corresponds to the second OLS specification in Appendix C-1, which controls for total restriction growth.

2. Third-tier forms

Given our results on second-tier forms, we further analyze whether specific regulatory forms contribute more to the negative or positive relationship between the broader forms and yield. Here we focus on all the third-tier forms under command-and-control regulation, including monitoring, reporting, and verification (MRV) requirements, performance standards, permitting, pre-market notice and approval, means-based standards, and prohibitions, as well as select third-tier forms under entry-and-exit

regulation, including licensing and certification. We focus on these forms for two reasons. First, these forms are more applicable to regulations affecting the crop production industries; in other words, they all have a higher frequency in the sample (Appendix B). Second, the forms under command-and-control regulation and entry-and-exit regulation are more different in nature, so a comparison of them is of more general research interest. For example, scholars often compare performance-based regulation with means-based regulation.⁴⁰ In contrast, forms under transfer regulation, including monetary transfer, technology transfer, user fees, and knowledge sharing are more similar in terms of regulatory objectives and the level of flexibility given to regulated entities.

As a result, we find that growth in certification requirements has a larger and statistically significant, negative relationship with yield growth, compared to licensing requirements. The coefficient in column (2) indicates that a one percentage-point increase in the growth of regulatory restrictions for certification is associated with approximately 0.11 percentage-point decrease in yield growth. Under command-and-control regulation, growth in MRV requirements has the largest and statistically significant negative relationship with yield growth. As seen in Column (3), a one percentage-point increase in the growth of MRV regulatory restrictions is associated with approximately 0.23 percentage-point decrease in yield growth. Similar to the second-tier form results, the signs and significance of the coefficients are consistent in OLS and other specifications (see all results in Appendix C-2).

⁴⁰ Christopher Carrigan and Cary Coglianese, "The Politics of Regulation: From New Institutionalism to New Governance," *Annual Review of Political Science* 14, no. 1 (2011): 107-129; Cary Coglianese, "The Limits of Performance-Based Regulation," *University of Michigan Journal of Law Reform* 50, no. 3 (2017): 525-563.

Table 6: Yield Growth and Restriction Growth for Third-tier Regulatory Forms (Industry FE + Time Trend Model)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: yield_growth	Licensing	Certification	MRV	Performance standards	Permitting	Pre-market notice & approval	Means-based standards	Prohibitions
	0.0554			0.0420	0.0120	0.001 5	0.0145	0.0007
L.regform_growth	-0.0554	-0.10/6**	-0.2272***	-0.0438	-0.0138	-0.0015	-0.0145	-0.0005
	(0.151)	(0.019)	(0.003)	(0.196)	(0.936)	(0.873)	(0.139)	(0.146)
L.total_reg_growth	-0.2732***	-0.2309**	-0.1558*	-0.1567	-0.2777**	-0.2523**	-0.2876***	-0.2814***
	(0.008)	(0.015)	(0.079)	(0.169)	(0.036)	(0.018)	(0.007)	(0.010)
time	-0.1089	-0.0198	-0.0850	-0.1113	-0.0943	-0.1733**	-0.0915	-0.0888
	(0.181)	(0.819)	(0.290)	(0.182)	(0.268)	(0.033)	(0.253)	(0.282)
time2	0.0018	0.0002	0.0015	0.0018	0.0016	0.0029*	0.0015	0.0015
	(0.274)	(0.929)	(0.345)	(0.273)	(0.374)	(0.078)	(0.353)	(0.374)
Constant	3.9081***	2.9395***	3.5911***	3.8010***	3.5445***	4.5268***	3.6766***	3.5376***
	(0.000)	(0.003)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.001)
Observations	928	928	928	928	928	891	928	923
R-squared	0.007	0.011	0.011	0.008	0.006	0.005	0.008	0.006
Prob > F	0.0501	0.0415	0.0093	0.0528	0.0319	0.0597	0.0208	0.0294
Number of industries	25	25	25	25	25	25	25	25

Robust p-value in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

C. Controlling for disaster risk

Controlling for disaster risk, the relationships found above all become stronger. As shown in column (1) of Table 7, the coefficient on total restriction growth is still statistically significant at the 0.01 level, and the magnitude increases from 0.28 to 0.37 in the negative direction after controlling for disaster risk.

The coefficients on restriction growth for individual regulatory forms remain statistically significant and mostly become larger in terms of the magnitude. Table 7 shows that, holding the level of disaster risk constant, the coefficient on growth in command-and-control regulatory restrictions is still statistically significant at the 0.01 level, and the magnitude increases from 0.30 to 0.41 in the negative direction. The coefficient on entry-and-exit restriction growth becomes statistically significant at the 0.05 level (which was only statistically significant at the 0.1 level before), and the magnitude increases from 0.14 to 0.18 in the negative direction. Further, a one percentage-point increase in the growth of transfer restrictions is associated with 0.51 percentage-point increase in yield growth after controlling for disaster risk, compared to 0.35 before.

The negative relationship between growth in certification and MRV restrictions and yield growth is also reinforced in terms of both significance and magnitude when controlling for disaster risk (Table 8). The coefficient on certification restriction growth becomes statistically significant at the 0.01 level (compared to 0.05 level before) and increases from 0.11 to 0.15 in the negative direction. The negative relationship between MRV restriction growth and yield growth also increases from 0.23 to 0.33. The most outstanding change is on the relationship between growth in permitting and yield growth. The coefficient on permitting restriction growth was close to zero and not statistically significant before but becomes -0.18 and statistically significant at the 0.01 level after controlling for disaster risk. The relationship between growth in prohibitions and yield growth also becomes statistically significant, but the magnitude is still very small (-0.0006).

Table 7: Yield Growth and Restriction Growth, Controlling for Disaster (Industry FE + Time Trend Model)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable: yield_growth	Total	Price	Quantity	Entry-and- Exit	Service Quality	Command- and- Control	Market- based	Information -based	Transfer	Administra tive
L.regform_growth		0.0109 (0.413)	0.0025	-0.1753** (0.024)	0.0119 (0.679)	-0.4081*** (0.002)	-0.0449 (0.117)	0.0931** (0.034)	0.5073*** (0.001)	-0.1319** (0.045)
L.total_reg_growth	-0.3668***	-0.3783***	-0.3695**	-0.2490***	-0.3667***	0.1261	-0.3248**	-0.3772***	-0.9384***	-0.3263***
	(0.006)	(0.004)	(0.012)	(0.008)	(0.006)	(0.318)	(0.011)	(0.005)	(0.001)	(0.005)
disaster_state	-0.0320***	-0.0303***	-0.0320***	-0.0270***	-0.0319***	-0.0282***	-0.0322***	-0.0301***	-0.0228**	-0.0314***
	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)	(0.002)	(0.001)	(0.002)	(0.014)	(0.001)
Time	-0.0493	-0.0447	-0.0480	-0.0148	-0.0500	-0.1181	-0.0969	-0.1340	-0.1037	-0.0240
	(0.641)	(0.678)	(0.632)	(0.884)	(0.636)	(0.270)	(0.429)	(0.328)	(0.321)	(0.815)
time2	0.0012	0.0010	0.0012	0.0003	0.0013	0.0021	0.0019	0.0028	0.0017	0.0006
	(0.562)	(0.669)	(0.555)	(0.901)	(0.552)	(0.324)	(0.426)	(0.285)	(0.405)	(0.768)
Constant	3.7282***	3.7205***	3.7204***	3.9422***	3.7009***	5.1954***	4.6082***	4.2384***	5.2905***	3.6541***
	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.000)	(0.005)	(0.005)	(0.001)	(0.003)
Observations	685	685	685	685	685	685	685	685	685	685
R-squared	0.022	0.024	0.022	0.032	0.022	0.044	0.024	0.032	0.051	0.029
Prob > F	0.0002	0.0004	0.0002	0.0003	0.0003	0.0004	0.0003	0.0002	0.0006	0.0002
Number of industries	19	19	19	19	19	19	19	19	19	19

Robust p-value in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Yield Growth and Restriction Growth, Controlling	g for Disaster (Industr	y FE + Time Trend Model)
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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: yield_growth	Licensing	Certification	MRV	Performance standards	Permitting	Pre-market notice & approval	Means-based standards	Prohibitions
	0.0506			0.0465	0.10054	0.0000	0.0000	
L.regform_growth	-0.0586	-0.1517***	-0.3331***	-0.0465	-0.1827***	-0.0030	-0.0098	-0.0006**
	(0.166)	(0.002)	(0.000)	(0.272)	(0.006)	(0.775)	(0.141)	(0.043)
L.total_reg_growth	-0.3520***	-0.2944**	-0.1730	-0.2336*	-0.2438**	-0.3420**	-0.3636***	-0.3693***
	(0.006)	(0.011)	(0.119)	(0.097)	(0.020)	(0.010)	(0.006)	(0.005)
disaster_state	-0.0285***	-0.0349***	-0.0340***	-0.0317***	-0.0296***	-0.0304***	-0.0310***	-0.0324***
	(0.007)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
time	-0.0699	0.0600	-0.0341	-0.0681	-0.0320	-0.1060	-0.0471	-0.0532
	(0.512)	(0.591)	(0.743)	(0.524)	(0.746)	(0.294)	(0.653)	(0.612)
time2	0.0014	-0.0009	0.0011	0.0014	0.0006	0.0021	0.0011	0.0012
	(0.503)	(0.698)	(0.609)	(0.506)	(0.766)	(0.308)	(0.591)	(0.561)
Constant	4.1924***	3.0000**	3.9124***	4.0742***	4.3378***	4.4692***	3.8174***	3.8975***
	(0.003)	(0.013)	(0.002)	(0.002)	(0.002)	(0.000)	(0.003)	(0.002)
Observations	685	685	685	685	685	659	685	685
R-squared	0.024	0.036	0.036	0.025	0.032	0.019	0.023	0.023
Prob > F	0.0003	0.0003	0.0001	0.0002	0.0004	0.0001	0.0003	0.0000
Number of industries	19	19	19	19	19	19	19	19

Robust p-value in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

V. Robustness Checks

We perform various robustness checks to assess the sensitivity of the baseline results. Appendix D reports the results.

(1) Using an alternative approach to distribute restrictive word counts by form

In the baseline analysis, we distribute the restrictive word count in a CFR part to regulatory forms by equally dividing the word count by the number of forms the part takes. However, we establish this assumption due to technical difficulty rather than theoretical foundation, and we acknowledge that this approach might over-count certain regulatory forms while under-counting others. To check the sensitivity of the results to this assumption, we use an alternative approach to construct the *regform_growth* variables by assuming all the restrictive word count in a CFR part is associated with all the forms it takes. That is, if a CFR part has X number of restrictive words and Y number of regulatory forms, the word count distributed to each of the Y form will be X.

Columns (1) in Appendix D-1 and D-2 contain the results from the industry FE and time trend specification, controlling for disaster risk. The results reveal similar relationships between yield growth and restriction growth for second-tier regulatory forms. On the third-tier forms, the coefficients on certification, MRV, permitting, and prohibition also reveal the same signs and similar magnitude to the baseline results. In addition, the coefficient on means-based regulation become statistically significant, although the magnitude is small (around 0.02).

(2) Adjusting restrictions for MRV

During our coding process as described in Chapter 2, we notice that many regulations contain MRV requirements. Unlike other forms of regulation, MRV requirements are often used as a secondary regulatory form that attempts to ensure the compliance with another form of regulation. Due to our word distribution strategy, it is likely that the restriction growth for MRV is picking up the effects of other forms of regulation. If that is the case, the relationship between MRV restriction growth and yield growth may be over-estimated. To test this, we remove MRV as a form from the coding results for CFR parts unless it is a stand-alone form for a part, and then use the same approach to distribute word counts and calculate restriction growth. For example, if a CFR part is coded as means-based standards and MRV requirements, we remove MRV and consider means-based standards as the only form for the part. Although this adjustment would likely under-estimate the relationship between MRV and yield growth, it is important to see whether this changes the coefficients on other regulatory forms.

As observed in column (2) of Appendix D, adjusting MRV restrictions diminishes the magnitude of coefficients on MRV as well as the command-and-control regulation it accompanies, but has little impact on the other forms of regulation. The results imply that counting MRV as a major regulatory form like others does not obscure the association between other forms and yield growth. In other words, we can likely attribute explanatory power to the baseline results for MRV.

(3) Using total word counts instead of restrictive word counts

Since some forms of regulation generally use more restrictive words than others (e.g., command-andcontrol regulation compared to market-based regulation), the form itself might be correlated with the restrictive word count. Hence, in this test, we construct the *total_reg_growth* and *regform_growth* variables by using total word counts rather than restrictive word counts in CFR parts.⁴¹ The calculation follows the same approach as restrictive word counts in the baseline analysis.

As shown in columns (3) of Appendix D, using total word counts does not affect the relationships found in the baseline analysis, except for information-based regulation, whose coefficient is no longer statistically significant. Further, the results show a statistically significant coefficient on performance standards, indicating that a one percentage-point increase in the restriction growth for performance standards is associated with approximately 0.15 percentage-point decrease in yield growth.

(4) Controlling for county-level disaster risk

In the baseline analysis, we use state-level area planted data to assess a commodity's exposure to natural disasters. In this test, we use county-level area planted data to construct the disaster variable. County-level data should capture a commodity's disaster risk in a more precise way, but the data are only available for field crops, so it reduces the number of industries in the econometric analysis.

