THE REGRESSIVE EFFECTS OF FEDERAL REGULATION AND A ROADMAP FOR REFORM

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Examination of the Effects of Regulatory Policy on the Economy and Business Growth

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Good morning, Chairman Lankford, Ranking Member Heitkamp, and the members of the committee. I thank you for inviting me to testify.

My name is Dustin Chambers, and I am a professor of economics at Salisbury University and a senior affiliated scholar with the Mercatus Center at George Mason University. My research focuses on income inequality, economic growth, and the regressive effects of regulation. Any statements I make reflect only my opinion and do not necessarily reflect the opinions of Salisbury University or the Mercatus Center.

I would like to begin by thanking Chairman Lankford and Ranking Member Heitkamp for their leadership in holding this hearing focusing on the often overlooked topic of regulatory policy. I am honored to be invited to speak on the panel this morning for what I hope to be a productive discussion on regulatory reform.

My testimony today focuses on three unintended consequences of an expanding and complex body of federal regulations:

1. Regulations reduce economic growth and GDP, thereby reducing living standards for most Americans.
2. Regulations harm small business.
3. Regulations increase poverty rates and disproportionately increase consumer prices paid by the poor.

I conclude testimony by sketching a possible roadmap for reform based on the British Columbia Model. I am happy to answer any relevant questions you have to the best of my knowledge.

THE NEGATIVE IMPACT OF FEDERAL REGULATIONS ON GDP

The creation and enforcement of regulation is an important function of government. Regulations, when appropriately applied, can protect consumers from harmful products, workers from unsafe conditions, promote stewardship of the environment, and protect citizens from government excesses. Ideally, government regulation should concisely and clearly articulate guide rails for public and private conduct, thus establishing universally understood "rules of the game." Government regulation that extends beyond these limited and prudential functions are difficult to justify on economic grounds, and can act as a drag on economic growth.

As long as ago as 1979, Milton Friedman openly speculated that declining US productivity was due in part to rising federal regulation. Lacking a precise measure of regulation, Friedman, like many observers, used page counts in the *Federal Register* as an indirect measure of the pace of annual regulatory growth. In 1936, its inaugural year, the Register comprised a mere 2,599 pages. Just 30 years later, the 1966 *Federal Register* had expanded to 16,850 pages, a 6.4 percent average annual growth rate over the period.[1] By 2016, the page count in the *Federal Register* reached its zenith, peaking at 95,894 pages, a 3.5 percent average rate of annual increase over the half century since 1966. In 2017, the page count of the *Federal Register* shrank to 61,950 pages, still a large number by any standard, but the slimmest volume since 1993.[2]

The *Federal Register* is a crude proxy for federal rule rulemaking because it contains proposed new rules and rule rollbacks and because rules vary in length. Consequently, regulation researchers began using page counts in the *Code of Federal Regulations* (CFR) which codifies the total stock of federal regulation. A 2013 study using this improved measure of total regulation to estimate the effect of federal regulation on physical capital, labor, US productivity, and ultimately GDP, concluded that federal regulations reduced the annual rate of US economic growth by 2 percentage points between 1949 and 2005, and that the cumulative loss of output between 1949 and 2011 equaled a staggering $38.8 trillion.[3]

While an improvement over the *Federal Register*, the use of page counts in the CFR suffers from many shortcomings. First, page counts are an imprecise measure of total regulatory rules. Second, and more importantly, total measures of regulation do not tell researchers the industries to which the regulations apply. Ideally, regulation counts should be matched by industry so that we can trace the impact of rule changes with more microeconomic granularity. This became possible through the use of computers and machine learning, resulting in the release of RegData 1.0 in 2012.[4] Prior to RegData, anyone seeking to manually analyze a single year of the CFR would have to read a volume of pages that, when laid out end to end, spans over 20 miles and contains nearly 104 million words. For a full-time employee reading 250 words per minute, this is a 3.3 year task.[5] The latest version of RegData (version 3.0) has identified just under 1.1 million regulatory restrictions and probabilistically matched these restrictions to industries up to the 6-digit North American Industrial Classification System (NAICS) code level.[6] Using this treasure trove of new data, researchers have begun to more accurately estimate the impact of regulations on GDP, small businesses, consumer prices, and poverty.

A 2016 research study using RegData found that regulations trimmed about 0.8 percentage points from the annual rate of US economic growth between 1977 and 2012.[7] To put this finding into perspective, if

[1] Milton Friedman and Rose Friedman, *Free to Choose* (New York: Harcourt, 1979).
[2] Clyde Wayne Crews, "Trump Regulations: Federal Register Page Count Is Lowest in Quarter Century," *Competitive Enterprise Institute*, December 29, 2017.
[3] John W. Dawson and John J. Seater, "Federal Regulation and Aggregate Economic Growth," *Journal of Economic Growth* 18, no. 2 (2013): 137–77.
[4] QuantGov, "The History of RegData," accessed September 20, 2018, https://quantgov.org/regdata/history/.
[5] QuantGov, "The QuantGov Regulatory Clock," accessed September 20, 2018, https://quantgov.org/charts/the-quantgov-regulatory-clock/.
[6] Patrick A. McLaughlin and Oliver Sherouse, "RegData 2.2: A Panel Dataset on US Federal Regulations," *Public Choice*, Online First Articles (2018): 1–13, https://link.springer.com/article/10.1007%2Fs11127-018-0600-y.
[7] Bentley Coffey, Patrick McLaughlin, and Pietro Peretto estimated the effect of federal regulations using a 22-industry model of the US economy. See Bentley Coffey, Patrick A. McLaughlin, and Pietro Peretto, "The Cumulative Cost of Regulations" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2016).

the total number of regulations had been frozen between 1980 and 2012, the US economy would have been $4 trillion (or 25 percent) larger in 2012 than what we actually experienced. In per capita terms, the lost output in 2012 alone equaled just under $13,000. Both of the foregoing studies,[8] despite using very different measures of regulation and very different models of the US economy, reach very similar conclusions: regulations produce a serious drag on economic growth rates resulting in very large losses in cumulative output over the long run. Even deceptively small reductions in the rate of economic growth, when compounded over several decades, have a profound impact—this is reflected in the quote often attributed to Albert Einstein describing compound interest as the most powerful force in the universe. Indeed, if the long-run rate of real economic growth, which averaged 3.2 percent between 1947 and 2018, were to be increased by 0.8 percentage points (from 3.2 percent to 4.0 percent), the resulting fast-growth US economy would be just over twice as large as our slower growing economy in a century. Such profound growth will likely do more for to eliminate absolute poverty than any well-intentioned government program.

THE NEGATIVE IMPACT OF FEDERAL REGULATIONS ON SMALL BUSINESSES

Although the overall cost of regulations is substantial, there is new and disturbing evidence suggesting that smaller businesses shoulder a disproportionate share of the compliance costs borne by private industry.[9] Regulation reduces both employment growth and total new firm creation at the industry level. Specifically, a 10 percent increase in federal regulations is associated with a 0.47 percent reduction in new firm formation and a 0.63 percent reduction in new hires. Interestingly, when controlling for firm size, this effect is only statistically significant for small firms. Moreover, the rate of large firm deaths (i.e., failures or exits) actually *declines* in response to rising regulation, suggesting that large firms are better suited to survive the pressures of higher regulation. In a similar study published this year (2018),[10] I, with my coauthors, find that rising regulations have a disparate impact on small businesses within an affected industry. In particular, a 10 percent increase in federal regulations is associated with a 0.5 percent reduction in total small firms, while the impact on large firms is statistically insignificant. Moreover, consecutive years of rising regulation within an industry has a compounding effect, wherein the negative effects of higher regulations are amplified if preceded by one or two years of above-average regulation growth. For example, a 10 percent increase in industry regulations, if preceded by two years of above average growth in regulations, is associated with a 1 percent decline in the total number of very small firms (firms with fewer than five employees).

It is reasonable to suspect that large firms can more easily afford to hire compliance-related personnel (e.g., lawyers and accountants) and spread the resulting compliance costs over a larger volume of output than small firms and especially sole proprietorships (where compliance burdens fall squarely on owners). This may hasten the exit of some entrepreneurs or deter the entry of new firms. Unfortunately, many policymakers mistakenly assume that small businesses are not harmed by regulation due to small business exemptions. Despite Congressional efforts like the Regulatory Flexibility Act of 1980 and the Small Business Regulatory Enforcement Fairness Act of 1996, small businesses still must spend time and money reviewing new rules to determine if those rules apply to their business, and if so, apply for exemptions or waivers, which still must be granted by regulators. Researchers who have studied this issue have found that small business concessions vary greatly by regulatory area and that their overall effectiveness is mixed.[11]

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[8] Dawson and Seater, "Federal Regulation and Aggregate Economic Growth"; Coffey, McLaughlin, and Peretto, "The Cumulative Cost of Regulation."

[9] James Bailey and Diana Thomas, "Regulating Away Competition: The Effect of Regulation on Entrepreneurship and Employment" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2015).

[10] Dustin Chambers, Patrick A. McLaughlin, and Tyler Richards, "Regulation Entrepreneurship, and Firm Size" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2018).