Results are in column (4) of Appendix D, showing that controlling for county-level disaster risk reinforces most of the relationships (i.e., keeping the statistical significance and increasing the magnitude of the coefficients). A difference it makes is that restriction growth for market-based regulation shows a significantly negative relationship with yield growth (with a magnitude of 0.07). The negative relationship on performance standards also becomes statistically significant.

(5) Controlling for other regulation growth instead of total regulation growth

In the baseline specifications, we control for total restriction growth when looking at individual regulatory forms, for the sake of direct comparisons of coefficients across forms. Since the purpose of adding the control variable is to hold constant the effects of other regulatory forms on yield growth, it is more intuitive to use restriction growth for all regulations except the regulatory form of interest (i.e., the independent variable of interest) instead of total restriction growth.

As seen in column (5) of Appendix D, all the relationships found in the baseline analysis hold in this test. Although the coefficients on market-based regulation and means-based standards from the industry FE and time trend specification are marginally significant, they are not robust in other specifications

⁴¹ However, Ellig and McLaughlin (2016) find that restrictions yield a better fit than word counts when examining the relationship between rail safety regulations and railroad safety outcome measures. *See* Jerry Ellig and Patrick McLaughlin, "The Regulatory Determinants of Railroad Safety," *Review of Industrial Organization* 49, no. 2 (2016): 371-398.

such as OLS and industry FE only. However, similar to the previous tests, the relationship between restriction growth for performance standards and yield growth becomes significantly negative in all specifications.

(6) Using expert judgment to exclude irrelevant CFR parts

As discussed in Chapter 3, we rely on RegData's estimates of industry relevance to select the sample of regulations affecting agricultural activities. We notice that, among the 661 CFR parts that are estimated to be relevant to at least one crop, some parts do not seem to have a clear linkage to any agriculture activity. For example, 5 CFR 792 (Federal Employees' Health, Counseling, and Work/Life Programs) and 10 CFR 11 (Criteria and Procedures for Determining Eligibility for Access to or Control over Special Nuclear Material) can hardly affect crop production. Therefore, to examine whether our estimates are biased by these "irrelevant" regulations, we conduct a robustness check by using only a subset of the sample regulations that are theoretically likely to affect crop production. We select this subset relying on expert judgement from USDA.⁴² According to the expert judgement, there are 196 of the 661 CFR parts that are unlikely to be related to agriculture, so the subset sample includes 465 CFR parts.

Using the same regression models as the baseline analysis, the results using the 465 parts are shown in column (6) of Appendix D. The results are generally consistent with the baseline results. Growth in entry-and-exit and command-and-control regulatory restrictions still shows a statistically significant negative relationship with yield growth, and the magnitude is even larger than the results using 661 parts. The same is true for the positive association between growth in information-based and transfer regulations and yield growth. With regard to the third-tier regulatory forms, growth in regulatory restrictions associated with certification and MRV still has a statistically significant, and larger, relationship with yield growth. The negative coefficient on licensing becomes marginally significant. An exception is prohibition. The results show a statistically significant, positive association between growth in regulatory restrictions related to prohibition and yield growth. This is different from the baseline results and results from all the other robustness checks, where prohibition only has a close-to-zero coefficient; this result also conflicts with theory. An explanation may be that eliminating the irrelevant parts by expert judgement reduces the sample size, leaving only seven CFR parts that take a form of prohibition in the sample. The small sample size reduces the statistical power of the analysis, making the statistically significant result not reflect a true effect.⁴³

To summarize the results of the robustness checks, the relationships between yield growth and restriction growth for command-and-control, entry-and-exit, administrative, transfer, and information-based regulations found in the baseline analysis are robust. Changing different assumptions and control

⁴² A team of agricultural experts in USDA went through the 661 CFR parts and marked those that are unlikely to be related to agriculture. The subset sample excludes these marked parts from the 661 parts.

⁴³ Katherine S. Button, John P. A. Ioannidis, Claire Mokrysz, Brian A. Nosek, Jonathan Flint, Emma S. J. Robinson, and Marcus R. Munafò, "Power Failure: Why Small Sample Size Undermines the Reliability of Neuroscience," *Nature Reviews Neuroscience* 14 (May 2013): 365-376.

variables in the analysis changes the magnitude of some coefficients but does not change the sign or significance. In addition, three of the five tests above suggest a significantly negative association between restriction growth for performance standards and yield growth.

VI. Discussion and Conclusion

In this study, we analyze the relationship between growth in regulations that take different forms and growth in land productivity. We use growth in crop yield as a measure of land productivity growth for 25 agricultural industries from 1971 to 2017. To quantify regulation, we use the count of restrictive words in CFR from RegData and combine it with our classification of regulatory forms. We aggregate restrictive word counts of each individual regulation into total restrictions for each industry based on the industry relevance estimates in RegData. In the econometric model, we add industry fixed effects and time trend variables to control for certain unobserved factors affecting yield growth. In addition, we control for the disaster risk to which each industry was exposed in each year. We also conduct a series of robustness checks to test the sensitivity of the baseline results. In this section, we summarize our findings and discuss the implications and limitations of the results.

A. Implications

The econometric analysis has at least two implications. First, it suggests that growth in total regulatory restrictions has a negative relationship with growth in crop yield. Second, the relationship differs depending on regulatory forms. If increasing farm productivity is a goal of regulatory reform, decision-makers can most effectively accomplish this goal by focusing on the forms of regulation shown to have negative effects on productivity. And regulatory reform could potentially be a "win-win," if decision-makers find ways to accomplish important public goals by replacing forms of regulation that diminish productivity with forms that have no effect or increase productivity.

With respect to specific regulatory forms, we find that growth in command-and-control regulation has the largest negative relationship with yield growth. Command-and-control regulation is a traditional form of regulation, commonly used in regulating environmental and safety issues. It typically prescribes actions, technologies, or targets that regulated entities must implement or comply with.⁴⁴ Command-and-control regulation has been frequently viewed as costly or inflexible relative to market-based or information-based regulation.⁴⁵ Our finding is consistent with this theoretical view.

Under command-and-control regulation, growth in MRV requirements and permitting has the largest negative relationship with yield growth. MRV requirements are inherent in many agriculture-related regulations,⁴⁶ and our empirical finding suggests that they might impose a substantial burden on

⁴⁴ Christopher Carrigan and Elise Harrington, "Choices in Regulatory Program Design and Enforcement," Penn Program on Regulation, June 2015, https://www.law.upenn.edu/live/files/4706-carriganharrington-ppr-researchpaper062015pdf.

⁴⁵ Carrigan and Coglianese 2011.

⁴⁶ See Chapter 3 for the frequency of each regulatory form.

productivity growth. Although scholars have often argued that performance standards bring more flexibility than means-based standards since regulated entities are allowed to adopt the most cost-effective technology to achieve required targets,⁴⁷ we do not find empirical evidence for that in our analysis.

As a form of economic regulation, entry-and-exit regulation is extremely costly for business start-ups,⁴⁸ and our findings suggest that it might also have a negative impact on yield growth. Under entry-and-exit regulation, growth in certification requirements has a larger negative relationship with yield growth than licensing. This might suggest that licensing is a more flexible regulatory form than certification. The findings are consistent with our definitions of the two forms, in which certification requires inspection and approval every time a relevant operation is conducted, while licensing is granted to a person who can conduct relevant operations at any authorized location at any time during the authorized period.

Further, growth in transfer regulation is associated with a large positive relationship with yield growth. Transfer regulation includes monetary transfer from government to farmers, technology transfer from government to farmers, user fees required for government services, and knowledge sharing between government and farmers. They are all intended to support farmers' incomes or farming activities, and thus can stimulate productivity growth. However, one factor that might introduce endogeneity is that certain disaster payment and crop insurance programs are a response to a low yield in a previous growing season. Hence, such programs are almost always associated with higher yields in subsequent years after the disaster has passed. For that reason, the positive relationship between growth in transfer regulation and yield growth is likely to be overestimated. Nonetheless, it does not mean that the positive estimates are completely meaningless. Controlling for disaster risk in the model has at least reduced part of the endogeneity problem, although FEMA disaster declarations may not capture all the disastrous events affecting crops or other factors that reduced yields and triggered a transfer program. Also, disaster payment and crop insurance programs in response to low yields are only one type of transfer regulations; other types of monetary transfers, technology transfers, and knowledge sharing may actually have productivity enhancing effects.

Growth in information-based regulation has a small positive association with yield growth. One explanation may be that requirements such as hazard warning and contingency planning improve workplace safety and help regulated entities recognize the risks inherent in their operations, eventually increasing productivity. Scholars sometimes refer to this approach as management-based regulation. For example, Carrigan and Harrington argue that "The fact that management-based regulation requires an

⁴⁷ Carrigan and Coglianese 2011; Michael E. Porter and Claas Van Der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives* 9, no. 4 (Fall 1995): 97-118.

⁴⁸ Simeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, "The Regulation of Entry," National Bureau of Economic Research, Working Paper 7892, September 2000, accessed October 16, 2018, doi: 10.3386/w7892.

examination of certain risks or problems may encourage firms to leverage this investment and identify opportunities for additional modifications to operations" (p. 19).⁴⁹

B. Limitations and Caveats

The interpretation of the results is subject to certain limitations and caveats. First, the extent to which restrictive word counts can accurately measure the actual restrictiveness of regulation is still not determined. It is possible that certain stringent regulations use few restrictive words. Hence, growth in restrictive word counts might not be sufficiently equivalent to growth in the amount of regulation or regulatory burden. However, as discussed in section I, this measure addresses many important concerns with previous measures, captures an important aspect of cumulative changes in regulation, and is arguably an improvement even if it is not a perfect measure. In addition, the robustness check of using total word counts also rules out the possibility that the results are confounded by the correlation between the use of restrictive words and regulatory forms.

Second, as discussed in Chapter 3, although the machine learning techniques used in RegData have enabled processing of a large amount of regulatory text, their accuracy needs to be further verified and improved. Because of our reliance on RegData estimates to select the regulation sample, we might have included some regulations that are not applicable to the crop production industries or omitted some important ones in our sample. This could potentially introduce measurement errors in growth of regulatory restrictions, which might lead to biases on our coefficient estimates. Nevertheless, there is no evidence that these errors are systematically correlated with the true value of growth in regulatory restrictions. Hence, the measurement errors tend to increase the statistical noise that leads to attenuation bias in our analysis where the coefficient would skew toward zero.⁵⁰ In other words, the statistically significant association between growth in regulatory forms and yield growth is actually understated rather than overstated—in the regression models. The robustness check using a subset of the sample identified by expert judgement also bolsters this point. Yet, the interpretation of the results that are not statistically significant needs more careful treatment due to the possible attenuation bias; that is, the regulatory forms that do not have a statistically significant coefficient in the regressions may actually have an association with yield growth. Future research can further improve the analysis by selecting a more precise sample of relevant regulations to each industry based on improved estimates of industry relevance.

Third, as shown in Appendix B, price, service quality, and quantity regulations are not as prevalent as the other forms in our sample. The number of relevant CFR parts that take any of these forms is less than or equal to 20 in this empirical analysis, which might be a too small sample for meaningful statistical analysis. Therefore, the fact that we do not find any statistically significant results for these forms does not necessarily mean that they do not have any impact on yield growth. Future research can expand the

⁴⁹ See more detailed discussion on management-based regulation in Coglianese and Lazer 2003.

⁵⁰ Sholom Wacholder, "When Measurement Errors Correlate with Truth: Surprising Effects of Nondifferential Misclassification," *Epidemiology* 6, no. 2 (March 1995): 157-161.

sample to include more regulations that take these forms to understand their relationships with yield growth.

Fourth, the R-squared values in the regressions are small, which suggests that the variation in regulatory restriction growth only explains a limited portion of the variation in yield growth. There are many other factors that affect land productivity growth such as weather conditions (not disastrous events but rainfall amounts, rainfall timing, temperature, etc.), the quality of land, the quantity and quality of other inputs, and technical change. Therefore, the results found in this analysis do not have much predictive power in predicting how yield growth would change given a change in regulatory restrictions. After all, the objective of this analysis is not to build a forecasting model for yield growth, but to present some preliminary empirical evidence on the relationship between growth in different forms of regulation and yield growth. The estimates in our analysis would only be biased by omitting variables if the omitted explanatory variables are simultaneously correlated with both regulatory form growth and yield growth and none of the factors seems to have such attribute.

Finally, the relationship found here indicates correlation rather than causation. This study provides preliminary results suggesting the possibility that different forms of regulation can affect productivity growth in different ways. Further research is required to explore what causal relationship exists between regulation and productivity.

Future research can further refine the analysis by addressing these limitations. Moreover, as discussed above, TFP growth is typically a better measure of productive efficiency than single factor productivity. Future studies can develop measures of agricultural TFP growth at the industry level and adopt more sophisticated macroeconomic models to investigate the impact of regulation on economic growth in the agriculture sector. Finally, since the Taxonomy of Regulatory Forms enables classification of any regulation, similar analysis can be extended to sectors other than agriculture or other economic outcomes such as innovation, output growth, and employment. Overall, research incorporating different regulatory forms as an explanatory variable into well-established macroeconomic models may add great value to understanding economic growth.

Appendix A: Industry-Commodity Crosswalk

NAICS 4-digit	NAICS 6-digit	NAICS title	Commodity Equivalent
1111	111110	Soybean Farming	Soybeans
	111120	Oilseed (except Soybean) Farming	Canola, flaxseed, rapeseed, safflower, sunflower
	111130	Dry Pea and Bean Farming	Beans (field crop), peas (field crop), lentils
	111140	Wheat Farming	Wheat
	111150	Corn Farming	Corn
	111160	Rice Farming	Rice
	111199	All Other Grain Farming	Barley, oats, rye, sorghum
1112	111211	Potato Farming	Potatoes
	111219	Other Vegetable (except Potato) and Melon Farming	Artichokes, asparagus, beans (vegetable), broccoli, cabbage, carrots, cauliflower, celery, cucumbers, garlic, lettuce, melons, onions, peas (vegetable), peppers, pumpkins, spinach, squash, sweet corn, sweet potatoes, tomatoes, beets, Brussel sprouts, eggplant, escarole & endive, ginger root, greens, okra, radishes
1113	111310	Orange Groves	Oranges
	111320	Citrus (except Orange) Groves	Grapefruit, lemons, limes, tangelos, tangerines, k- early citrus, temples
	111331	Apple Orchards	Apples
	111332	Grape Vineyards	Grapes
	111333	Strawberry Farming	Strawberries
	111334	Berry (except Strawberry) Farming	Blackberries, blueberries, boysenberries, cranberries, raspberries, caneberries, loganberries
	111335	Tree Nut Farming	Almonds, hazelnuts, macadamias, pecans, pistachios, walnuts
	111339	Other Noncitrus Fruit Farming	Apricots, avocados, bananas, cherries, coffee, dates, figs, kiwifruit, nectarines, olives, papayas, peaches, pears, plums, prunes, pineapples, guavas,
1114	111411	Mushroom Production	Mushrooms
1119	111910	Tobacco Farming	Tobacco
	111920	Cotton Farming	Cotton
	111930	Sugarcane Farming	Sugarcane
	111940	Hay Farming	Hay, haylage
	111991	Sugar Beet Farming	Sugarbeets
	111992	Peanut Farming	Peanuts
	111998	All Other Miscellaneous Crop Farming	Hops, mint
		Total # of 6-digit NAI	CS industries: 25

Appendix B: Frequency of Regulatory Forms

Second-tier Form	Frequency	Third-tier Form	Frequency
Price	3	Benchmarking (or yardstick regulation)	2
		Price ceiling/floor	1
		Rate of return	0
		Revenue cap	0
Quantity	18	Obligation to serve	1
		Portfolio standards	0
		Rationing and quotas	17
Entry & Exit	81	Certificate of need	0
		Licensing	43
		Rivalrous/exclusive permits	1
		Certification	35
		Antitrust	2
Service Quality	17	Product Identity or Grades	17
		Quality levels	0
Command-and-	423	Monitoring, reporting and verification (MRV)	176
Control		requirement	
		Performance standards	103
		Permitting	83
		Pre-market notice and approval	12
		Means-based standards	38
		Prohibitions	11
Market-based	68	Bonds	23
		Marketable permits	0
		Subsidies	45
		Taxes and fees	0
Information-based	58	Hazard warnings	6
		Labeling	21
		Other disclosure	17
		Contingency planning	14
Transfer	283	Monetary transfer	186
		Technology transfer	13
		User fees	68
		Knowledge transfer	16
Administrative	104	Definitions	7
		Government action	72
		Organizational	25
	Total	instances of regulatory forms: 1,059	

The sample includes 661 CFR parts. Each part can have up to five regulatory forms. They total sum up to 1,059 instances of regulatory forms. This table shows the frequency of each form in the sample. A frequency of one means that one CFR part in the sample contains that form.

Appendix C: Complete Baseline Results

Appendix C-1: Yield Growth and Restriction Growth for Second-tier Regulatory Forms (All Results)

Dependent Variable:		P	rice Regulati	on		Quantity Regulation					
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	
L.regform_growth	0.0074	0.0082	0.0084	0.0079	0.0084	-0.0084	0.0140	0.0122	0.0118	0.0098	
	(0.480)	(0.433)	(0.429)	(0.393)	(0.395)	(0.718)	(0.578)	(0.625)	(0.572)	(0.632)	
L.total_reg_growth		-0.2755**	-0.3012**	-0.2709***	-0.2981***		-0.2840**	-0.3018**	-0.2774**	-0.2962**	
		(0.018)	(0.019)	(0.004)	(0.006)		(0.023)	(0.024)	(0.010)	(0.012)	
time			-0.1025		-0.0886			-0.1031		-0.0916	
			(0.461)		(0.284)			(0.458)		(0.232)	
time2			0.0017		0.0014			0.0019		0.0016	
			(0.511)		(0.418)			(0.475)		(0.309)	
Constant	1.9504***	2.3223***	3.5560**	2.3189***	3.5067***	1.9799***	2.4385***	3.5381*	2.4225***	3.4778***	
	(0.000)	(0.000)	(0.050)	(0.000)	(0.001)	(0.000)	(0.000)	(0.050)	(0.000)	(0.000)	
Observations	918	918	918	918	918	928	928	928	928	928	
R-squared	0.001	0.007	0.007	0.007	0.007	0.000	0.006	0.006	0.006	0.006	
Prob > F	0.4800	0.0499	0.1800	0.0111	0.0292	0.7180	0.0693	0.2210	0.0115	0.0376	
Number of industries				25	25				25	25	
	Entry-and-Exit Regulation					Service Quality Regulation					
Dependent Variable		Entry	-and-Exit Reg	gulation			Servic	e Quality Re	gulation		
Dependent Variable: yield_growth	OLS	Entry- OLS	-and-Exit Reg OLS + Time Trend	ulation Industry FE	Industry FE + Time Trend	OLS	Servic OLS	e Quality Reg OLS + Time Trend	gulation Industry FE	Industry FE +	
Dependent Variable: yield_growth	OLS	Entry- OLS	-and-Exit Reg OLS + Time Trend -0 1404**	Industry FE	Industry FE + Time Trend	OLS	OLS	e Quality Reg OLS + Time Trend	Julation Industry FE	Industry FE + Time Trend	
Dependent Variable: yield_growth L.regform_growth	OLS -0.1735***	Entry- OLS -0.1404** (0.017)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026)	ulation Industry FE -0.1352** (0.047)	Industry FE + Time Trend -0.1363* (0.054)	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340)	e Quality Reg OLS + Time Trend -0.0322 (0.346)	Industry FE -0.0325 (0.431)	Industry FE + Time Trend -0.0331 (0.425)	
Dependent Variable: yield_growth L.regform_growth	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945	ulation Industry FE -0.1352** (0.047) -0.1717***	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941**	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661**	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906**	gulation Industry FE -0.0325 (0.431) -0.2625***	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875***	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114)	Judustry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014)	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661** (0.022)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023)	-0.0325 (0.431) -0.2625*** (0.005)	Industry FE + Time Trend -0.0331 (0.425) -0.2875*** (0.007)	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711	Judustry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661*** (0.022)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005)	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606)	Judustry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445)	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661*** (0.022)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437)	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005)	Industry FE + Time Trend -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244)	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011	Industry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661** (0.022)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019	Judustry FE -0.0325 (0.431) -0.2625*** (0.005)	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2	OLS -0.1735*** (0.004)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687)	Industry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622)	OLS -0.0329 (0.331)	Servic OLS -0.0321 (0.340) -0.2661** (0.022)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474)	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005)	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336)	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant	OLS -0.1735*** (0.004) 2.5607***	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897***	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716**	Judustry FE -0.1352** (0.047) -0.1717*** (0.008)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102***	OLS -0.0329 (0.331) 2.0370***	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005***	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474) 3.6445**	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960***	Industry FE + Time Trend -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784***	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant	OLS -0.1735*** (0.004) 2.5607*** (0.000)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897*** (0.000)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716** (0.043)	Judustry FE -0.1352** (0.047) -0.1717*** (0.008) 2.6734*** (0.000)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102*** (0.000)	OLS -0.0329 (0.331) 2.0370*** (0.000)	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005*** (0.000)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474) 3.6445** (0.045)	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960*** (0.000)	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784*** (0.001)	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant	OLS -0.1735*** (0.004) 2.5607*** (0.000)	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897*** (0.000)	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716** (0.043)	Judustry FE -0.1352** (0.047) -0.1717*** (0.008) 2.6734*** (0.000)	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102*** (0.000)	OLS -0.0329 (0.331) 2.0370*** (0.000)	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005*** (0.000)	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474) 3.6445** (0.045)	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960*** (0.000)	Industry FE + Time Trend -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784*** (0.001)	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations	OLS -0.1735*** (0.004) 2.5607*** (0.000) 928	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897*** (0.000) 928 0.011	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716** (0.043) 928 0.011	Judustry FE -0.1352** (0.047) -0.1717*** (0.008) 2.6734*** (0.000) 928 0.010	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102*** (0.000) 928 0.010	OLS -0.0329 (0.331) 2.0370*** (0.000) 928	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005*** (0.000) 928 0.007	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474) 3.6445** (0.045) 928 0.007	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960*** (0.000) 928	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784*** (0.001) 928 0.007	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations R-squared Duck of F	OLS -0.1735*** (0.004) 2.5607*** (0.000) 928 0.008 0.00220	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897*** (0.000) 928 0.011 0.0022	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716** (0.043) 928 0.011	Judustry FE -0.1352** (0.047) -0.1717*** (0.008) 2.6734*** (0.000) 928 0.010 0.0152	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102*** (0.000) 928 0.010 0.0470	OLS -0.0329 (0.331) 2.0370*** (0.000) 928 0.001 0.2210	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005*** (0.000) 928 0.007 0.0221	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.474) 3.6445** (0.045) 928 0.007 0.1210	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960*** (0.000) 928 0.007 0.0021	Industry FE + <u>Time Trend</u> -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784*** (0.001) 928 0.007 0.0225	
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations R-squared Prob > F	OLS -0.1735*** (0.004) 2.5607*** (0.000) 928 0.008 0.0038	Entry- OLS -0.1404** (0.017) -0.1713 (0.138) 2.6897*** (0.000) 928 0.011 0.0082	-and-Exit Reg OLS + Time Trend -0.1404** (0.026) -0.1945 (0.114) -0.0711 (0.606) 0.0011 (0.687) 3.6716** (0.043) 928 0.011 0.0411	gulation Industry FE -0.1352** (0.047) -0.1717*** (0.008) 2.6734*** (0.000) 928 0.010 0.0168	Industry FE + <u>Time Trend</u> -0.1363* (0.054) -0.1941** (0.014) -0.0603 (0.445) 0.0008 (0.622) 3.6102*** (0.000) 928 0.010 0.0478 25	OLS -0.0329 (0.331) 2.0370*** (0.000) 928 0.001 0.3310	Servic OLS -0.0321 (0.340) -0.2661** (0.022) 2.4005*** (0.000) 928 0.007 0.0331	e Quality Reg OLS + Time Trend -0.0322 (0.346) -0.2906** (0.023) -0.1078 (0.437) 0.0019 (0.437) 0.0019 (0.474) 3.6445** (0.045) 928 0.007 0.1310	gulation Industry FE -0.0325 (0.431) -0.2625*** (0.005) 2.3960*** (0.000) 928 0.007 0.0091 2.5	Industry FE + Time Trend -0.0331 (0.425) -0.2875*** (0.007) -0.0947 (0.244) 0.0016 (0.336) 3.5784*** (0.001) 928 0.007 0.0236	

Appendix C-1 (Continued)

Dependent Variable:		Command	-and-Control	Regulation		Market-based Regulation				
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.2487***	-0.2954***	-0.3068***	-0.2920***	-0.3041***	-0.0141	0.0165	0.0127	0.0169	0.0124
	(0.001)	(0.004)	(0.003)	(0.006)	(0.005)	(0.759)	(0.758)	(0.813)	(0.738)	(0.828)
L.total_reg_growth		0.1056	0.0810	0.1047	0.0809		-0.2894**	-0.3012**	-0.2859**	-0.2978***
		(0.509)	(0.623)	(0.271)	(0.406)		(0.046)	(0.042)	(0.010)	(0.009)
time			-0.1480		-0.1360			-0.0960		-0.0833
			(0.291)		(0.107)			(0.494)		(0.409)
time2			0.0024		0.0021			0.0018		0.0015
			(0.353)		(0.188)			(0.507)		(0.411)
Constant	2.7190***	2.7085***	4.5499**	2.6997***	4.4921***	2.0749***	2.3216***	3.3261**	2.3148***	3.2645**
	(0.000)	(0.000)	(0.013)	(0.000)	(0.000)	(0.000)	(0.000)	(0.046)	(0.000)	(0.032)
Observations	928	928	928	928	928	928	928	928	928	928
R-squared	0.014	0.014	0.015	0.014	0.015	0.000	0.006	0.006	0.006	0.006
Prob > F	0.0005	0.0020	0.0113	0.0088	0.0386	0.7590	0.0698	0.2210	0.0153	0.0362
Number of industries				25	25				25	25
Danandant Variablas		Informa	tion-based R	egulation			Tra	unsfer Regula	ation	
vield growth	01.0	01.0	OLS +	X 1	Industry FE +	2.10	01.0	OLS +	X 1	Industry FE +
yleid_glowiii	OLS	OLS	Time Trend	Industry FE	Time Trend	OLS	OLS	Time Trend	Industry FE	Time Trend
L.regform_growth	0.0855**	0.0848**	0.0937**	0.0868***	0.0950**	0.0361	0.3435**	0.3507***	0.3405**	0.3490**
<i>e _e</i>	(0.027)	(0.025)	(0.023)	(0.009)	(0.012)	(0.663)	(0.011)	(0.008)	(0.021)	(0.021)
L.total_reg_growth		-0.2650**	-0.3017**	-0.2604***	-0.2981***		-0.6464***	-0.6895***	-0.6395***	-0.6845***
		(0.022)	(0.018)	(0.005)	(0.006)		(0.001)	(0.000)	(0.007)	(0.007)
time			-0.1940		-0.1822*			-0.1284		-0.1170
			(0.184)		(0.087)			(0.351)		(0.150)
time2			0.0035		0.0033			0.0021		0.0018
			(0.199)		(0.108)			(0.423)		(0.259)
Constant	1.7518***	2.1167***	4.1599**	2.1043***	4.0987***	2.0080***	2.9088***	4.5397***	2.8993***	4.4914***
	(0.000)	(0.000)	(0.023)	(0.000)	(0.001)	(0.000)	(0.000)	(0.010)	(0.000)	(0.000)
Observations	928	928	928	928	928	928	928	928	928	928
R-squared	0.006	0.012	0.013	0.012	0.013	0.000	0.016	0.017	0.016	0.017
Prob > F	0.0272	0.0028	0.0184	0.0038	0.0036	0.6630	0.0028	0.0113	0.0130	0.0454
Number of industries				25	25				25	25