[11] For small business concessions by regulatory area, see Ryan Keefe, Susan Gates, and Eric Talley, "Criteria Used to Define a Small Business in Determining Thresholds for the Application of Federal Statutes" (Working Paper, RAND Corporation, Santa

THE REGRESSIVE EFFECTS OF FEDERAL REGULATIONS

Furthermore, businesses located in poorer areas tend to be smaller than those located in more affluent areas,[12] implying that any disparate negative effects of regulations are likely to be amplified in the most economically vulnerable communities. In a recent study,[13] I, with my coauthors, find that more federal regulations are associated with higher poverty rates at the US state level. Specifically, we find that a 10 percent increase in the federal regulatory burden on a state is associated with a 2.5 percent increase in the state poverty rate. Unfortunately, the regressive effects of federal regulations also harm poorer households in the form of higher consumer prices.

In another 2018 study,[14] we combined regulation data from RegData with consumer expenditure and pricing data from the Bureau of Labor Statistics, and estimated that a 10 percent increase in federal regulations is associated with a 1 percent increase in consumer prices. Although this result is predictable, as regulatory compliance is costly and firms will attempt to pass these costs onto consumers in the form of higher prices, we also determined that the poorest households (those in the bottom 20 percent of the income distribution) spent on average a larger share of their income on the 25 most heavily regulated goods than any other income group. Not surprisingly, these poor households faced an average inflation rate of 2.46 percent per year, far higher than the 2.08 percent average inflation rate experienced by households in the top 20 percent of the income distribution. These findings are particularly disturbing given that one of the principal goals of government regulation is the protection of vulnerable populations. Well-designed and appropriate regulations notwithstanding, this result underscores the need to reduce unnecessary red tape from the body of administrative law.

A ROADMAP FOR REFORM: THE BRITISH COLUMBIA MODEL

The United States needs to achieve lasting reform without radical policy reversals between administrations. Fortunately, the regulatory reform undertaken in the Canadian province of British Columbia in 2002 provides a roadmap for US policy makers.

Following the election of a reformist government in 2001, British Columbia (BC) sought to reduce the number of regulatory requirements, which initially stood at just over 382,000, by an ambitious 33 percent.[15] To achieve this goal, two regulatory restrictions were to be removed for every new rule imposed. Once the target reduction of one-third was achieved, the policy switched to a one-in-one-out rule. All newly proposed regulatory rules were required to be "necessary, outcome-based, transparently developed, cost-effective, evidence-based, and support[ive of] the economy and small business."[16] The reform process was decentralized, and each agency was tasked with achieving the mandated regulatory goals. The BC government successfully engaged with private individuals and firms to help identify ineffective and burdensome rules. Finally, and perhaps most importantly, the BC government successfully changed the culture of its own bureaucracy by shifting the focus of regulators' energy from the drafting of new rules to the ongoing management of a regulatory portfolio. Such an approach not only institutionalizes reform efforts, but also ensures that (1) regulators must constantly reevaluate past regulatory rules and eliminate poor performers, and (2) regulators cannot create new rules unless their

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Monica, CA, August 2005); for the effectiveness of small business concessions, see Dixon et al., "The Impact of Regulation and Litigation on Small Business and Entrepreneurship" (Working Paper, RAND Corporation, Santa Monica, CA, February 2006).

12 Kugler et al., *Entrepreneurship in Low-Income Areas* (Washington, DC: US Small Business Administration, September 2017).

13 Dustin Chambers, Patrick A. McLaughlin, and Laura Stanley, "Regulation and Poverty: An Empirical Examination of the Relationship between the Incidence of Federal Regulation and the Occurrence of Poverty across the States," *Public Choice* (forthcoming).

14 Dustin Chambers, Courtney Collins, and Alan Krause, "How Do Federal Regulations Affect Consumer Prices? An Analysis of the Regressive Effects of Regulation," *Public Choice* (forthcoming).

15 For a detailed description of the British Columbia Model, see Laura Jones Cutting Red Tape in Canada: A Regulatory Reform Model for the United States (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, 2015).

16 *Cutting Red Tape in Canada: A Regulatory Reform Model for the United States* (Arlington, VA: Mercatus Center at George Mason University, 2015).

net benefits (i.e. benefits net of costs) exceed the performance of the least effective current rule, which is initially a weaker standard than a simple cost-benefit test when "red tape" remains, but gradually transitions into a stricter standard once regulators have effectively eliminated all "red tape."[17] Economist Laura Jones reports that following the implementation of these reforms, BC reduced regulatory requirements by 37 percent, the number of business incorporations rose while the number of business bankruptcies declined, and the province's rate of economic growth went from below average before the election of reformers (1992 to 2000) to above average in the six years after reform (2002 to 2008), all without adverse effects on environmental quality.[18]

CONCLUSION

In view of the unintended consequences of excessive red tape, which include lower rates of economic growth, reduced small business formation and entrepreneurship, higher rates of poverty, and higher prices for all consumers (especially the poorest), the nonpartisan and urgent need for regulatory reform that slashes red tape while preserving rules that protect workers, consumers, and the environment should be apparent. Moreover, the ability to stimulate the economy without impacting the federal budget or the national debt through increased spending or tax cuts is especially appealing.

ATTACHMENTS (2)

Dustin Chambers, Patrick A. McLaughlin, and Tyler Richards, "Regulation, Entrepreneurship, and Firm Size" (Mercatus Working Paper)
Dustin Chambers, Patrick A. McLaughlin, and Laura Stanley, "Regulation and Poverty: An Empirical Examination of the Relationship between the Incidence of Federal Regulation and the Occurrence of Poverty across the States" (Mercatus Working Paper)

[17] This is an especially important property given recent research, which calls into question the quality of regulatory impact analysis (RIA) performed by federal agencies. See for example, Jerry Ellig, "Evaluating the Quality and Use of Regulatory Impact Analysis: The Mercatus Center's Regulatory Report Card, 2008–2013" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2016).
[18] See Jones (2015).

Regulation, Entrepreneurship, and Firm Size

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Abstract

We investigate whether regulatory growth disproportionately burdens small businesses relative to large businesses. Using panel data from RegData 3.0 and exploiting variation across industries over time, we empirically estimate the relationship between regulatory growth and growth in the number of small and large firms. Controlling for other factors, we find that a 10 percent increase in regulatory restrictions on a particular industry is associated with a reduction in the total number of small firms within that industry by about 0.5 percent, while simultaneously having no statistically significant association with the number of large firms in that industry. We also find that these magnitudes are amplified when this regulatory growth follows previous years of high regulatory growth, implying that unrelenting regulatory increases harm small businesses at an escalating rate.

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This paper can be accessed at https://www.mercatus.org/publications/regulation-entrepreneurship-firm-size

Regulation, Entrepreneurship, and Firm Size

Dustin Chambers, Patrick A. McLaughlin, and Tyler Richards

1. Introduction

Regulations, by their nature, generate costs and benefits for the entities they affect. These effects can accrue in different ways and to different groups. Some of the effects are estimated in regulatory impact analyses prepared by the agencies responsible for the regulations. However, as regulations build up over time, their accumulation may have more significant effects than agencies are able to impute in their analyses of individual rules. Furthermore, the effects of accumulation may impact some groups more than others because of certain group characteristics. In this paper, we focus on discovering whether increases in regulations disproportionately burden small businesses as compared with large businesses. In particular, we seek to determine whether increases in regulations that apply to individual industries reduce the number of small firms in those industries, while having less of an effect on their larger competitors.

Regulatory costs come in many forms, but a common manifestation is compliance costs—the costs that businesses must incur in order to fulfill regulatory obligations. Compliance costs might include filling out paperwork, purchasing new equipment to meet mandated standards, or paying lawyers to advise on compliance strategies, just to name a few examples. Such compliance activities may have economies of scale that allow large businesses to navigate the regulatory landscape more easily than small businesses. For instance, large businesses are likely to have lawyers on payroll, while small businesses may be limited to contracting for legal services. Not only is the same legal advice likely to cost more from a contractor than from a full-time hire, but the contracted lawyer must spend extra time learning the specific details of the business—knowledge a lawyer on payroll would already have when compliance issues arise.

Moreover, the costs of many regulations are fixed rather than purely variable (per-unit) costs, and larger businesses are able to spread fixed costs over a larger volume of output. In other words, if regulations apply equally to all businesses within an industry, we should expect that the relative costs of compliance—meaning the costs relative to the size of the business—will be larger for small businesses than for large businesses.

If the burden of regulations falls disproportionately on small businesses, this burden is likely to have ripple effects throughout the economy owing to the importance of small businesses for employment, innovation, and economic opportunity. Small businesses represent a large portion of the US economy, both in terms of the number of businesses and in terms of the workforce. According to the US Census Bureau's "Statistics of US Businesses" (SUSB), businesses with fewer than 500 employees—the definition of a small business used by the Small Business Administration (SBA)—account for 99.7 percent of US businesses and 47.5 percent of US employment (SBA 2017). Furthermore, research has shown not only that small businesses exhibit roughly the same rate of innovative activity per worker as large businesses, but that in some industries small businesses are more innovative than their larger counterparts (Audretsch 1995).

In addition to these macroeconomic implications, the burden of regulatory costs on small businesses may also have important distributional effects based on income. Low-income areas tend to have smaller businesses than other areas (Kugler et al. 2017), meaning that any disproportionately high costs for small businesses are likely to hit these low-income areas hardest. Small businesses are also an important mechanism for economic mobility, specifically for low-income households with little access to capital. To the extent that regulations hurt small businesses or create barriers to entry for such businesses, they may also limit the economic opportunities available to low-income households.

In order to mitigate these potential problems, Congress has built some relief mechanisms for small businesses into the regulatory process. For example, the Regulatory Flexibility Act of 1980 and the Small Business Regulatory Enforcement Fairness Act of 1996 instruct federal agencies to attempt to determine a regulation's economic impact on small entities and explore alternatives that might reduce that impact, including partial or total exemptions for small businesses (although these statutes allow the agency to determine what constitutes a small business under the specific circumstances). However, we know little beyond limited anecdotal evidence about the extent of small business exemptions or their characteristics, because there currently exists no way to scour the federal regulatory code for all exemptions and their details. Furthermore, exemptions that do exist may not constitute complete cost savings—some are only partial exemptions, and even full exemptions may involve compliance costs because businesses must determine whether they are eligible for the exemptions and must file for them.

The idea that regulatory burdens may fall disproportionately on small businesses is not new to the academic literature. However, limited data on the breadth and incidence of federal regulation have made empirical testing of the concept difficult at best. A few studies have attempted to look at the general effects of regulations on small businesses (Hopkins 1995; Crain and Hopkins 2001; Kitching, Hart, and Wilson 2015; Crain and Crain 2014), and others have analyzed specific case studies or anecdotes (Adler 1993; Becker 2005; Dean, Brown, and Stango 2000). While these studies are informative, the robustness of their results is debatable because they either lack a good measure of the incidence of regulation or require extrapolating to the entire economy from a single industry. However, a novel database called RegData, which quantifies federal regulatory restrictions within the *Code of Federal Regulations* (CFR) and identifies the industries those restrictions directly impact, allows us to empirically test the effects of regulations on small businesses with more granularity and robustness (McLaughlin and Sherouse 2017).

This study is the first to estimate how changes in the stock of regulations influence the number businesses of varying sizes across industries. In particular, we evaluate how increases in the number of regulatory restrictions that apply to individual industries affect the number of small firms and large firms in those industries between 1998 and 2015. We also evaluate the effect of increases in regulatory restrictions during that time period on total employment in small and large firms from those industries. Controlling for other factors, we find that a 10 percent increase in regulatory restrictions on a particular industry is associated with a reduction of 0.432–0.565 percent in the total number of small firms in that industry, but the same increase is not associated with any change in the number of large firms in that industry. The reduction in small firms rises to 1.00–1.54 percent when the industry has experienced above-average regulatory growth over the previous two years. We also find that a 10 percent increase in regulatory restrictions on an industry is associated with a 0.410–0.547 percent reduction in total employment within small firms in that industry. However, when industries endure two consecutive years of above-average regulatory growth, we find statistically significant reductions in employment for firms of all sizes within that industry, including large firms.

This paper is organized as follows. Section 2 provides a review of the existing literature on the effects of regulations on small businesses. Section 3 describes the data used in the study. Section 4 provides exploratory analysis of the differing effects of regulations on small and large businesses. Section 5 describes the formal regression model. Section 6 presents the estimation results. Finally, section 7 concludes with a discussion of the topic and results.

2. Literature Review

Our study is the first in the literature to address how changes in the stock of regulations influence the number of businesses of different sizes across industries. The lack of existing research likely reflects the fact that, before RegData, there existed no comprehensive panel of federal regulatory restrictions that was based on the North American Industry Classification System (NAICS). Consequently, the bulk of the existing literature focuses on either the general impact of federal regulations on all small businesses or industry-specific case studies. General studies risk conflating the effects of other factors with those of regulations, and case studies paint only part of the picture. Moreover, much of the literature on small businesses and regulation has relied on surveys of small business owners, who are asked to give potentially biased feedback concerning the monetary and time burdens of compliance.

Nevertheless, a large body of research exists on whether and how regulations affect small businesses. Bradford (2004) develops a mathematical model of how regulatory costs and benefits affect businesses of different sizes, with the aim of determining whether small business exemptions are justified. However, he falls short of providing a general answer to that question owing both to uncertainty about the compounding effects of many regulations and to case-by-case considerations regarding transaction costs. Becker (2005) presents a case study of asymmetric enforcement of the Clean Air Act, which exempts small businesses from many regulations. He finds that many asymmetries exist in enforcement, some favoring small businesses and some favoring large businesses. Thus, he is unable to draw any conclusions regarding whether regulations favor small businesses specifically. Dean, Brown, and Stango (2000) conduct a different study on the effects of environmental regulations on small businesses, finding that greater intensity of regulation is associated with fewer small business formations but no change in large business formations.

Crain and Crain (2014), looking at the costs of regulations for small businesses, measure regulatory cost incidence by evaluating the cost of regulatory compliance for various industries and determining the cost per employee for small businesses (those with fewer than 50 employees), medium businesses (50 to 99 employees), and large businesses (100 or more employees). They find that, across all industries, the compliance cost per employee is $11,724 for small businesses, $10,664 for medium businesses, and $9,083 for large businesses. The National Federation of Independent Business (NFIB), a US association of small businesses, provides some insight into the costs as perceived by small business owners. The association recently released the results of a questionnaire in which it asked its members to rate 75 potential business problems related to the marketplace and government activities on the basis of each problem's severity. "Unreasonable government regulations" was rated the second-most-severe problem, trailing behind only the cost of health insurance (Wade 2016).

Kitching, Hart, and Wilson (2015), however, suggest that by treating regulation as a static and negative influence (e.g., by considering only the one-time costs of purchasing new technology or filling out paperwork), small business owners and much of the existing literature overlook the positive effects of regulation on business performance. They argue that regulation is in fact a dynamic force that can benefit or harm businesses as they adapt to the new regulations and interact with stakeholders, but that the dynamic effects (including the benefits) may be less apparent than the static effects. These dynamic effects include changes such as new opportunities created by the adoption of new mandated business practices and technologies and entrepreneurial opportunities created by changes in the market structure due to regulatory effects.

Regarding the cumulative costs of regulations, Bradford (2004, 28) argues that they may be less than the sum of the individual (marginal) costs of compliance with each regulation. This stems from the fact that some regulations overlap:

> For example, one of the costs of the Americans with Disabilities Act is training a firm's hiring personnel, who must learn what hiring practices are disallowed by the Act. The Equal Employment Opportunity Act imposes a similar cost, but with respect to women and minorities rather than the disabled. To the extent that personnel training for the two statutes can be combined, the overall training cost may be less than what it would cost to train people under each statute separately. Paperwork and labeling requirements may involve similar economies.

Thus, Bradford argues that the cumulative costs of regulations are increasing at a declining rate. This is in sharp contrast to Adler (1993), who argues that regulations have a compounding effect on costs:

> The problem is not so much with any specific regulation as it is with the overall phenomenon. . . . The cumulative impact of regulatory efforts is to depress economic activity, retard job creation, and stifle the entrepreneurial spirit. When regulations are issued with little regard for their marginal impact when added to existing requirements, their results can be particularly oppressive. Regulations are like straws that eventually break the camel's back.

Nonetheless, both authors predict that the total regulatory burden is not simply the sum of the compliance costs projected by regulatory agencies, but rather a function of the buildup of regulations over time. Neither author, however, addresses the two central questions of our paper: First, does the pace of short-run changes in federal regulations differentially impact the number of small and large firms within an industry? Second, how do these changes impact total employment for small and large firms within an industry? Thus, our paper advances the literature in several key ways. First, we look at the impact of regulatory flow rather than the overall level of regulation. Second, we examine enterprises of all sizes, not just small businesses. Finally, we use objectively generated and unbiased measures of regulation to estimate effects over nearly two decades (1998–2015).

3. Data

For our measure of federal regulation, we use RegData 3.0, which quantifies regulation from the CFR for the years 1970–2016 (McLaughlin and Sherouse 2017). To obtain this measure, RegData first searches the CFR for restrictive words, such as "shall" or "must." It then uses a machine learning model to assign probabilities that an industry is likely to be affected by each restriction. These industries are identified using NAICS industry codes (Al-Ubaydli and McLaughlin 2017). The model is trained to identify industries by looking for textual similarities between a rule in the CFR containing specific restrictions and a set of rules and proposed rules published in the *Federal Register* that mention at least one NAICS industry by name. RegData identifies these industries from the two-digit to six-digit NAICS levels, with two-digit being the broadest (e.g., 23—Construction) and six-digit being the narrowest (e.g., 238140—Masonry Contractors).

We combine the data from RegData with the SUSB data, which provide the number of firms and total employment for businesses of various sizes within NAICS industries each year from 1998 to 2015.[1] SUSB defines a firm as "a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control."[2] It defines size by the number of employees, grouping businesses into six categories: 0–4, 5–9, 10–19, 20–99, 100–499, and 500+ employees. SUSB also identifies industries from the two-digit to six-digit NAICS level, allowing for direct mapping to the RegData database. It is important to note that firms can move between categories over time for

[1] We chose SUSB over County Business Patterns for two reasons: (1) SUSB has data at the firm and establishment levels, while CBP has data only at the establishment level (which means its data give a less accurate picture of the total number of "businesses"); and (2) the Census Bureau recommends that County Business Patterns data not be used as a time series.
[2] See the SUSB glossary at https://www.census.gov/programs-surveys/susb/about/glossary.html.

various reasons—for instance, they might hire additional workers, lay workers off, or merge with other firms. That said, firms only exist in a single category each year.