Appendix C-1 (Continued)

Dependent Variable:	Administrative Regulation										
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend						
L.regform_growth	-0.1435**	-0.1264**	-0.1273**	-0.1309***	-0.1330***						
0	(0.015)	(0.039)	(0.034)	(0.006)	(0.006)						
L.total_reg_growth		-0.2246*	-0.2516*	-0.2194***	-0.2467**						
		(0.063)	(0.057)	(0.009)	(0.010)						
time			-0.0945		-0.0815						
			(0.493)		(0.300)						
time2			0.0015		0.0012						
			(0.565)		(0.454)						
Constant	2.1481***	2.4387***	3.6638**	2.4361***	3.6136***						
	(0.000)	(0.000)	(0.039)	(0.000)	(0.000)						
Observations	928	928	928	928	928						
R-squared	0.007	0.011	0.012	0.012	0.012						
Prob > F	0.0151	0.0044	0.0182	0.0073	0.0278						
Number of industries				25	25						

Appendix C-2: Yield Growth and Restriction Growth for Third-tier Regulatory Forms (All Results)

Dependent Variable:			Licensing					Certification	n	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.0699	-0.0534	-0.0574	-0.0508	-0.0554	-0.1270***	-0.1123***	-0.1114***	-0.1078**	-0.1076**
	(0.125)	(0.241)	(0.248)	(0.156)	(0.151)	(0.000)	(0.002)	(0.003)	(0.014)	(0.019)
L.total_reg_growth		-0.2478**	-0.2759**	-0.2451***	-0.2732***		-0.2201*	-0.2319*	-0.2191***	-0.2309**
		(0.033)	(0.029)	(0.006)	(0.008)		(0.063)	(0.075)	(0.008)	(0.015)
time			-0.1223		-0.1089			-0.0285		-0.0198
			(0.382)		(0.181)			(0.841)		(0.819)
time2			0.0021		0.0018			0.0004		0.0002
			(0.426)		(0.274)			(0.889)		(0.929)
Constant	2.2397***	2.5237***	3.9864**	2.5114***	3.9081***	2.2702***	2.5410***	2.9832*	2.5303***	2.9395***
	(0.000)	(0.000)	(0.040)	(0.000)	(0.000)	(0.000)	(0.000)	(0.100)	(0.000)	(0.003)
Observations	928	928	928	928	928	928	928	928	928	928
R-squared	0.002	0.007	0.008	0.007	0.007	0.008	0.012	0.012	0.011	0.011
Prob > F	0.1250	0.0409	0.1400	0.0180	0.0501	0.0003	0.0003	0.0023	0.0109	0.0415
Number of industries				25	25				25	25
Dependent Variable:		Monitoring,	, Reporting &	Verification			Perfo	ormance Star	ndards	
Dependent Variable: yield_growth	OLS	Monitoring, OLS	, Reporting & OLS + Time Trand	verification	Industry FE +	OLS	Perfo	OLS +	ndards Industry FE	Industry FE +
Dependent Variable: yield_growth	OLS	Monitoring, OLS	, Reporting & OLS + Time Trend	Verification	Industry FE + Time Trend	OLS	Perfo OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
Dependent Variable: yield_growth L.regform_growth	OLS -0.2778***	Monitoring, OLS -0.2251**	, Reporting & OLS + Time Trend -0.2237** (0.047)	Verification Industry FE -0.2292***	Industry FE + <u>Time Trend</u> -0.2272*** (0.002)	OLS -0.0608**	Perfo OLS -0.0436 (0.142)	OLS + Time Trend -0.0461	ndards Industry FE -0.0410 (0.210)	Industry FE + Time Trend -0.0438 (0.106)
Dependent Variable: yield_growth L.regform_growth	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) 0.1421	Reporting & OLS + Time Trend -0.2237** (0.047) 0.1608	 Verification Industry FE -0.2292*** (0.003) 0.1271* 	Industry FE + Time Trend -0.2272*** (0.003) 0.1558*	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) 0.1201	OLS + Time Trend -0.0461 (0.131) 0.1524	ndards Industry FE -0.0410 (0.219) 0.1245	Industry FE + Time Trend -0.0438 (0.196) 0.1567
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.282)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265)	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 	Industry FE + Time Trend -0.2272*** (0.003) -0.1558* (0.070)	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.202)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.224)	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.160)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) 0.0082	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) 0.0850	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292)	OLS + Time Trend -0.0461 (0.131) -0.1534 (0.234) 0.1242	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) 0.1112
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476)	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 	Industry FE + Time Trend -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.200)	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.275)	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + <u>Time Trend</u> -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283)	, Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481)	z Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070)	Industry FE + Time Trend -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.245)	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427)	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2	OLS -0.2778*** (0.005)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 2 6582**	2 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070)	Industry FE + Time Trend -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 2 5011***	OLS -0.0608** (0.022)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 2.8721**	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 2 8010***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant	OLS -0.2778*** (0.005) 2.5616*** (0.000)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283) 2.6521*** (0.000)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 3.6582** (0.043)	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 2.6521*** (0.000) 	Industry FE + Time Trend -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 3.5911*** (0.000)	OLS -0.0608** (0.022) 2.2724*** (0.000)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292) 2.3753***	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 3.8731** (0.026)	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218) 2.3699*** (0.000)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 3.8010*** (0.000)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant	OLS -0.2778*** (0.005) 2.5616*** (0.000)	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283) 2.6521*** (0.000)	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 3.6582** (0.043)	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 2.6521*** (0.000) 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 3.5911*** (0.000)	OLS -0.0608** (0.022) 2.2724*** (0.000)	Perfo OLS -0.0436 (0.143) -0.1301 (0.292) 2.3753*** (0.000)	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 3.8731** (0.036)	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218) 2.3699*** (0.000)	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 3.8010*** (0.000)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations	OLS -0.2778*** (0.005) 2.5616*** (0.000) 928	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283) 2.6521*** (0.000) 928	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 3.6582** (0.043) 928	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 2.6521*** (0.000) 928 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 3.5911*** (0.000) 928	OLS -0.0608** (0.022) 2.2724*** (0.000) 928	Perfo OLS -0.0436 (0.143) -0.1301 (0.292) 2.3753*** (0.000) 928	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 3.8731** (0.036) 928	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218) 2.3699*** (0.000) 928	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 3.8010*** (0.000) 928
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations R-squared	OLS -0.2778*** (0.005) 2.5616*** (0.000) 928 0.009	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283) 2.6521*** (0.000) 928 0.011	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 3.6582** (0.043) 928 0.011	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 2.6521*** (0.000) 928 0.011 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 3.5911*** (0.000) 928 0.011	OLS -0.0608** (0.022) 2.2724*** (0.000) 928 0.007	Perfo OLS -0.0436 (0.143) -0.1301 (0.292) 2.3753*** (0.000) 928 0.008	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 3.8731** (0.036) 928 0.008	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218) 2.3699*** (0.000) 928 0.007	Industry FE + <u>Time Trend</u> -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 3.8010*** (0.000) 928 0.008
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth time time2 Constant Observations R-squared Prob > F	OLS -0.2778*** (0.005) 2.5616*** (0.000) 928 0.009 0.0049	Monitoring, OLS -0.2251** (0.046) -0.1431 (0.283) 2.6521*** (0.000) 928 0.011 0.0089	Reporting & OLS + Time Trend -0.2237** (0.047) -0.1608 (0.265) -0.0983 (0.476) 0.0018 (0.481) 3.6582** (0.043) 928 0.011 0.0438	 Verification Industry FE -0.2292*** (0.003) -0.1371* (0.070) 2.6521*** (0.000) 928 0.011 0.0039 	Industry FE + <u>Time Trend</u> -0.2272*** (0.003) -0.1558* (0.079) -0.0850 (0.290) 0.0015 (0.345) 3.5911*** (0.000) 928 0.011 0.0093	OLS -0.0608** (0.022) 2.2724*** (0.000) 928 0.007 0.0219	Perfo OLS -0.0436 (0.143) -0.1301 (0.292) 2.3753*** (0.000) 928 0.008 0.0493	OLS + <u>Time Trend</u> -0.0461 (0.131) -0.1534 (0.234) -0.1242 (0.375) 0.0021 (0.427) 3.8731** (0.036) 928 0.008 0.1730	ndards Industry FE -0.0410 (0.219) -0.1345 (0.218) 2.3699*** (0.000) 928 0.007 0.0200	Industry FE + Time Trend -0.0438 (0.196) -0.1567 (0.169) -0.1113 (0.182) 0.0018 (0.273) 3.8010*** (0.000) 928 0.008 0.00528