Table 1 (page 33) provides the distribution of firms by size and year in the US between 1998 and 2015, as reported by SUSB. Over this time period, very small businesses (0–4 employees) constituted the bulk of all firms (61.21 percent), while all small firms (0–499 employees), as defined by the SBA, represented more than 99 percent of all firms. Large firms (with 500 or more employees) represented less than one-third of one percent of all firms. Nonetheless, large firms were important sources of overall employment. Table 2 (page 34) provides the distribution of employment by firm size between 1998 and 2015, as reported by SUSB. Over this time period, large firms provided just under 51 percent of total employment, while all small firms (0–499 employees) provided the other 49 percent. The smallest firms (0–4 employees) provided approximately 5 percent of all employment.

In the regression analysis that follows in section 5, we match the RegData data and SUSB data with two indicators of the US business cycle: the unemployment rate and the US GDP gap. The unemployment rate, obtained from the St. Louis Federal Reserve, measures the US average rate of unemployment from 1998 to 2015 (OECD 2018). The GDP gap is a measure of how far the current level of US output is above or below its long-run trend. This measure is derived from annual real GDP data obtained from the St. Louis Federal Reserve (BEA 2018) and is decomposed into trend and cycle components.[3] The latter series (cycle) is interpreted to measure economic deviations from trend—that is, the business cycle (in billions of 2009 chained dollars). Finally, we divide the cycle series by the trend measure to express the GDP gap as a percentage of full output.

[3] Because this is annual data, the smoothing parameter was set to 6.25 ($\lambda = 6.25$).

For example, a positive value of 2 percent corresponds to economic output that is 2 percent above trend output (an economic expansion), while negative readings correspond to recessions.

4. Exploratory Analysis

Before specifying and estimating the formal regression model, it is instructive to examine the data directly to find evidence of patterns within and relationships between the variables in our dataset. We begin by looking at the year-over-year rate of growth of industry-specific regulations, which averaged 3.83 percent between 1998 and 2015. This growth rate, while high, varied significantly by year (see table 3, page 35), with regulatory growth exceeding 5 percent per year on four occasions (2004, 2008, 2012, and 2015).

Moreover, we find that the burden of regulation falls disproportionately on smaller businesses. To explore this further, we use the SUSB firm size classifications to calculate the effective regulatory restrictions by firm size and year using weights based on the proportion of firms of a given size within an industry. For example, focusing on the smallest firms (0–4 employees), for each year (*t*) we first calculate the total number of small firms (F_t^{0-4}) in our dataset:

$$F_t^{0-4} = \sum_i F_{t,i}^{0-4}, \tag{1}$$

where *i* is an index of industry and $F_{t,i}^{0-4}$ is a measure of the number of small firms in industry *i* in year *t*. Next, we derive weights based on the share of all small firms that operate in a given industry, which reflects the distribution of small firms across industries:

$$w_{t,i}^{0-4} = \frac{F_{t,i}^{0-4}}{F_t^{0-4}}. \tag{2}$$

For example, in 1998, there were 5,400,968 firms with 0–4 employees in our matched dataset. Of those small firms that year, 198,580 were in the wholesale trade sector (NAICS code

42). Therefore, the share ($w_{t,i}^{0-4}$) of all small firms in the wholesale trade sector in 1998 equaled approximately 3.7 percent (i.e., 198,580/5,400,968 = 0.03677). Finally, we multiply these annual industry weights by the level of federal regulation that pertains to each industry (reg_{it}), and sum across industries:

$$reg_t^{0-4} = \sum_i w_{t,i}^{0-4} \cdot reg_{it}. \tag{3}$$

Repeating this process for each firm size classification (i.e., 5–9 employees, 10–19 employees, etc.), we derive the weighted regulatory restrictions by firm size for each year (see table 4, page 36).[4] The resulting data enable us to determine whether regulatory restrictions tend to be higher in industries that have a higher concentration of small firms. The resulting regulation total represents the universe of regulations collectively faced by firms of a given size in a given year. Therefore, it is important to emphasize that no single firm faces the totality of these weighted restrictions, but rather this is a measure of regulation brought to bear collectively on all firms of a given size.

We find that the smallest firms, defined as enterprises with four or fewer employees, faced a regulatory burden between 19 and 83 percent greater than that of their larger counterparts in 1998. By 2015, this imbalance had declined somewhat, but was nonetheless large, ranging from 15 to 48 percent. To show this more clearly, figure 1 (page 37) plots an index of weighted

[4] The drop in weighted regulations across all firm size classes between 2002 and 2003 was due to a change in Census Bureau methodology in the tabulation of SUSB statistics. Specifically, 2002 was the last year in which the 1997 NAICS code system was used. Beginning in 2003, SUSB switched to the 2002 NAICS code system, resulting in the loss of 43 sectors in our dataset and the addition of 195 new sectors. The Census Bureau updated the underlying NAICS code system again in 2008 and in 2012, but the updates resulted in few sectoral changes in our matched dataset, with net total firm changes of less than 1.5 percent in both transition years.

regulation by firm size, with 100 corresponding to the level of regulation faced collectively by small firms in 1998 (25,633 weighted regulatory restrictions).[5]

There is also anecdotal evidence that federal regulations have a more erosive effect on small firms than on larger firms. Figure 2 (page 38) plots an index of total small firms (100 corresponds to the total number of small firms in 1998) against the index of weighted regulations for small firms from figure 1 (100 corresponds to the level of regulation faced by small firms in 1998) from 2003 to 2015.[6] These results are intriguing even though the relationship between the *level* of small-firm entrepreneurship and federal regulations is beyond the scope of this paper.[7] Specifically, there appears to be an inverse relationship between total firms and total weighted regulations, with the two series often moving in opposite directions (i.e., the total number of firms tends to fall during periods of regulatory buildup, while entrepreneurship increases during periods of deregulation).

Granted, the first few years of the 21st century were a period of high growth followed by contraction (the Great Recession) and slow recovery; therefore one cannot credit regulations alone with the pattern of total small firms observed. However, it is worth noting that a similar pattern *does not* emerge when examining large firms with 500 or more employees (see figure 3, page 39). Despite a recession and surge of regulation, the pattern of growth for large firms is

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[5] These measures do not take into account small business regulatory waivers, which exempt some small businesses (on a case-by-case basis) from specific regulations. Data about these waivers are not readily available, and regulations are costly irrespective of waivers. First, firms must stay apprised of, analyze, and understand all new regulations affecting their industry. Second, the costs of applying for a waiver (e.g., legal, consulting, and filing costs) may be substantial. Therefore, all applicable regulations are costly to firms, regardless of their enforcement.

[6] We plot from 2003 onward because of the change in SUSB methodology between 2002 and 2003 discussed above.

[7] Testing the relationship between the stock (or level) of firms and regulations would be an ambitious undertaking, as it would require the construction of a model that mimics the distributional structure of the US economy. Instead, in section 5, we test the relationship between growth in the total number of firms in a given industry and growth in federal regulations germane to that industry. This flow model necessarily eliminates any static or slow-evolving structural factors governing firm size and distribution, yielding a model wherein growth in total firms is driven by regulatory changes and the business cycle.

very different. While this may seem puzzling to some, it does fit a pattern consistent with the predictions of public choice theorists (see, for example, Stigler 1971 and Peltzman 1976, among others), who posit that large and more powerful firms often seek regulations, which act as barriers to entry to the industry by smaller firms, and so limit competition to existing firms. This pattern is also consistent with the theory that larger firms both possess the resources to cope with new regulations and can spread the costs of regulations over a larger volume of output.

To show the extent to which weighted regulations are correlated with the number of firms of a given size, table 5 (page 40) provides the relevant correlation coefficients over the periods 2003–2015 and 2009–2015.

Given the sharp economic contraction of the Great Recession followed by the brisk pace of new regulation during the Obama administration, one would expect, a priori, a negative correlation between total firms and regulation. We do observe this pattern quite clearly in smaller firms (with fewer than 100 employees). However, large firms display the opposite behavior, with surging numbers of large firms alongside higher regulations.

To further explore this issue, we set aside the total weighted regulation data by year and instead investigate the unweighted, industry-level regulation and firm data. As a first step, we calculate the year-over-year growth rate of the total number of firms of a given category size (e.g., 5–9 employees) between 1998 and 2015. Next, we group these growth observations by their corresponding *rate of regulatory growth*. Observations from industries experiencing the relatively lowest rates of regulatory growth within a given year (i.e., the bottom 25 percent) are assigned to the low-regulation-growth group, while observations from industries experiencing rapid regulatory growth within a given year (i.e., the. top 25 percent) are assigned to the high-regulation-growth group. Next, we subdivide the low-regulation-growth group by size class and calculate the average growth rate in the total number of firms. This step is repeated for the high-regulation-growth group. The results are plotted in figure 4 (page 41). Clearly, the total number of firms in industries with regulatory stability grew at a higher pace (or shrank at a slower pace) than the number of firms in industries deluged by new regulations. This suggests that firms operating in an environment with little regulatory growth are less likely to fail than their peers doing business in an environment with rapidly increasing regulations.

As a final exploratory exercise before moving to the formal regression model, we ask this question: If firms within an industry are subjected to several consecutive years of growing regulatory burden, does the number of firms within that industry decline at a faster pace? To assess this question, we filter our dataset to include firms that experienced one, two, or three consecutive years of regulatory growth. Focusing specifically on the smallest firms (0–4 employees), we find that both total firms and employment decline more rapidly with more consecutive years of regulatory growth (see figure 5, page 42).