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Dopondont Variable:		P	rice Regulati	on			Qu	antity Regula	ation	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	0.0120	0.0130	0.0113	0.0114	0.0109	-0.0287	0.0015	0.0028	0.0020	0.0025
0 0	(0.373)	(0.334)	(0.405)	(0.368)	(0.413)	(0.270)	(0.958)	(0.919)	(0.936)	(0.916)
L.total_reg_growth		-0.3833***	-0.3776***	-0.3754***	-0.3783***		-0.3788***	-0.3686**	-0.3716***	-0.3695**
		(0.003)	(0.006)	(0.002)	(0.004)		(0.007)	(0.011)	(0.007)	(0.012)
disaster_state	-0.0242**	-0.0291***	-0.0306***	-0.0300***	-0.0303***	-0.0265***	-0.0300***	-0.0321***	-0.0307***	-0.0320***
	(0.014)	(0.004)	(0.005)	(0.000)	(0.001)	(0.008)	(0.003)	(0.004)	(0.000)	(0.001)
time			-0.0783		-0.0447		. ,	-0.0815		-0.0480
			(0.606)		(0.678)			(0.594)		(0.632)
time2			0.0019		0.0010			0.0022		0.0012
			(0.518)		(0.669)			(0.465)		(0.555)
Constant	2.6964***	3.3396***	3.7454**	3.3689***	3.7205***	2.7841***	3.4901***	3.7443**	3.5024***	3.7204***
	(0.000)	(0.000)	(0.029)	(0.000)	(0.004)	(0.000)	(0.000)	(0.029)	(0.000)	(0.003)
Observations	685	685	685	685	685	685	685	685	685	685
R-squared	0.010	0.025	0.026	0.024	0.024	0.008	0.022	0.024	0.021	0.022
Prob > F	0.0314	0.0010	0.0058	0.0002	0.0004	0.0156	0.0010	0.0060	0.0001	0.0002
Number of industries				19	19				19	19
Donandant Variable		Entry-	and-Exit Reg	gulation			Servic	e Quality Reg	gulation	
Dependent Variable:		Entry-	and-Exit Reg	gulation	Industry FE +		Servic	e Quality Rea OLS +	gulation	Industry FE +
Dependent Variable: yield_growth	OLS	Entry- OLS	•and-Exit Reg OLS + Time Trend	gulation Industry FE	Industry FE + Time Trend	OLS	Service OLS	e Quality Reg OLS + Time Trend	gulation Industry FE	Industry FE + Time Trend
Dependent Variable: yield_growth L.regform_growth	OLS -0.2347***	Entry- OLS -0.1858***	and-Exit Reg OLS + Time Trend -0.1767***	ulation Industry FE -0.1758**	Industry FE + Time Trend -0.1753**	OLS 0.0035	Service OLS 0.0052	e Quality Reg OLS + Time Trend 0.0093	gulation Industry FE 0.0102	Industry FE + Time Trend 0.0119
Dependent Variable: yield_growth L.regform_growth	OLS -0.2347*** (0.000)	Entry- OLS -0.1858*** (0.001)	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004)	gulation Industry FE -0.1758** (0.018)	Industry FE + <u>Time Trend</u> -0.1753** (0.024)	OLS 0.0035 (0.905)	Service OLS 0.0052 (0.849)	e Quality Res OLS + Time Trend 0.0093 (0.739)	gulation Industry FE 0.0102 (0.721)	Industry FE + <u>Time Trend</u> 0.0119 (0.679)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.2347*** (0.000)	Entry- OLS -0.1858*** (0.001) -0.2458*	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468*	gulation Industry FE -0.1758** (0.018) -0.2458***	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490***	OLS 0.0035 (0.905)	Service OLS 0.0052 (0.849) -0.3773***	e Quality Res OLS + Time Trend 0.0093 (0.739) -0.3655***	gulation Industry FE 0.0102 (0.721) -0.3696***	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.2347*** (0.000)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053)	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008)	OLS 0.0035 (0.905)	Service OLS 0.0052 (0.849) -0.3773*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002)	Industry FE + Time Trend 0.0119 (0.679) -0.3667*** (0.006)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS -0.2347*** (0.000) -0.0224**	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262**	end-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275**	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271***	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270***	OLS 0.0035 (0.905) -0.0251**	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299***	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321***	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306***	Industry FE + Time Trend 0.0119 (0.679) -0.3667*** (0.006) -0.0319***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS -0.2347*** (0.000) -0.0224** (0.031)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014)	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007)	OLS 0.0035 (0.905) -0.0251** (0.012)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000)	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS -0.2347*** (0.000) -0.0224** (0.031)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014)	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148	OLS 0.0035 (0.905) -0.0251** (0.012)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000)	Industry FE + Time Trend 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS -0.2347*** (0.000) -0.0224** (0.031)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014)	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884)	OLS 0.0035 (0.905) -0.0251** (0.012)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000)	Industry FE + Time Trend 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2	OLS -0.2347*** (0.000) -0.0224** (0.031)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014)	and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003	OLS 0.0035 (0.905) -0.0251** (0.012)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000)	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2	OLS -0.2347*** (0.000) -0.0224** (0.031)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014)	end-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901)	OLS 0.0035 (0.905) -0.0251** (0.012)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000)	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077***	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887***	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506**	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834***	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422***	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348***	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774***	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308**	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806***	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077*** (0.000)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887*** (0.000)	and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506** (0.021)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834*** (0.000)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422*** (0.002)	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348*** (0.000)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774*** (0.000)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308** (0.030)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806*** (0.000)	Industry FE + Time Trend 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009*** (0.003)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077*** (0.000)	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887*** (0.000)	end-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506** (0.021)	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834*** (0.000)	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422*** (0.002)	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348*** (0.000)	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774*** (0.000)	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308** (0.030)	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806*** (0.000)	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009*** (0.003)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077*** (0.000) 685	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887*** (0.000) 685	end-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506** (0.021) 685	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834*** (0.000) 685	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422*** (0.002) 685	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348*** (0.000) 685	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774*** (0.000) 685	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308** (0.030) 685	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806*** (0.000) 685	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009*** (0.003) 685
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077*** (0.000) 685 0.028	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887*** (0.000) 685 0.033	•and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506** (0.021) 685 0.034	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834*** (0.000) 685 0.032	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422*** (0.002) 685 0.032	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348*** (0.000) 685 0.007	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774*** (0.000) 685 0.022	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308** (0.030) 685 0.024	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806*** (0.000) 685 0.022	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009*** (0.003) 685 0.022
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Prob > F	OLS -0.2347*** (0.000) -0.0224** (0.031) 3.5077*** (0.000) 685 0.028 0.0000	Entry- OLS -0.1858*** (0.001) -0.2458* (0.053) -0.0262** (0.014) 3.7887*** (0.000) 685 0.033 0.0000	and-Exit Reg OLS + Time Trend -0.1767*** (0.004) -0.2468* (0.068) -0.0275** (0.017) -0.0468 (0.759) 0.0012 (0.689) 3.9506** (0.021) 685 0.034 0.0002	gulation Industry FE -0.1758** (0.018) -0.2458*** (0.002) -0.0271*** (0.001) 3.7834*** (0.000) 685 0.032 0.0001	Industry FE + <u>Time Trend</u> -0.1753** (0.024) -0.2490*** (0.008) -0.0270*** (0.007) -0.0148 (0.884) 0.0003 (0.901) 3.9422*** (0.002) 685 0.032 0.0003	OLS 0.0035 (0.905) -0.0251** (0.012) 2.8348*** (0.000) 685 0.007 0.0402	Service OLS 0.0052 (0.849) -0.3773*** (0.004) -0.0299*** (0.004) 3.4774*** (0.000) 685 0.022 0.0013	e Quality Reg OLS + Time Trend 0.0093 (0.739) -0.3655*** (0.008) -0.0321*** (0.004) -0.0834 (0.583) 0.0022 (0.454) 3.7308** (0.030) 685 0.024 0.0067	gulation Industry FE 0.0102 (0.721) -0.3696*** (0.002) -0.0306*** (0.000) 3.4806*** (0.000) 685 0.022 0.0001	Industry FE + <u>Time Trend</u> 0.0119 (0.679) -0.3667*** (0.006) -0.0319*** (0.001) -0.0500 (0.636) 0.0013 (0.552) 3.7009*** (0.003) 685 0.022 0.0003

Appendix C-3: Yield Growth and Restriction Growth for Second-tier Regulatory Forms, Controlling for Disaster (All Results)

Appendix C-3 (Continued)

Dependent Verichles		Command	-and-Control	Regulation			Mark	et-based Reg	ulation	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.3459***	-0.4102***	-0.4120***	-0.4004***	-0.4081***	-0.0785**	-0.0442	-0.0434	-0.0418	-0.0449
	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.018)	(0.220)	(0.230)	(0.101)	(0.117)
L.total_reg_growth		0.1438	0.1321	0.1386	0.1261		-0.3187**	-0.3249**	-0.3150***	-0.3248**
		(0.333)	(0.383)	(0.264)	(0.318)		(0.025)	(0.026)	(0.007)	(0.011)
disaster_state	-0.0296***	-0.0286***	-0.0287***	-0.0294***	-0.0282***	-0.0293***	-0.0316***	-0.0324***	-0.0324***	-0.0322***
	(0.004)	(0.005)	(0.008)	(0.000)	(0.002)	(0.004)	(0.003)	(0.004)	(0.000)	(0.001)
time			-0.1501		-0.1181			-0.1291		-0.0969
			(0.330)		(0.270)			(0.404)		(0.429)
time2			0.0031		0.0021			0.0028		0.0019
			(0.306)		(0.324)			(0.351)		(0.426)
Constant	3.9550***	3.9164***	5.1987***	3.9180***	5.1954***	3.3325***	3.6623***	4.6051***	3.6684***	4.6082***
	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.005)
	<0 5	<0 7	<0 7	<0 7	<0 7	<0 7	<0 7	<0 7	<0 5	<0 .5
Observations	685	685	685	685	685	685	685	685	685	685
R-squared	0.043	0.044	0.046	0.043	0.044	0.015	0.024	0.026	0.023	0.024
Prob > F	0.0000	0.0000	0.0001	0.0002	0.0004	0.0020	0.0006	0.0037	0.0001	0.0003
Number of industries				19	19				19	19
		TC	· I ID	1 4			T	6 D 1		
Dependent Variable:		Informa	tion-based R	egulation	Inductory EE		Tra	Insfer Regula	ation	Inductory EE
Dependent Variable: yield_growth	OLS	Informa OLS	tion-based R OLS + Time Trend	egulation Industry FE	Industry FE + Time Trend	OLS	Tra OLS	onsfer Regula OLS + Time Trend	ation Industry FE	Industry FE + Time Trend
Dependent Variable: yield_growth L.regform_growth	OLS 0.0837*	Informa OLS 0.0828**	tion-based R OLS + Time Trend 0.0910**	egulation Industry FE 0.0871**	Industry FE + Time Trend 0.0931**	OLS 0.0675	Tra OLS 0.5147***	OLS + Time Trend 0.5138***	ntion Industry FE 0.4998***	Industry FE + Time Trend 0.5073***
Dependent Variable: yield_growth L.regform_growth	OLS 0.0837* (0.051)	Informa OLS 0.0828** (0.044)	tion-based R OLS + Time Trend 0.0910** (0.040)	egulation Industry FE 0.0871** (0.027)	Industry FE + <u>Time Trend</u> 0.0931** (0.034)	OLS 0.0675 (0.333)	Tra OLS 0.5147*** (0.000)	Insfer Regula OLS + Time Trend 0.5138*** (0.000)	ation Industry FE 0.4998*** (0.001)	Industry FE + Time Trend 0.5073*** (0.001)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS 0.0837* (0.051)	Informa OLS 0.0828** (0.044) -0.3747***	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762***	egulation Industry FE 0.0871** (0.027) -0.3659***	Industry FE + Time Trend 0.0931** (0.034) -0.3772***	OLS 0.0675 (0.333)	Tra OLS 0.5147*** (0.000) -0.9308***	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444***	ation Industry FE 0.4998*** (0.001) -0.9069***	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS 0.0837* (0.051)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005)	OLS 0.0675 (0.333)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000)	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001)	Industry FE + Time Trend 0.5073*** (0.001) -0.9384*** (0.001)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS 0.0837* (0.051) -0.0240**	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288***	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303***	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294***	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301***	OLS 0.0675 (0.333) -0.0234**	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238**	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236**	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245***	Industry FE + Time Trend 0.5073*** (0.001) -0.9384*** (0.001) -0.0228**
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS 0.0837* (0.051) -0.0240** (0.015)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002)	OLS 0.0675 (0.333) -0.0234** (0.019)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023)	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS 0.0837* (0.051) -0.0240** (0.015)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340	OLS 0.0675 (0.333) -0.0234** (0.019)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023)	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS 0.0837* (0.051) -0.0240** (0.015)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328)	OLS 0.0675 (0.333) -0.0234** (0.019)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023)	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + Time Trend 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time	OLS 0.0837* (0.051) -0.0240** (0.015)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028	OLS 0.0675 (0.333) -0.0234** (0.019)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023)	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time	OLS 0.0837* (0.051) -0.0240** (0.015)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285)	OLS 0.0675 (0.333) -0.0234** (0.019)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023)	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343***	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783***	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498**	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693***	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384***	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939***	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834***	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797***	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343*** (0.000)	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783*** (0.000)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498** (0.016)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693*** (0.000)	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384*** (0.005)	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939*** (0.000)	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834*** (0.000)	Insfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797*** (0.002)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001) 4.0704*** (0.000)	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905*** (0.001)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343*** (0.000) 685	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783*** (0.000)	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498** (0.016)	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693*** (0.000) 695	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384*** (0.005) 685	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939*** (0.000) 685	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834*** (0.000)	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797*** (0.002)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001) 4.0704*** (0.000)	Industry FE + Time Trend 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905*** (0.001) 685
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343*** (0.000) 685 0.015	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783*** (0.000) 685 0.020	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498** (0.016) 685 0.024	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693*** (0.000) 685 0.021	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384*** (0.005) 685 0.022	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939*** (0.000) 685 0.009	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834*** (0.000) 685 0.052	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797*** (0.002)	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001) 4.0704*** (0.000) 685 0.051	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905*** (0.001) 685 0.051
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Deple 2	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343*** (0.000) 685 0.015 0.0044	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783*** (0.000) 685 0.030 0.0001	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498** (0.016) 685 0.034	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693*** (0.000) 685 0.031 0.0001	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384*** (0.005) 685 0.032 0.0002	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939*** (0.000) 685 0.008 0.0270	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834*** (0.023) 4.0834*** (0.000) 685 0.053	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797*** (0.002) 685 0.054 0.0000	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001) 4.0704*** (0.000) 685 0.051 0.0002	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905*** (0.001) 685 0.051 0.0006
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Prob > F	OLS 0.0837* (0.051) -0.0240** (0.015) 2.5343*** (0.000) 685 0.015 0.0044	Informa OLS 0.0828** (0.044) -0.3747*** (0.004) -0.0288*** (0.005) 3.1783*** (0.000) 685 0.030 0.0001	tion-based R OLS + Time Trend 0.0910** (0.040) -0.3762*** (0.006) -0.0303*** (0.006) -0.1655 (0.304) 0.0038 (0.231) 4.2498** (0.016) 685 0.034 0.0004	egulation Industry FE 0.0871** (0.027) -0.3659*** (0.002) -0.0294*** (0.000) 3.1693*** (0.000) 685 0.031 0.0001 10	Industry FE + <u>Time Trend</u> 0.0931** (0.034) -0.3772*** (0.005) -0.0301*** (0.002) -0.1340 (0.328) 0.0028 (0.285) 4.2384*** (0.005) 685 0.032 0.0002 10	OLS 0.0675 (0.333) -0.0234** (0.019) 2.7939*** (0.000) 685 0.008 0.0279	Tra OLS 0.5147*** (0.000) -0.9308*** (0.000) -0.0238** (0.023) 4.0834*** (0.023) 4.0834*** (0.000) 685 0.053 0.0000	Imsfer Regula OLS + Time Trend 0.5138*** (0.000) -0.9444*** (0.000) -0.0236** (0.036) -0.1345 (0.373) 0.0027 (0.362) 5.2797*** (0.002) 685 0.054 0.0000	ation Industry FE 0.4998*** (0.001) -0.9069*** (0.001) -0.0245*** (0.001) 4.0704*** (0.000) 685 0.051 0.0002	Industry FE + <u>Time Trend</u> 0.5073*** (0.001) -0.9384*** (0.001) -0.0228** (0.014) -0.1037 (0.321) 0.0017 (0.405) 5.2905*** (0.001) 685 0.051 0.0006 10

Appendix C-3 (Continued)