Moreover, this phenomenon is exacerbated when the rate of regulatory growth is higher. To demonstrate this, we repeat the exercise above, but this time focus on consecutive years of *above average* regulatory growth. The results for the smallest firms are similar but noticeably more pronounced (see figure 6, page 43). In the case of a single year of positive regulatory growth, the corresponding total number of small firms within an industry shrinks by about 0.31 percent (see figure 5). However, when firms experience a single year of above-average regulatory growth, the total number of small firms shrinks by 1.11 percent, which is over 3.5 times the 0.31 percent rate of decline. To put this number into perspective, there were more than 3.6 million firms with 0–4 employees in 2015. A decline of just 0.31 percent represents the loss of more than 11,000 firms. When regulatory growth extends to three consecutive years, the impacts are more pronounced: the corresponding total number of small firms within an industry shrinks by about 0.42 percent annually (see figure 5). However, when firms experience three consecutive years of above-average regulatory growth, the total number of small firms shrinks 3.5 times more rapidly (1.47% vs. 0.42%). If such a drastic decline were to befall all very small firms in 2015, the result would be the loss of more than 53,000 businesses.

Turning to the employment statistics of the smallest firms, a single year of positive regulatory growth is associated with a 0.02 percent decline in employment, while three consecutive years of regulatory growth is associated with a 0.19 percent decline in employment each year (see figure 5). To put this into perspective, nearly 5.9 million people were employed by small firms in 2015. A decline of just 0.19 percent would represent the loss of just over 11,000 jobs. When regulatory growth increases to above-average levels, the effects are amplified. For a single year of above-average regulatory growth, small business employment recedes by 0.69 percent. Increasing the duration to three consecutive years of above-average regulatory growth, the employment shrinkage rate increases to 1.05 percent. If all very small firms (0–4 employees) were to face a decline of this magnitude, the job losses in 2015 would exceed 61,000 jobs. Clearly, the flow of new regulations is associated with sharp changes in both the number of and employment in very small firms. As firms face longer spells of regulatory growth (i.e., two or three consecutive years), these effects become more pronounced. Moreover, if the intensity of regulatory growth is increased (i.e., if growth is above average), the effects are greater still.

Next, we build a more formal regression model to estimate more precisely the effect of changes in federal regulations on the number of businesses.

5. Regression Analysis

As previously mentioned, building a model that explains the structure of the US economy and its distribution of firms of varying sizes by industry would be a monumental task and is beyond the scope of this paper. Instead, we seek to model changes in the number of firms over time—that is, we are concerned with the flow rather than the stock of firms by industry. This approach is advantageous in that any invariant or slowly evolving characteristic that influences the level of firms by size within an industry will exert little or no effect on the annual growth rate of firms. Our focus on the flow of regulations yields a simpler framework wherein the growth rate of total firms is regressed on exogenous factors that drive (or accelerate) that growth. Given that the rate of growth of the total number of firms within an industry naturally fluctuates over time with the business cycle and changing competitive pressures, we specifically control for the effects of these exogenous factors when estimating the impact of regulations on the number of firms. Our preferred model takes the form of the following fixed effects panel:

$$FirmGrowth_{it} = \alpha_i + \beta \cdot RegGrowth_{it} + X_{it}B + u_{it}, \tag{4}$$

where i is the cross-sectional NAICS industry index; t is the time period index; $FirmGrowth_{it}$ is the year-over-year growth rate in the total number of firms in industry i; α_i is an industry-specific fixed effect (which captures any differences in the long-run rate of growth of the industry due to exogenous changes in relative competitiveness, consumer demand, etc.); $RegGrowth_{it}$ is the year-over-year growth rate in the number federal regulatory restrictions that pertain to industry i; X_{it} is a matrix of control variables, including the US rate of unemployment and the US GDP gap (both of which capture business cycle conditions); and u_{it} is a mean-zero error term.[8] Given our model specification, the coefficient on regulatory growth (i.e., β) is an elasticity measure equal to the percent change in the number of firms for a 1 percent change in regulations.[9] This growth elasticity of regulation, which we believe to be negative, reveals the sensitivity of firms (of a given size class) to increases in the rate of regulation.

Analogously to model (4) above, we also estimate the impact of federal regulatory growth on the growth rate of employment ($EmploymentGrowth_{it}$) within various industries by replacing the $FirmGrowth_{it}$ dependent variable with $EmploymentGrowth_{it}$, and we label the result model (5):

$$EmploymentGrowth_{it} = \alpha_i + \beta \cdot RegGrowth_{it} + X_{it}B + u_{it}. \quad (5)$$

We consider three firm-size classifications: (1) 0–4 employees, (2) 0–499 employees, and (3) 500 or more employees. These categories correspond to the smallest firms (0–4 employees), all small firms as defined by the SBA (0–499 employees), and large firms (500 or more employees). Given the exploratory results above, there is reason to believe that the impact of regulations on firms depends on firm size, and this hypothesis is testable given our firm size classifications.

Although we control for the common influence of the US business cycle on firms across industries, it is reasonable to anticipate that exogenous shocks may influence multiple industries simultaneously. Because of this, industry panels should exhibit cross-sectional dependence. While common exogenous shocks do not bias coefficient point estimates, they do impact

[8] Model (4) does not include a period fixed effect term, as the business cycle covariates already capture temporal fluctuations in the growth rate of total firms. Indeed, the fixed effects are so highly correlated with the business cycle measures that including period fixed effects within the model results in singularity problems (i.e., the projection matrix is not well defined and the regression coefficients cannot be calculated).

[9] In log-log models, the dependent variable, say ln(y), is regressed on a covariate of interest, say ln(x), and other log transformed covariates. The coefficient on ln(x) has an elasticity interpretation: it reveals the percent change in y that results from a 1 percent change in x. If this model is first differenced, we now regress Δln(y) on Δln(x) and the first difference of the remaining logged covariates. Note that the coefficient on Δln(x) remains unchanged by the transformation and therefore retains the same elasticity interpretation.

coefficient standard errors and therefore inferential test statistics. Following common empirical practice, we compensate by utilizing White robust (cross-sectional) standard errors in assessing the statistical significance of coefficient estimates.

6. Estimation Results

Table 6 (page 44) reports the baseline regression estimates of models (4) and (5) for small and large firms. Columns (1) to (3) report the results for model (4)—that is, the impact of regulatory growth on the growth rate of the total number of firms of a given size within a given industry. In column (1), the coefficient on regulatory growth equals −0.0565 and is statistically significant at the 1 percent level. This coefficient indicates that a 1 percent increase in federal regulations is associated with a 0.0565 percent reduction in the number of very small firms (with 0–4 employees). To put this into perspective, a hypothetical 10 percent across-the-board increase in regulations (which is approximately equal to one standard deviation) would be associated with a 0.565 percent reduction in the total number of small firms. In 2015, there were more than 3.6 million small firms—therefore a 0.565 percent reduction represents the elimination of almost 21,000 small businesses. However, this is probably an optimistic assessment. Both the preceding exploratory analysis and the regression results suggest that the marginal impact of regulatory growth increases with the size of the regulatory growth.

Continuing with column (1), the coefficient on unemployment equals −0.3270, implying that a 1 percentage point increase in the US national rate of unemployment is associated with a reduction in the rate of growth in the number of small firms within an industry by 0.3270 percentage points. Although the sign of this coefficient estimate makes economic sense—a sagging economy with rising unemployment likely coincides with the failure of many small businesses—it is statistically insignificant. Finally, the coefficient on the GDP gap[10] equals 0.0407, implying that each 1 percent increase in real US cyclical output above trend is associated with an increase in the rate of growth in the number of small firms by 0.0407 percentage points. This too makes economic sense: a booming economy should not only reduce the likelihood of business failure, but also encourage the formation of new startups. As with unemployment, this coefficient, while consistent with a priori expectations, is statistically insignificant.

Turning to the broadest measure of small business used by the SBA—that is, firms with 0 to 499 employees (see column 2)—the coefficient on regulatory growth equals −0.0423 and is statistically significant at the 5 percent level. This coefficient indicates that a 1 percent increase in federal regulations is associated with a 0.0423 percent reduction in the number of small firms (with between 0 and 499 employees). The coefficients on unemployment and the GDP gap are similar in to those reported in column (1), with the notable exception that the coefficient on unemployment is statistically significant at the 10 percent level. Interestingly, when we turn to large businesses—that is, firms with 500 or more employees (see column 3)—regulatory growth fails to have a statistically significant impact on the total number of firms. Clearly, large firms, in stark contrast to small firms, appear to be less susceptible to failure in environments of high regulatory growth.

To measure the impact of federal regulatory growth on total sectoral employment in firms of varying sizes, estimates of model (5) are provided in columns (4) through (6) of table 6. For very small firms (with 0–4 employees), a 1 percent increase in federal regulations is associated with a 0.0410 percent reduction in employment among the small firms in the affected industry.

[10] The GDP gap equals the cyclical component of US real GDP derived via the Hodrick-Prescott filter. Measured in billions of real 2009 dollars, positive values for the GDP gap correspond to periods of economic expansion while negative values correspond to periods of recession.

As before, we can demonstrate the importance of this finding by considering a 10 percent across-the-board increase in federal regulations, which is associated with a 0.410 percent decline in small business employment. In 2015, nearly 5.9 million people were employed by very small businesses (with 0–4 employees). A 0.410 percent reduction in employment would result in the loss of just over 24,000 jobs.

For all small businesses (0–499 employees), a 1 percent increase in federal regulations is associated with a 0.0547 percent reduction in employment among the small firms in the affected industry. Again, this may seem like a low value, but a 10 percent across-the-board increase in federal regulations is associated with a loss of more than 322,000 jobs, on the basis of 2015 employment levels. We again find that regulatory growth does not have a statistically significant impact on large firms: the coefficient for employment among large firms is statistically insignificant.

Taken together, these results paint an important picture. First, when federal regulations are increased within a given industry, both the level of employment and the total number of firms are reduced by a similar rate, roughly 0.5 percent per 10 percent increase in regulations. Second, these unintended consequences fall squarely on small firms with fewer than 500 employees. And finally, relatively large firms with 500 or more employees are not negatively affected in a statistically significant way. However, this is probably an optimistic assessment. Both the preceding exploratory analysis and the regression results described below suggest that the marginal impact of higher regulatory growth is neither constant over time nor constant in intensity when industries are subjected to consecutive periods of above-average regulatory growth.

6.1. The Impact of Regulations on Firms Pre- and Post-2008

In the wake of the financial crisis of 2008 and the change of presidential administrations, the sensitivity of small businesses to increases in federal regulations appears to be more pronounced, with the growth rate of the total number of small firms exhibiting large negative correlations with regulatory growth, in marked contrast to that of large firms, which appeared to thrive in this high-regulatory-growth environment. To more formally test this phenomenon, we estimate the following variant of model (4):

$$FirmGrowth_{it} = \alpha_i + \alpha \cdot \delta_{t<08} + (\beta_1 + \beta_2 \cdot \delta_{t<08}) \cdot RegGrowth_{it} + X_{it}B + u_{it}, \qquad (6)$$

where the dummy variable $\delta_{t<08}$ equals 1 for all years before 2008. Entering model (6) in this way, the dummy variable acts as both an intercept and slope dummy, allowing the impact of regulatory growth on growth of the number of firms to vary over the two time periods. For the pre-2008 period, the coefficient β_2 captures the change in this important regulation-firm elasticity measure. We therefore use a one-sided t-test on β_2 to determine whether regulatory growth is associated with less firm attrition in the pre-2008 time period (or, equivalently, whether there was more associated firm attrition from 2008 onward):

$$H_0: \beta_2 \leq 0$$

$$H_1: \beta_2 > 0.$$

Under this formulation of the test, our a priori expectations are captured by the alternative hypothesis (H_1), whereby the coefficient on regulatory growth is larger in the pre-2008 period ($\beta_1 + \beta_2$) and smaller from 2008 onward (β_1). The null hypothesis is therefore a "straw man" which, if rejected, supports our theory.

Analogously to model (6) above, we also estimate the impact of federal regulatory growth on the growth rate of employment ($EmploymentGrowth_{it}$) within various industries by replacing the $FirmGrowth_{it}$ dependent variable with $EmploymentGrowth_{it}$, and we label the result model (7):

$$EmploymentGrowth_{it} = \alpha_i + \alpha \cdot \delta_{t<08} + (\beta_1 + \beta_2 \cdot \delta_{t<08}) \cdot RegGrowth_{it} + X_{it}B + u_{it}. \quad (7)$$

Table 7 (page 45) reports the estimation results of models (6) and (7). Looking first at the impact of regulations on the total number of firms of various sizes (i.e., columns 1 to 3), the results are in line with our expectations. In the smallest firms (0–4 employees), the regulation coefficient (β_1) equals −0.0854 and is significant at the 1 percent level. This implies that from 2008 onward, a 1 percent increase in industry regulations is associated with a 0.0854 percent decline in very small firms within that industry. In line with our expectations, the slope dummy coefficient (β_2), which equals 0.0700, is positive and statistically significant at the 10 percent level (its two-sided p-value equals 0.0893). Conducting the one-sided hypothesis test outlined above, we reject the hypothesis that β_2 is weakly negative at the 5 percent level and accept the alternative hypothesis that regulatory growth is associated with less firm attrition in the pre-2008 time period.

Our model predicts that in the pre-2008 period, a 1 percent increase in industry regulations is associated with a 0.0154 percent decline in very small firms within that industry. While statistically significant, this result is economically insignificant—that is, the result is tiny in absolute magnitude and close to zero. Among all small businesses (0–499 employees), the results are very similar. Both regulation slope coefficients possess the correct signs and are statistically significant at the 1 percent level. Therefore, we also reject the hypothesis that β_2 is weakly negative at the 1 percent level and accept the alternative hypothesis that regulatory growth is associated with less small business attrition in the pre-2008 time period. Therefore, our model predicts that from 2008 onward, a 1 percent increase in industry regulations is associated with a 0.0811 percent decline in the number of small firms within that industry. Our model also predicts that in the pre-2008 period, a 1 percent increase in industry regulations is associated with a 0.0104 percent increase in very small firms within that industry. As before, while statistically significant, this result is economically insignificant. Hence, there is a stark difference in the sensitivity of small businesses to increases in federal regulations in the periods before and after 2008. Finally, the number of large firms within a given industry does not appear to be negatively impacted by regulatory growth either before or after 2008.

Turning to the effect of regulations on industry employment over these time periods (i.e., columns 4 to 6), we find results similar to those reported in columns (1) to (3). Specifically, for the period of 2008 and beyond, regulations have a negative and statistically significant impact on small firm employment, with coefficient estimates ranging from −0.0770 for the smallest firms (0–4 employees) to −0.1065 for all small firms (0–499 employees). These values are quite large and imply that a 10 percent increase in industry-specific regulation is associated with a nearly 1.1 percent reduction in the level of employment in small firms. In line with our expectations, the slope dummy coefficient (β_2) is positive and statistically significant at the 5 percent level in both of the small business regression models (see columns 4 and 5). For both the smallest firms (0–4 employees) and all small firms (0–499 employees), we conduct the one-sided hypothesis test outlined above and reject the hypothesis that β_2 is weakly negative at the 5 percent and 1 percent levels respectively, and in both cases accept the alternative hypothesis that regulatory growth is associated with greater small firm employment losses from 2008 onward.

6.2. The Impact of Consecutive Spells of Above-Average Regulatory Growth

Not surprisingly, our exploratory analysis suggests that when businesses are subjected to several consecutive years of above-average regulatory growth, the negative impact of additional regulatory increases is amplified. To formally test this hypothesis, we modify model (4) as follows:

$$FirmGrowth_{it} = \alpha_i + \alpha \cdot \delta_{high} + \left(\beta_1 + \beta_2 \cdot \delta_{high}\right) \cdot RegGrowth_{it} + X_{it}B + u_{it}, \quad (8)$$

where the dummy variable δ_{high} equals 1 when the two preceding years experienced above-average growth in industry-specific federal regulations (i.e., $RegGrowth_{it-1}$ and $RegGrowth_{it-2} > 3.83\%$). This dummy variable enters as both an intercept and slope dummy, allowing the impact of regulatory growth on growth of the number of firms to vary depending on the severity of past regulatory growth episodes. For cases where industries endure prior consecutive years of above-average regulatory growth, $\beta_1 + \beta_2$ captures this high-stress elasticity measure while β_1 captures the regulation-firm elasticity in all other cases. We therefore use a one-sided t-test on β_2 to determine whether regulatory growth is associated with greater firm attrition following two consecutive years of high regulatory growth:

$$H_0: \beta_2 \geq 0$$

$$H_1: \beta_2 < 0.$$

Under this formulation of the test, our a priori expectations are captured by the alternative hypothesis (H_1), whereby the coefficient on regulatory growth ($\beta_1 + \beta_2$) is smaller (i.e., "more negative") following two consecutive years of high regulatory growth. The null hypothesis is therefore a "straw man" which, if rejected, supports our theory.

Analogously to model (8) above, we also estimate the impact of federal regulatory growth on the growth rate of employment ($EmploymentGrowth_{it}$) within various industries by replacing the $FirmGrowth_{it}$ dependent variable with $EmploymentGrowth_{it}$, and we label the result model (9):

$$EmploymentGrowth_{it} = \alpha_i + \alpha \cdot \delta_{high} + \left(\beta_1 + \beta_2 \cdot \delta_{high}\right) \cdot RegGrowth_{it} + X_{it}B + u_{it}. \quad (9)$$

Table 8 (page 46) reports the estimation results of models (8) and (9). Looking first at the impact of regulatory growth on small firms (with 0–4 employees), we see that an increase in current regulations has a negative and statistically significant impact on the total number of small firms, regardless of the severity of prior regulatory growth. Both the coefficient on regulatory growth (β_1) and the high regulation slope dummy coefficient (β_2) are negative and statistically significant at the 5 percent level. Therefore, we reject the above null hypothesis that consecutive years of high regulatory growth are associated with less firm attrition. In the case of two prior years of high consecutive regulatory growth, the regulation-firm elasticity measure equals −0.154 (i.e., $\beta_1 + \beta_2$). This implies that if an industry is recovering from prior back-to-back years of above-average regulatory growth, each additional 1 percent increase in federal regulations in the current period is associated with a 0.154 percent reduction in the number of very small firms. In other words, a 10 percent across-the-board increase in federal regulations would reduce the number of very small firms by 1.54 percent, which is equivalent to over 56,000 very small firms in 2015.