Dependent Variable:		Admir	nistrative Reg	gulation	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.1675***	-0.1414**	-0.1345**	-0.1341**	-0.1319**
	(0.002)	(0.012)	(0.018)	(0.040)	(0.045)
L.total_reg_growth		-0.3323**	-0.3242**	-0.3270***	-0.3263***
		(0.012)	(0.022)	(0.002)	(0.005)
disaster_state	-0.0256***	-0.0299***	-0.0316***	-0.0307***	-0.0314***
	(0.010)	(0.003)	(0.004)	(0.000)	(0.001)
time			-0.0560		-0.0240
			(0.711)		(0.815)
time2			0.0016		0.0006
			(0.602)		(0.768)
Constant	2.9935***	3.5377***	3.6579**	3.5479***	3.6541***
	(0.000)	(0.000)	(0.031)	(0.000)	(0.003)
Observations	685	685	685	685	685
R-squared	0.019	0.030	0.032	0.029	0.029
Prob > F	0.0003	0.0000	0.0003	0.0001	0.0002
Number of industries				19	19

Demondant Variables			Licensing					Certification	1	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.0932**	-0.0660	-0.0605	-0.0591	-0.0586	-0.1714***	-0.1511***	-0.1490***	-0.1491***	-0.1517***
	(0.036)	(0.139)	(0.217)	(0.109)	(0.166)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
L.total_reg_growth		-0.3491***	-0.3503**	-0.3443***	-0.3520***		-0.3183**	-0.2940**	-0.3132***	-0.2944**
		(0.008)	(0.011)	(0.003)	(0.006)		(0.016)	(0.038)	(0.003)	(0.011)
disaster_state	-0.0220**	-0.0274**	-0.0289**	-0.0283***	-0.0285***	-0.0283***	-0.0320***	-0.0345***	-0.0333***	-0.0349***
	(0.034)	(0.010)	(0.015)	(0.001)	(0.007)	(0.005)	(0.002)	(0.002)	(0.000)	(0.001)
time			-0.1042		-0.0699			0.0259		0.0600
			(0.492)		(0.512)			(0.867)		(0.591)
time2			0.0024		0.0014			0.0001		-0.0009
			(0.415)		(0.503)			(0.979)		(0.698)
Constant	3.0603***	3.5929***	4.2249**	3.5881***	4.1924***	3.2872***	3.7783***	3.0331*	3.8023***	3.0000**
	(0.000)	(0.000)	(0.016)	(0.000)	(0.003)	(0.000)	(0.000)	(0.078)	(0.000)	(0.013)
Observations	685	685	685	685	685	685	685	685	685	685
R-squared	0.012	0.024	0.026	0.023	0.024	0.026	0.036	0.037	0.036	0.036
Prob > F	0.0030	0.0004	0.0024	0.0001	0.0003	0.0000	0.0000	0.0000	0.0001	0.0003
Number of industries				19	19				19	19
Dener dent Verichler		Monitoring,	Reporting &	Verification			Perfo	ormance Star	ndards	
Dependent variable:			OLS +	La la star EE	Industry FE +			OLS +	L. data data EE	Industry FE +
yield_growth	OLS	OLS	Time Trend	Industry FE	Time Trend	OLS	OLS	Time Trend	Industry FE	Time Trend
					Time Trend			Time Trend		
L.regform_growth	-0.3969***	-0.3218***	-0.3282***	-0.3300***	-0.3331***	-0.0803**	-0.0507	-0.0481	-0.0467	-0.0465
L.regform_growth	-0.3969*** (0.000)	-0.3218*** (0.003)	-0.3282*** (0.002)	-0.3300*** (0.000)	-0.3331*** (0.000)	-0.0803** (0.011)	-0.0507 (0.145)	-0.0481 (0.176)	-0.0467 (0.267)	-0.0465 (0.272)
L.regform_growth L.total_reg_growth	-0.3969*** (0.000)	-0.3218*** (0.003) -0.1960	-0.3282*** (0.002) -0.1740	-0.3300*** (0.000) -0.1839*	-0.3331*** (0.000) -0.1730	-0.0803** (0.011)	-0.0507 (0.145) -0.2225*	-0.0481 (0.176) -0.2278*	-0.0467 (0.267) -0.2269*	-0.0465 (0.272) -0.2336*
L.regform_growth L.total_reg_growth	-0.3969*** (0.000)	-0.3218*** (0.003) -0.1960 (0.193)	-0.3282*** (0.002) -0.1740 (0.269)	-0.3300*** (0.000) -0.1839* (0.063)	-0.3331*** (0.000) -0.1730 (0.119)	-0.0803** (0.011)	-0.0507 (0.145) -0.2225* (0.087)	-0.0481 (0.176) -0.2278* (0.095)	-0.0467 (0.267) -0.2269* (0.091)	-0.0465 (0.272) -0.2336* (0.097)
L.regform_growth L.total_reg_growth disaster_state	-0.3969*** (0.000) -0.0293***	-0.3218*** (0.003) -0.1960 (0.193) -0.0310***	-0.3282*** (0.002) -0.1740 (0.269) -0.0339***	-0.3300*** (0.000) -0.1839* (0.063) -0.0320***	-0.3331*** (0.000) -0.1730 (0.119) -0.0340***	-0.0803** (0.011) -0.0291***	-0.0507 (0.145) -0.2225* (0.087) -0.0305***	-0.0481 (0.176) -0.2278* (0.095) -0.0319***	-0.0467 (0.267) -0.2269* (0.091) -0.0313***	-0.0465 (0.272) -0.2336* (0.097) -0.0317***
L.regform_growth L.total_reg_growth disaster_state	-0.3969*** (0.000) -0.0293*** (0.004)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002)	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000)	-0.3331*** (0.000) -0.1730 (0.119) -0.0340*** (0.001)	-0.0803** (0.011) -0.0291*** (0.004)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004)	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000)	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001)
L.regform_growth L.total_reg_growth disaster_state time	-0.3969*** (0.000) -0.0293*** (0.004)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000)	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341 \end{array}$	-0.0803** (0.011) -0.0291*** (0.004)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000)	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681
L.regform_growth L.total_reg_growth disaster_state time	-0.3969*** (0.000) -0.0293*** (0.004)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646)	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000)	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743) \end{array}$	-0.0803** (0.011) -0.0291*** (0.004)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507)	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000)	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524)
L.regform_growth L.total_reg_growth disaster_state time time2	-0.3969*** (0.000) -0.0293*** (0.004)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000)	$\begin{array}{c} -0.3331^{***} \\ (0.000) \\ -0.1730 \\ (0.119) \\ -0.0340^{***} \\ (0.001) \\ -0.0341 \\ (0.743) \\ 0.0011 \end{array}$	-0.0803** (0.011) -0.0291*** (0.004)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000)	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524) 0.0014
L.regform_growth L.total_reg_growth disaster_state time time2	-0.3969*** (0.000) -0.0293*** (0.004)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483)	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000)	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743)\\ 0.0011\\ (0.609) \end{array}$	-0.0803** (0.011) -0.0291*** (0.004)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024 (0.424)	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000)	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524) 0.0014 (0.506)
L.regform_growth L.total_reg_growth disaster_state time time2 Constant	-0.3969*** (0.000) -0.0293*** (0.004) 3.7458***	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002) 3.9096***	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483) 3.9373**	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000) 3.9364***	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743)\\ 0.0011\\ (0.609)\\ 3.9124^{***} \end{array}$	-0.0803** (0.011) -0.0291*** (0.004) 3.2953***	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003)	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024 (0.424) 4.0962**	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000) 3.5189***	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524) 0.0014 (0.506) 4.0742***
L.regform_growth L.total_reg_growth disaster_state time time2 Constant	-0.3969*** (0.000) -0.0293*** (0.004) 3.7458*** (0.000)	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002) 3.9096*** (0.000)	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483) 3.9373** (0.022)	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000) 3.9364*** (0.000)	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743)\\ 0.0011\\ (0.609)\\ 3.9124^{***}\\ (0.002) \end{array}$	-0.0803** (0.011) -0.0291*** (0.004) 3.2953*** (0.000)	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003) 3.5075*** (0.000)	$\begin{array}{c} -0.0481 \\ (0.176) \\ -0.2278* \\ (0.095) \\ -0.0319*** \\ (0.004) \\ -0.1011 \\ (0.507) \\ 0.0024 \\ (0.424) \\ 4.0962** \\ (0.019) \end{array}$	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000) 3.5189*** (0.000)	$\begin{array}{c} -0.0465 \\ (0.272) \\ -0.2336^{*} \\ (0.097) \\ -0.0317^{***} \\ (0.001) \\ -0.0681 \\ (0.524) \\ 0.0014 \\ (0.506) \\ 4.0742^{***} \\ (0.002) \end{array}$
L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations	-0.3969*** (0.000) -0.0293*** (0.004) 3.7458*** (0.000) 685	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002) 3.9096*** (0.000) 685	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483) 3.9373** (0.022) 685	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000) 3.9364*** (0.000) 685	-0.3331*** (0.000) -0.1730 (0.119) -0.0340*** (0.001) -0.0341 (0.743) 0.0011 (0.609) 3.9124*** (0.002) 685	-0.0803** (0.011) -0.0291*** (0.004) 3.2953*** (0.000) 685	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003) 3.5075*** (0.000) 685	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024 (0.424) 4.0962** (0.019) 685	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000) 3.5189*** (0.000) 685	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524) 0.0014 (0.506) 4.0742*** (0.002) 685
L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared	-0.3969*** (0.000) -0.0293*** (0.004) 3.7458*** (0.000) 685 0.032	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002) 3.9096*** (0.000) 685 0.035	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483) 3.9373** (0.022) 685 0.037	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000) 3.9364*** (0.000) 685 0.035	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743)\\ 0.0011\\ (0.609)\\ 3.9124^{***}\\ (0.002)\\ \end{array}$	-0.0803** (0.011) -0.0291*** (0.004) 3.2953*** (0.000) 685 0.023	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003) 3.5075*** (0.000) 685 0.026	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024 (0.424) 4.0962** (0.019) 685 0.027	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000) 3.5189*** (0.000) 685 0.025	-0.0465 (0.272) -0.2336* (0.097) -0.0317*** (0.001) -0.0681 (0.524) 0.0014 (0.506) 4.0742*** (0.002) 685 0.025
L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Prob > F	-0.3969*** (0.000) -0.0293*** (0.004) 3.7458*** (0.000) 685 0.032 0.0000	-0.3218*** (0.003) -0.1960 (0.193) -0.0310*** (0.002) 3.9096*** (0.000) 685 0.035 0.0000	-0.3282*** (0.002) -0.1740 (0.269) -0.0339*** (0.002) -0.0689 (0.646) 0.0021 (0.483) 3.9373** (0.022) 685 0.037 0.0001	-0.3300*** (0.000) -0.1839* (0.063) -0.0320*** (0.000) 3.9364*** (0.000) 685 0.035 0.0000	$\begin{array}{c} -0.3331^{***}\\ (0.000)\\ -0.1730\\ (0.119)\\ -0.0340^{***}\\ (0.001)\\ -0.0341\\ (0.743)\\ 0.0011\\ (0.609)\\ 3.9124^{***}\\ (0.002)\\ \end{array}$	-0.0803** (0.011) -0.0291*** (0.004) 3.2953*** (0.000) 685 0.023 0.0013	-0.0507 (0.145) -0.2225* (0.087) -0.0305*** (0.003) 3.5075*** (0.000) 685 0.026 0.0011	-0.0481 (0.176) -0.2278* (0.095) -0.0319*** (0.004) -0.1011 (0.507) 0.0024 (0.424) 4.0962** (0.019) 685 0.027 0.0060	-0.0467 (0.267) -0.2269* (0.091) -0.0313*** (0.000) 3.5189*** (0.000) 685 0.025 0.0001	$\begin{array}{c} -0.0465\\ (0.272)\\ -0.2336*\\ (0.097)\\ -0.0317***\\ (0.001)\\ -0.0681\\ (0.524)\\ 0.0014\\ (0.506)\\ 4.0742***\\ (0.002)\\ \end{array}$

Appendix C-4: Yield Growth and Restriction Growth for Third-tier Regulatory Forms, Controlling for Disaster (All Results)

Appendix C-4 (Continued)