Clearly, higher regulatory growth hurts very small firms, but the unintended consequences compound with repeated years of steep regulatory growth. For all small firms (0–499 employees), the results are very similar. Specifically, both the coefficient on regulatory growth (β_1) and the high regulation slope dummy coefficient (β_2) are negative and statistically significant at the 10 percent level. Therefore, we reject the above null hypothesis that consecutive years of high regulatory growth are associated with less firm attrition. In the case of two prior years of high consecutive regulatory growth, the regulation-firm elasticity measure equals −0.1 (i.e., $\beta_1 + \beta_2$). This implies that if an industry is recovering from prior back-to-back years of above-average regulatory growth, each additional 1 percent increase in federal regulations in the current period is associated with a 0.1 percent reduction in the number of all small firms. In other words, a 10 percent across-the-board increase in federal regulations would reduce the number of small firms by 1 percent, which is equivalent to just under 59,000 small firms in 2015. For large firms (500 or more employees), both elasticity measures are statistically insignificant. Thus, bouts of prolonged regulatory growth are more negatively associated with the loss of small businesses than of large businesses.

Lastly, we examine the employment impacts of consecutive years of regulatory growth on small and large firms (see columns 4 to 6). Overall, the results are somewhat mixed. For both very small firms (0–4 employees) and large firms (more than 500 employees), the estimated high regulation slope dummy coefficients (β_2) are negative and statistically significant at the 5 percent level. Therefore, for both of these size classes we reject the above null hypothesis that consecutive years of high regulatory growth are associated with lower employment losses. Moreover, the coefficient on regulatory growth (β_1) has the correct sign but is statistically insignificant in the regressions for both very small firms (0–4 employees) and large firms (500 or more employees). Therefore, a 10 percent across-the-board increase in all regulations (when preceded by two consecutive years of above-average regulations) is associated with a 0.959 percent decline in very-small-firm employment and a 1.362 percent decline in large-firm employment. In 2015, this corresponds to job losses totaling over 56,000 and 887,000, respectively. For the group of all small businesses (0–499 employees), the high regulation slope dummy coefficient (β_2) is statistically insignificant. While this result is puzzling, the coefficient on overall regulatory growth (β_1) has the correct sign and is statistically significant.

7. Discussion

Economic theory tells us that regulations, if applied equally to businesses of all sizes, are likely to disproportionately harm smaller businesses. While some relief mechanisms for smaller businesses do exist, the extent of their availability is still unknown, let alone the degree to which they actually balance the burden of regulations across businesses of different sizes. Although the disparate effects of regulatory costs on businesses of different sizes have long been discussed in the political and academic realms, little work has been done to empirically test the existence and magnitude of such effects. This paper begins to fill this gap in the academic literature, and contributes information to the political debate in a way that might improve our knowledge of the true effects of regulations, particularly as they continue to accumulate.

Controlling for relevant factors, we test how increases in regulation on specific industries are associated with the number of firms and the employment in firms of various sizes within those industries. We find that increases in industry-specific regulations are associated with decreases in the number of and employment in small firms within those industries, while having no association with changes experienced by large firms. These declines in the number of firms and in employment are also amplified when they follow previous years of regulatory growth, implying that regulatory increases disproportionately burden small businesses at an increasing rate. We also find that these developments are not statistically significant in the lead-up to the 2008 financial crisis, but are statistically significant in the period following the crisis. Because the post–financial crisis period was one of high regulatory growth, this provides further evidence that the negative effects of regulation are not constant but are amplified during periods of abnormally high regulatory growth.

Existing research already shows that regulations are associated with disproportionately high costs for lower-income households. The disproportionate burdens on these households come in forms such as lower wages (Bailey, Thomas, and Anderson 2018) and higher prices for household goods (Chambers, Collins, and Krause 2017). Chambers, McLaughlin, and Stanley (2018) show that entry regulations (rules that set requirements for starting businesses and entering markets) increase income inequality. Furthermore, Coffey, McLaughlin, and Peretto (2016) show that regulatory accumulation reduces economic growth, slowing the process that creates wealth for the entire society, including lower-income households.

Our study advances this research by showing how regulatory accumulation appears to harm small businesses relative to their larger competitors. Since small businesses are more common in low-income areas, and because these businesses may often provide low-income households with opportunities for economic advancement, any negative effects of regulations on small businesses add to this list of harmful regressive effects. Taken together, these studies indicate that we must consider not only the costs and benefits of regulations on the parties immediately affected, but also the disproportionate effects of regulations and regulatory accumulation on specific groups. Consideration of these costs is essential for understanding the true individual and cumulative effects of regulations, and for ensuring a fair economic system.

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Table 1. Distribution of Firms by Size in the US, 1998–2015

	Firm size category (by number of employees)							
Year	Total	0–4	5–9	10–19	20–99	100–499	<500	500+
1998	5,579,177	3,376,351	1,011,849	600,167	494,357	80,075	5,562,799	16,378
1999	5,607,743	3,389,161	1,012,954	605,693	501,848	81,347	5,591,003	16,740
2000	5,652,544	3,396,732	1,021,210	617,087	515,977	84,385	5,635,391	17,153
2001	5,657,774	3,401,676	1,019,105	616,064	518,258	85,304	5,640,407	17,367
2002	5,697,759	3,465,647	1,010,804	613,880	508,249	82,334	5,680,914	16,845
2003	5,767,127	3,504,432	1,025,497	620,387	515,056	84,829	5,750,201	16,926
2004	5,885,784	3,579,714	1,043,448	632,682	526,355	86,538	5,868,737	17,047
2005	5,983,546	3,677,879	1,050,062	629,946	520,897	87,285	5,966,069	17,477
2006	6,022,127	3,670,028	1,060,787	646,816	535,865	90,560	6,004,056	18,071
2007	6,049,655	3,705,275	1,060,250	644,842	532,391	88,586	6,031,344	18,311
2008	5,930,132	3,617,764	1,044,065	633,141	526,307	90,386	5,911,663	18,469
2009	5,767,306	3,558,708	1,001,313	610,777	495,673	83,326	5,749,797	17,509
2010	5,734,538	3,575,240	968,075	617,089	475,125	81,773	5,717,302	17,236
2011	5,684,424	3,532,058	978,993	592,963	481,496	81,243	5,666,753	17,671
2012	5,726,160	3,543,991	992,716	593,641	494,170	83,423	5,707,941	18,219
2013	5,775,055	3,575,290	992,281	600,551	503,033	85,264	5,756,419	18,636
2014	5,825,458	3,598,185	998,953	608,502	513,179	87,563	5,806,382	19,076
2015	5,900,731	3,643,737	1,004,555	617,390	526,106	89,479	5,881,267	19,464

Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html.

Table 2. Distribution of Employment by Firm Size in the US, 1998–2015

	Firm size category (by number of employees)								
Year	Total	0–4	5–9	10–19	<20	20–99	100–499	<500	500+
1998	108,117,731	5,584,470	6,643,285	8,047,650	20,275,405	19,377,614	15,411,390	55,064,409	53,053,322
1999	110,705,661	5,606,302	6,652,370	8,129,615	20,388,287	19,703,162	15,637,643	55,729,092	54,976,569
2000	114,064,976	5,592,980	6,708,674	8,285,731	20,587,385	20,276,634	16,260,025	57,124,044	56,940,932
2001	115,061,184	5,630,017	6,698,077	8,274,541	20,602,635	20,370,447	16,410,367	57,383,449	57,677,735
2002	112,400,654	5,697,652	6,639,666	8,246,053	20,583,371	19,874,069	15,908,852	56,366,292	56,034,362
2003	113,398,043	5,768,407	6,732,132	8,329,813	20,830,352	20,186,989	16,430,229	57,447,570	55,950,473
2004	115,074,924	5,844,637	6,852,769	8,499,681	21,197,087	20,642,614	16,757,751	58,597,452	56,477,472
2005	116,317,003	5,936,859	6,898,483	8,453,854	21,289,196	20,444,349	16,911,040	58,644,585	57,672,418
2006	119,917,165	5,959,585	6,973,537	8,676,398	21,609,520	21,076,875	17,537,345	60,223,740	59,693,425
2007	120,604,265	6,139,463	6,974,591	8,656,182	21,770,236	20,922,960	17,173,728	59,866,924	60,737,341
2008	120,903,551	6,086,291	6,878,051	8,497,391	21,461,733	20,684,691	17,547,567	59,693,991	61,209,560
2009	114,509,626	5,966,190	6,580,830	8,191,289	20,738,309	19,389,940	16,153,254	56,281,503	58,228,123
2010	111,970,095	5,926,452	6,358,931	8,288,385	20,573,768	18,554,372	15,868,540	54,996,680	56,973,415
2011	113,425,965	5,857,662	6,431,931	7,961,281	20,250,874	18,880,001	15,867,437	54,998,312	58,427,653
2012	115,938,468	5,906,506	6,527,943	7,974,340	20,408,789	19,387,249	16,266,855	56,062,893	59,875,575
2013	118,266,253	5,926,660	6,523,516	8,058,077	20,508,253	19,697,707	16,617,417	56,823,377	61,442,876
2014	121,069,944	5,940,248	6,570,776	8,176,519	20,687,543	20,121,588	17,085,461	57,894,592	63,175,352
2015	124,085,947	5,877,075	6,614,340	8,297,864	20,789,279	20,645,466	17,503,402	58,938,147	65,147,800

Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html.