Danandant Variable:			Permitting				Pre-mar	ket Notice &	Approval	
yield_growth	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend	OLS	OLS	OLS + Time Trend	Industry FE	Industry FE + Time Trend
L.regform_growth	-0.2433***	-0.1937***	-0.1852***	-0.1836***	-0.1827***	-0.0041	-0.0033	-0.0031	-0.0034	-0.0030
	(0.000)	(0.006)	(0.009)	(0.005)	(0.006)	(0.674)	(0.738)	(0.757)	(0.751)	(0.775)
L.total_reg_growth		-0.2375*	-0.2407*	-0.2379***	-0.2438**		-0.3399**	-0.3420**	-0.3320***	-0.3420**
		(0.069)	(0.085)	(0.009)	(0.020)		(0.012)	(0.017)	(0.008)	(0.010)
disaster_state	-0.0262**	-0.0290***	-0.0301***	-0.0297***	-0.0296***	-0.0258**	-0.0301***	-0.0314***	-0.0301***	-0.0304***
	(0.011)	(0.006)	(0.007)	(0.000)	(0.002)	(0.010)	(0.004)	(0.004)	(0.000)	(0.002)
time			-0.0646		-0.0320			-0.1432		-0.1060
			(0.675)		(0.746)			(0.458)		(0.294)
time2			0.0016		0.0006			0.0032		0.0021
			(0.606)		(0.766)			(0.372)		(0.308)
Constant	3.8323***	4.0362***	4.3595**	4.0170***	4.3378***	2.9712***	3.5191***	4.5526*	3.5079***	4.4692***
	(0.000)	(0.000)	(0.012)	(0.000)	(0.002)	(0.000)	(0.000)	(0.054)	(0.000)	(0.000)
Observations	685	685	685	685	685	659	659	659	659	659
R-squared	0.029	0.034	0.034	0.032	0.032	0.007	0.019	0.022	0.018	0.019
Proh > F	0.0000	0,0000	0.0003	0.0002	0.0004	0.0363	0.0033	0.0162	0.0002	0.0001
Number of industries	0.0000	0.0000	0.0005	19	19	0.0505	0.0035	0.0102	19	19
		Mear	ns-based Stan	dards				Prohibitions	5	
Dependent Variable:		Mear	ns-based Stan OLS +	idards	Industry FE +		OI S	Prohibitions OLS +	S La ductaria EE	Industry FE +
Dependent Variable: yield_growth	OLS	Mear OLS	ns-based Stan OLS + Time Trend	dards Industry FE	Industry FE + Time Trend	OLS	OLS	Prohibitions OLS + Time Trend	s Industry FE	Industry FE + Time Trend
Dependent Variable: yield_growth L.regform_growth	OLS -0.0134	Mear OLS -0.0111	ns-based Stan OLS + Time Trend -0.0094	Industry FE -0.0104	Industry FE + Time Trend -0.0098	OLS -0.0007**	OLS -0.0007**	Prohibitions OLS + Time Trend -0.0006**	5 Industry FE -0.0007**	Industry FE + Time Trend -0.0006**
Dependent Variable: yield_growth L.regform_growth	OLS -0.0134 (0.113)	Mean OLS -0.0111 (0.156)	ns-based Stan OLS + Time Trend -0.0094 (0.231)	idards Industry FE -0.0104 (0.104)	Industry FE + Time Trend -0.0098 (0.141)	OLS -0.0007** (0.021)	OLS -0.0007** (0.023)	Prohibitions OLS + Time Trend -0.0006** (0.036)	s Industry FE -0.0007** (0.038)	Industry FE + <u>Time Trend</u> -0.0006** (0.043)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.0134 (0.113)	Mean OLS -0.0111 (0.156) -0.3711***	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624***	Industry FE -0.0104 (0.104) -0.3640***	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636***	OLS -0.0007** (0.021)	OLS -0.0007** (0.023) -0.3762***	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679***	Industry FE -0.0007** (0.038) -0.3686***	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth	OLS -0.0134 (0.113)	Mear OLS -0.0111 (0.156) -0.3711*** (0.004)	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009)	dards Industry FE -0.0104 (0.104) -0.3640*** (0.002)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006)	OLS -0.0007** (0.021)	OLS -0.0007** (0.023) -0.3762*** (0.004)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008)	Industry FE -0.0007** (0.038) -0.3686*** (0.002)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS -0.0134 (0.113) -0.0242**	Mear OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291***	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312***	dards Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300***	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310***	OLS -0.0007** (0.021) -0.0260***	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308***	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326***	s Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315***	Industry FE + Time Trend -0.0006** (0.043) -0.3693*** (0.005) -0.0324***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state	OLS -0.0134 (0.113) -0.0242** (0.016)	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005)	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005)	Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002)	OLS -0.0007** (0.021) -0.0260*** (0.009)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003)	s Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS -0.0134 (0.113) -0.0242** (0.016)	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005)	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471	OLS -0.0007** (0.021) -0.0260*** (0.009)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time	OLS -0.0134 (0.113) -0.0242** (0.016)	Mear OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005)	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595)	ndards Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653)	OLS -0.0007** (0.021) -0.0260*** (0.009)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571)	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2	OLS -0.0134 (0.113) -0.0242** (0.016)	Mear OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005)	ns-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021	Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011	OLS -0.0007** (0.021) -0.0260*** (0.009)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2	OLS -0.0134 (0.113) -0.0242** (0.016)	Mear OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005)	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481)	Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591)	OLS -0.0007** (0.021) -0.0260*** (0.009)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462)	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313***	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501***	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388**	Industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000) 3.5576***	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174***	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179***	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597***	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139**	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.5666***	Industry FE + Time Trend -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975***
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313*** (0.000)	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501*** (0.000)	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388** (0.025)	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000)	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174*** (0.003)	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179*** (0.000)	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597*** (0.000)	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139** (0.023)	s Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.5666*** (0.000)	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975*** (0.002)
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313*** (0.000) 685	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501*** (0.000) 685	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388** (0.025)	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000) 3.5576*** (0.000) 685	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174*** (0.003) 685	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179*** (0.000) 685	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597*** (0.000) 685	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139** (0.023) 685	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.56666*** (0.000) 685	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975*** (0.002) 685
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313*** (0.000) 685 0.008	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501*** (0.000) 685 0.023	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388** (0.025)	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000) 3.5576*** (0.000) 685 0.022	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174*** (0.003) 685 0.023	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179*** (0.000) 685 0.009	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597*** (0.000) 685 0.024	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139** (0.023) 685 0.026	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.5666*** (0.000) 685 0.023	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975*** (0.002) 685 0.023
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Prob > F	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313*** (0.000) 685 0.008 0.0138	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501*** (0.000) 685 0.023 0.0004	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388** (0.025) 685 0.025 0.0029	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000) 3.5576*** (0.000) 685 0.022 0.0001	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174*** (0.003) 685 0.023 0.0003	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179*** (0.000) 685 0.009 0.0049	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597*** (0.000) 685 0.024 0.0001	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139** (0.023) 685 0.026 0.0010	s Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.5666*** (0.000) 685 0.023 0.0000	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975*** (0.002) 685 0.023 0.0000
Dependent Variable: yield_growth L.regform_growth L.total_reg_growth disaster_state time time2 Constant Observations R-squared Prob > F Number of industries	OLS -0.0134 (0.113) -0.0242** (0.016) 2.9313*** (0.000) 685 0.008 0.0138	Mean OLS -0.0111 (0.156) -0.3711*** (0.004) -0.0291*** (0.005) 3.5501*** (0.000) 685 0.023 0.0004	is-based Stan OLS + Time Trend -0.0094 (0.231) -0.3624*** (0.009) -0.0312*** (0.005) -0.0808 (0.595) 0.0021 (0.481) 3.8388** (0.025) 685 0.025 0.0029	industry FE -0.0104 (0.104) -0.3640*** (0.002) -0.0300*** (0.000) 3.5576*** (0.000) 685 0.022 0.0001 19	Industry FE + <u>Time Trend</u> -0.0098 (0.141) -0.3636*** (0.006) -0.0310*** (0.002) -0.0471 (0.653) 0.0011 (0.591) 3.8174*** (0.003) 685 0.023 0.0003 19	OLS -0.0007** (0.021) -0.0260*** (0.009) 2.9179*** (0.000) 685 0.009 0.0049	OLS -0.0007** (0.023) -0.3762*** (0.004) -0.0308*** (0.003) 3.5597*** (0.000) 685 0.024 0.0001	Prohibitions OLS + Time Trend -0.0006** (0.036) -0.3679*** (0.008) -0.0326*** (0.003) -0.0861 (0.571) 0.0022 (0.462) 3.9139** (0.023) 685 0.026 0.0010	Industry FE -0.0007** (0.038) -0.3686*** (0.002) -0.0315*** (0.000) 3.56666*** (0.000) 685 0.023 0.0000 19	Industry FE + <u>Time Trend</u> -0.0006** (0.043) -0.3693*** (0.005) -0.0324*** (0.001) -0.0532 (0.612) 0.0012 (0.561) 3.8975*** (0.002) 685 0.023 0.0000 19

Appendix D: Robustness Checks

Appendix D-1: Yield Growth and Restriction Growth for Second-tier Regulatory Forms (Industry FE + Time Trend Model)

Dependent Variable:			Price Re	gulation					Quantity I	Regulation		
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
L.regform_growth	0.0058	0.0107	0.0064	-0.0019	0.0106	0.0091	0.0012	-0.0013	0.0125	0.0085	-0.0113	0.0224
	(0.740)	(0.421)	(0.294)	(0.846)	(0.426)	(0.406)	(0.961)	(0.956)	(0.651)	(0.738)	(0.598)	(0.320)
L.total_reg_growth	-0.3726***	-0.3785***	-0.4079^{***}	-0.3725***		-0.3439***	-0.3679**	-0.3652**	-0.4123***	-0.3833***		-0.3792***
	(0.004)	(0.004)	(0.003)	(0.006)		(0.004)	(0.011)	(0.014)	(0.008)	(0.007)		(0.006)
L.other_reg_growth					-0.3779***						-0.3488**	
					(0.004)						(0.015)	
disaster_state	-0.0315***	-0.0304***	-0.0305***		-0.0303***	-0.0353***	-0.0320***	-0.0320***	-0.0327***		-0.0318***	-0.0370***
	(0.001)	(0.001)	(0.001)			(0.000)	(0.001)	(0.001)	(0.001)			(0.000)
disaster_county				-3.0146**						-2.9863**		
				(0.018)	(0.001)					(0.019)	(0.001)	
Constant	3.7498***	3.7280***	3.5948***	3.3615**	3.7196***	2.6584***	3.7262***	3.7324***	3.5882***	3.3381**	3.6909***	2.6678***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.010)	(0.003)	(0.001)
Observations	685	685	685	531	685	685	685	685	685	531	685	685
R-squared	0.022	0.024	0.024	0.024	0.024	0.020	0.022	0.022	0.020	0.024	0.022	0.019
Prob > F	0.0003	0.0004	0.0001	0.0257	0.0004	0.0000	0.0003	0.0002	0.0001	0.0247	0.0002	0.0000
Number of industries	19	19	19	12	19	19	19	19	19	12	19	19

Dependent Variable:		Ε	ntry-and-Ex	kit Regulatio	on			S	ervice Quali	ty Regulation	on	
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
L.regform_growth	-0.1644**	-0.1957**	-0.2346***	-0.2285***	-0.1893**	-0.2625**	0.0125	0.0093	0.0463	-0.0024	0.0051	0.0087
	(0.027)	(0.012)	(0.006)	(0.005)	(0.020)	(0.015)	(0.660)	(0.704)	(0.354)	(0.939)	(0.857)	(0.761)
L.total_reg_growth	-0.2785***	-0.2264**	-0.1508	-0.2309**		-0.1524	-0.3660***	-0.3657***	-0.3884***	-0.3747***		-0.3360***
	(0.007)	(0.012)	(0.136)	(0.025)		(0.171)	(0.006)	(0.006)	(0.004)	(0.006)		(0.006)
L.other_reg_growth					-0.2384***						-0.3599***	
					(0.008)						(0.006)	
disaster_state	-0.0283***	-0.0278***	-0.0241***		-0.0273***	-0.0378***	-0.0319***	-0.0319***	-0.0318***		-0.0320***	-0.0366***
	(0.005)	(0.004)	(0.008)			(0.000)	(0.001)	(0.001)	(0.000)			(0.000)
disaster_county				-2.0385*						-2.9849**		
				(0.094)	(0.006)					(0.016)	(0.001)	
Constant	3.7532***	3.7569***	3.3812***	3.5658***	3.9786***	3.4884***	3.7016***	3.7003***	3.5324***	3.3681***	3.6941***	2.7086***
	(0.003)	(0.002)	(0.003)	(0.007)	(0.002)	(0.000)	(0.003)	(0.003)	(0.003)	(0.009)	(0.003)	(0.001)
Observations	685	685	685	531	685	685	685	685	685	531	685	685
R-squared	0.030	0.035	0.038	0.045	0.032	0.039	0.022	0.022	0.022	0.024	0.022	0.018
Prob > F	0.0004	0.0003	0.0001	0.0177	0.0003	0.0000	0.0003	0.0003	0.0000	0.0037	0.0003	0.0000
Number of industries	19	19	19	12	19	19	19	19	19	12	19	19

(1): Using an alternative approach to distribute restrictive word counts; (2): adjusting restrictions for MRV; (3): using total word counts; (4): controlling for county-level disaster risk; (5): controlling for other restriction growth; (6): using expert judgment to exclude irrelevant CFR parts. All specifications include industry fixed effects and time trend; coefficients are omitted.

Chapter 4: Does the Form of Regulation Matter? Appendix D-1 (Continued) Dependent Variable: **Command-and-Control Regulation Market-based Regulation** yield growth (2)(1)(2)(6)(1)(3)(5)(6)(3)(4)(5)(4)-0.1414** -0.4206*** -0.7449*** -0.4379*** -0.3726*** -0.3541*** -0.0842 -0.0386 -0.0352 -0.0674** -0.0573* -0.0333 L.regform_growth (0.000)(0.048)(0.000)(0.001)(0.001)(0.000)(0.117)(0.171)(0.164)(0.027)(0.054)(0.225)-0.3200** -0.2949** 0.3203** -0.1236 -0.0936 0.1405 -0.0551 -0.2855** -0.3287*** -0.3616*** L.total reg growth (0.353)(0.422)(0.341)(0.019)(0.023)(0.018)(0.511)(0.010)(0.009)(0.015)-0.3079** 0.1099 Lother reg growth (0.155)(0.013)-0.0288*** -0.0296*** -0.0277*** -0.0278*** -0.0329*** -0.0334*** -0.0323*** -0.0331*** -0.0322*** -0.0364*** disaster state (0.001)(0.003)(0.002)(0.002)(0.001)(0.001)(0.001)(0.000)-2.2665* -3.0338** disaster_county (0.069)(0.003)(0.018)(0.001)Constant 5.5027*** 4.4541*** 6.2557*** 4.8032*** 5.0987*** 4.0943*** 4.6535*** 4.4401*** 4.2600*** 4.7067*** 4.6866*** 3.3112*** (0.001)(0.000)(0.005)(0.000)(0.001)(0.000)(0.000)(0.004)(0.005)(0.002)(0.005)(0.004)Observations 685 685 685 531 685 685 685 685 685 531 685 685 0.039 0.056 0.044 0.029 0.023 0.030 0.019 **R**-squared 0.059 0.030 0.026 0.021 0.024 Prob > F0.0002 0.0004 0.0001 0.0049 0.0004 0.0000 0.0003 0.0003 0.0001 0.0073 0.0004 0.0000 Number of industries 19 19 19 12 19 19 19 19 19 12 19 19 Dependent Variable: **Information-based Regulation Transfer Regulation** yield_growth (1)(2)(5) (5) (3) (4)(6) (1)(2)(3)(4)(6)0.0688* 0.0931** 0.1020* 0.0874** 0.1151*** 0.3795** 0.4002*** 0.4517*** 0.6126*** 0.1409** 0.3720*** L.regform growth 0.0515 (0.050)(0.034)(0.058)(0.037)(0.006)(0.017)(0.009)(0.002)(0.000)(0.025)(0.000)(0.138)-0.3795*** -0.3772*** -0.4333*** -0.3809*** -0.3631** -0.7303*** -0.7777*** -1.0447*** -1.0922*** -0.7944*** L.total_reg_growth (0.005)(0.005)(0.003)(0.006)(0.002)(0.005)(0.003)(0.001)(0.000)(0.000)L.other_reg_growth -0.3767*** -0.5478*** (0.004)(0.001)-0.0300*** -0.0328*** 0.0263*** -0.0251*** -0.0242*** -0.0260*** -0.0288*** -0.0303*** -0.0301*** -0.0317*** disaster state (0.002)(0.002)(0.001)(0.006)(0.008)(0.006)(0.002)(0.001)disaster county -2.7557** -1.3097 (0.026)(0.002)(0.277)(0.006)4.2070*** 4.2384*** 3.9508*** 3.8884** 4.3296*** 3.6727*** 4.6123*** 4.7624*** 6.0735*** 4.9745*** 5.4392*** 3.7314*** Constant (0.004)(0.005)(0.003)(0.015)(0.004)(0.000)(0.001)(0.001)(0.000)(0.001)(0.000)(0.000)Observations 685 685 685 531 685 685 685 685 685 531 685 685 R-squared 0.028 0.032 0.024 0.040 0.033 0.033 0.031 0.036 0.044 0.078 0.050 0.032 Prob > F0.0002 0.0002 0.0001 0.0019 0.0002 0.0000 0.0004 0.0005 0.0001 0.0027 0.0005 0.0001

(1): Using an alternative approach to distribute restrictive word counts; (2): adjusting restrictions for MRV; (3): using total word counts; (4): controlling for county-level disaster risk; (5): controlling for other restriction growth; (6): using expert judgment to exclude irrelevant CFR parts. All specifications include industry fixed effects and time trend; coefficients are omitted.

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Number of industries

Appendix D-1 (Continued)

Dependent Variable:		А	dministrati	ve Regulatio	n	
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)
L.regform_growth	-0.1278*	-0.1319**	-0.0606*	-0.2227***	-0.1465**	-0.0727***
	(0.061)	(0.045)	(0.054)	(0.003)	(0.032)	(0.007)
L.total_reg_growth	-0.3286***	-0.3263***	-0.3253**	-0.3078***		-0.3156***
	(0.005)	(0.005)	(0.010)	(0.007)		(0.007)
L.other_reg_growth					-0.3140***	
					(0.006)	
disaster_state	-0.0314***	-0.0314***	-0.0331***		-0.0314***	-0.0325***
	(0.002)	(0.001)	(0.001)			(0.001)
disaster_county				-2.7381**		
				(0.027)	(0.001)	
Constant	3.6459***	3.6541***	3.7429***	3.1240**	3.6969***	2.2146***
	(0.003)	(0.003)	(0.002)	(0.013)	(0.003)	(0.007)
Observations	685	685	685	531	685	685
R-squared	0.029	0.029	0.024	0.050	0.029	0.034
Prob > F	0.0002	0.0002	0.0001	0.0081	0.0002	0.0003
Number of industries	19	19	19	12	19	19

(1): Using an alternative approach to distribute restrictive word counts; (2): adjusting restrictions for MRV; (3): using total word counts; (4): controlling for county-level disaster risk; (5): controlling for other restriction growth; (6): using expert judgment to exclude irrelevant CFR parts. All specifications include industry fixed effects and time trend; coefficients are omitted.

Appendix D-2: Yield Growth and Restriction Growth for Third-tier Regulatory Forms (Industry FE + Time Trend Model)

Dependent Variable:			Lice	nsing					Certif	ication		
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
L.regform_growth	-0.0444*	-0.0475	-0.0270	-0.0669	-0.0690	-0.1023*	-0.0991**	-0.1151***	-0.1216***	-0.1839***	-0.1575***	-0.1511***
	(0.090)	(0.190)	(0.469)	(0.110)	(0.118)	(0.053)	(0.012)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
L.total_reg_growth	-0.3504***	-0.3549***	-0.3771***	-0.3621***		-0.2963**	-0.3272***	-0.2919**	-0.2701**	-0.2855**		-0.2104**
	(0.006)	(0.006)	(0.007)	(0.006)		(0.015)	(0.008)	(0.011)	(0.018)	(0.014)		(0.038)
L.other_reg_growth					-0.3452***						-0.2872**	
					(0.006)						(0.011)	
disaster_state	-0.0291***	-0.0295***	-0.0305***		-0.0286***	-0.0371***	-0.0340***	-0.0345***	-0.0352***		-0.0349***	-0.0381***
	(0.005)	(0.005)	(0.002)		(0.007)	(0.000)	(0.001)	(0.001)	(0.000)		(0.001)	(0.000)
disaster_county				-2.3860**						-3.4580**		
				(0.048)						(0.014)		
Constant	4.0508***	4.1326***	3.7129***	3.8637***	4.2264***	3.5829***	3.3681***	2.9333**	2.5968**	2.4846**	3.0001**	2.0316**
	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.000)	(0.006)	(0.015)	(0.023)	(0.047)	(0.013)	(0.017)
Observations	685	685	685	531	685	685	685	685	685	531	685	685
R-squared	0.024	0.023	0.020	0.027	0.024	0.023	0.030	0.036	0.038	0.051	0.036	0.032
Prob > F	0.0003	0.0003	0.0001	0.0176	0.0003	0.0000	0.0001	0.0004	0.0001	0.0201	0.0003	0.0000
Number of industries	19	19	12	19	19	19	19	19	19	12	19	19

Dependent Variable:	Monitoring, Reporting & Verification							Performance Standards						
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)		
L.regform_growth	-0.3705***	-0.0416***	-0.2332**	-0.2729***	-0.3607***	-0.3875***	-0.0458	-0.0473	-0.1506**	-0.0698**	-0.0668*	-0.0577		
	(0.000)	(0.004)	(0.024)	(0.004)	(0.000)	(0.002)	(0.387)	(0.283)	(0.014)	(0.027)	(0.088)	(0.266)		
L.total_reg_growth	-0.1724*	-0.1909	-0.2209*	-0.2162**		-0.0139	-0.2697**	-0.2348*	-0.2780**	-0.1836		-0.2811***		
	(0.098)	(0.233)	(0.054)	(0.040)		(0.914)	(0.048)	(0.095)	(0.022)	(0.208)		(0.007)		
L.other_reg_growth					-0.1435						-0.1686			
					(0.127)						(0.176)			
disaster_state	-0.0354***	-0.0321***	-0.0338***		-0.0340***	-0.0341***	-0.0324***	-0.0318***	-0.0292***		-0.0315***	-0.0360***		
	(0.001)	(0.001)	(0.001)		(0.001)	(0.000)	(0.001)	(0.001)	(0.001)		(0.001)	(0.000)		
disaster_county				-2.9832**						-2.8786**				
				(0.023)						(0.023)				
Constant	3.7175***	-0.0025	2.7660**	3.5836***	3.9022***	3.0688***	3.7480***	3.9991***	7.2922***	3.8014***	3.9653***	3.2643***		
	(0.003)	(0.999)	(0.013)	(0.007)	(0.002)	(0.001)	(0.003)	(0.002)	(0.000)	(0.003)	(0.002)	(0.000)		
Observations	685	559	685	531	685	685	685	685	685	531	685	685		
R-squared	0.036	0.027	0.028	0.036	0.036	0.034	0.024	0.025	0.031	0.033	0.024	0.020		
Prob > F	0.0000	0.0017	0.0001	0.0205	0.0001	0.0000	0.0003	0.0002	0.0001	0.0118	0.0004	0.0000		
Number of industries	19	19	19	12	19	19	19	19	19	12	19	19		

(1): Using an alternative approach to distribute restrictive word counts; (2): adjusting restrictions for MRV; (3): using total word counts; (4): controlling for county-level disaster risk; (5): controlling for other restriction growth; (6): using expert judgment to exclude irrelevant CFR parts. All specifications include industry fixed effects and time trend; coefficients are omitted.

Appendix D-2 (Continued)

Dependent Variable:	Permitting						Pre-market Notice & Approval							
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)		
L.regform_growth	-0.1827**	-0.1576**	-0.1322**	-0.1943***	-0.1960***	0.0077	-0.0172	-0.0046	-0.0015	0.0039	-0.0052	-0.0036		
	(0.011)	(0.019)	(0.023)	(0.002)	(0.005)	(0.916)	(0.367)	(0.641)	(0.785)	(0.587)	(0.630)	(0.735)		
L.total_reg_growth	-0.3093***	-0.2917***	-0.3092**	-0.2450**		-0.3385***	-0.3457**	-0.3424**	-0.3854***	-0.3483***		-0.2921**		
	(0.007)	(0.009)	(0.012)	(0.034)		(0.005)	(0.011)	(0.010)	(0.005)	(0.010)		(0.016)		
L.other_reg_growth					-0.2296**						-0.3428**			
					(0.016)						(0.010)			
disaster_state	-0.0277***	-0.0303***	-0.0307***		-0.0299***	-0.0367***	-0.0305***	-0.0304***	-0.0311***		-0.0305***	-0.0349***		
	(0.003)	(0.002)	(0.001)		(0.002)	(0.000)	(0.002)	(0.002)	(0.001)		(0.002)	(0.000)		
disaster_county				-2.7025**						-2.8854**				
				(0.029)						(0.023)				
Constant	4.6359***	4.0949***	3.6955***	3.8786***	4.3465***	2.7242***	4.5474***	4.4718***	4.6001***	4.3772***	4.5143***	2.9637***		
	(0.002)	(0.002)	(0.002)	(0.006)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)		
Observations	685	685	685	531	685	685	659	659	659	507	659	659		
R-squared	0.033	0.028	0.024	0.040	0.032	0.018	0.020	0.019	0.018	0.020	0.019	0.015		
Prob > F	0.0002	0.0004	0.0001	0.0048	0.0004	0.0000	0.0001	0.0001	0.0000	0.0501	0.0001	0.0000		
Number of industries	19	19	19	12	19	19	19	19	19	12	19	19		
Dependent Variable:		Means-based Standards						Prohibitions						
yield_growth	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)		

yield_glowill	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
L.regform_growth	-0.0199**	-0.0107	-0.0022	-0.0080	-0.0115*	-0.0041	-0.0004**	-0.0005**	-0.0018**	-0.0004	-0.0007**	0.4846***
	(0.030)	(0.107)	(0.847)	(0.471)	(0.096)	(0.199)	(0.045)	(0.042)	(0.030)	(0.186)	(0.030)	(0.007)
L.total_reg_growth	-0.3737***	-0.3642***	-0.3946***	-0.3700***		-0.3298***	-0.3690***	-0.3690***	-0.3985***	-0.3759***		-0.2162
	(0.006)	(0.006)	(0.004)	(0.005)		(0.006)	(0.005)	(0.005)	(0.004)	(0.006)		(0.183)
L.other_reg_growth					-0.3666***						-0.3653***	
					(0.006)						(0.005)	
disaster_state	-0.0297***	-0.0309***	-0.0325***		-0.0317***	-0.0367***	-0.0323***	-0.0324***	-0.0333***		-0.0324***	-0.0433***
	(0.002)	(0.002)	(0.001)		(0.001)	(0.000)	(0.001)	(0.001)	(0.001)		(0.001)	(0.002)
disaster_county				-2.8558**						-3.0286**		
				(0.020)						(0.019)		
Constant	4.1306***	3.8169***	3.6402***	3.3986**	3.8624***	3.0164***	3.8741***	3.8832***	3.8141***	3.4591***	3.8696***	2.2428
	(0.003)	(0.003)	(0.002)	(0.011)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.009)	(0.002)	(0.519)
Observations	685	685	685	531	685	682	685	685	685	531	685	361
R-squared	0.026	0.023	0.020	0.025	0.023	0.019	0.023	0.023	0.022	0.025	0.023	0.035
Prob > F	0.0003	0.0003	0.0001	0.0162	0.0003	0.0000	0.0000	0.0000	0.0000	0.0256	0.0000	0.0114
Number of industries	19	19	19	12	19	19	19	19	19	12	19	13

(1): Using an alternative approach to distribute restrictive word counts; (2): adjusting restrictions for MRV; (3): using total word counts; (4): controlling for county-level disaster risk; (5): controlling for other restriction growth; (6): using expert judgment to exclude irrelevant CFR parts. All specifications include industry fixed effects and time trend; coefficients are omitted.