Table 3. Annual Growth of Industry-Specific Regulations

Year	Regulatory growth (%)	Year	Regulatory growth (%)
1999	3.13	2008	5.09
2000	0.82	2009	3.46
2001	3.76	2010	4.82
2002	3.06	2011	4.54
2003	3.06	2012	6.70
2004	6.02	2013	3.62
2005	3.49	2014	2.95
2006	2.37	2015	5.56
2007	1.73		

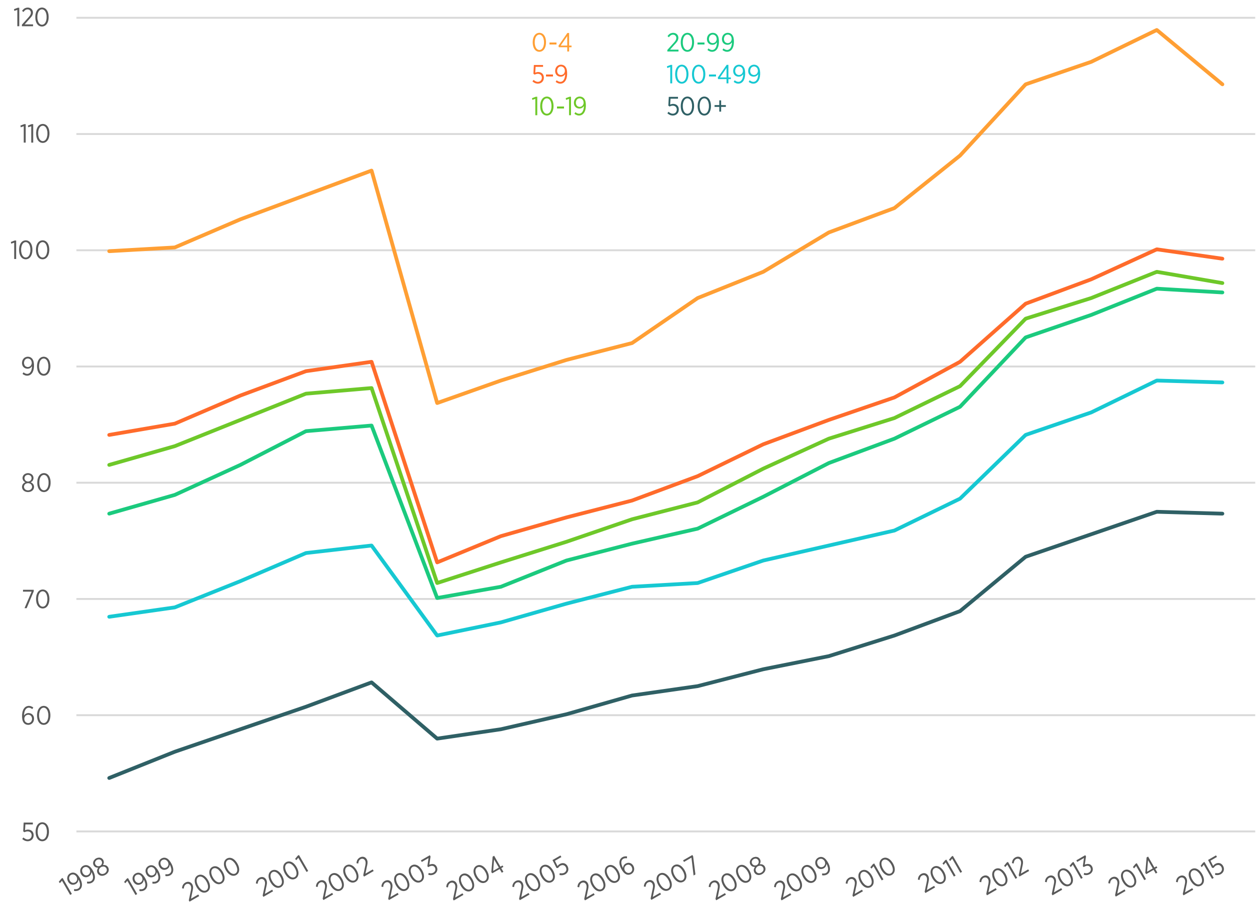
Note: Table displays average year-over-year rate of growth of industry-specific regulations.
Source: RegData 3.0.

Table 4. Weighted Regulatory Restrictions by Year

	Firm size category (by number of employees)					
Year	0–4	5–9	10–19	20–99	100–499	500+
1998	25,633	21,583	20,895	19,817	17,550	14,026
1999	25,687	21,819	21,321	20,228	17,756	14,610
2000	26,300	22,446	21,889	20,906	18,367	15,099
2001	26,864	22,989	22,496	21,653	18,973	15,562
2002	27,400	23,186	22,603	21,764	19,123	16,098
2003	22,250	18,765	18,327	17,965	17,152	14,880
2004	22,750	19,353	18,770	18,239	17,423	15,083
2005	23,233	19,741	19,204	18,803	17,870	15,428
2006	23,599	20,133	19,698	19,162	18,213	15,815
2007	24,563	20,670	20,091	19,487	18,313	16,036
2008	25,169	21,382	20,845	20,227	18,791	16,401
2009	26,033	21,907	21,491	20,960	19,118	16,702
2010	26,558	22,390	21,930	21,476	19,463	17,138
2011	27,714	23,176	22,651	22,200	20,172	17,686
2012	29,290	24,439	24,111	23,727	21,565	18,889
2013	29,790	24,990	24,585	24,225	22,071	19,378
2014	30,508	25,648	25,143	24,784	22,774	19,862
2015	29,310	25,447	24,915	24,726	22,743	19,827

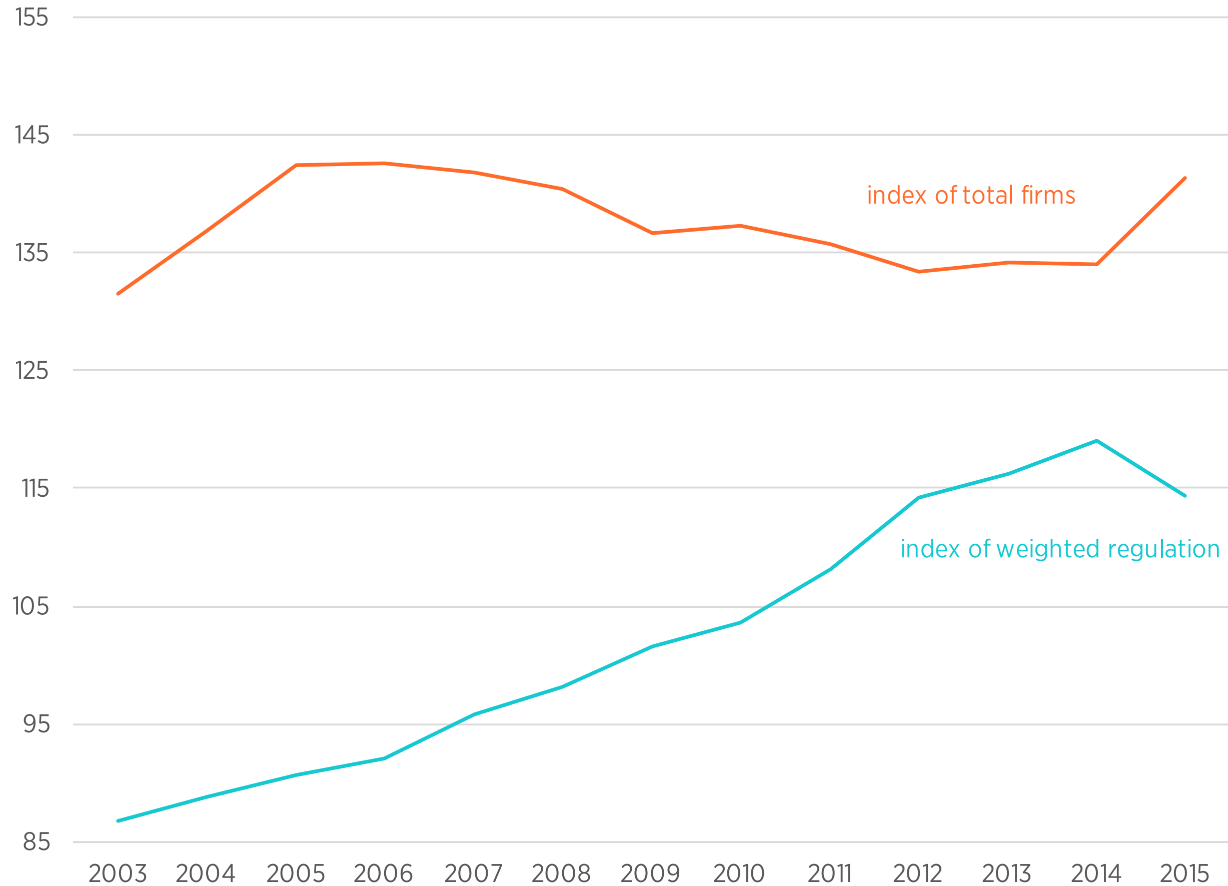
Note: Regulations by industry are weighted by the proportion of total firms of a given size within that industry.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Figure 1. Index of Weighted Regulation by Firm Size



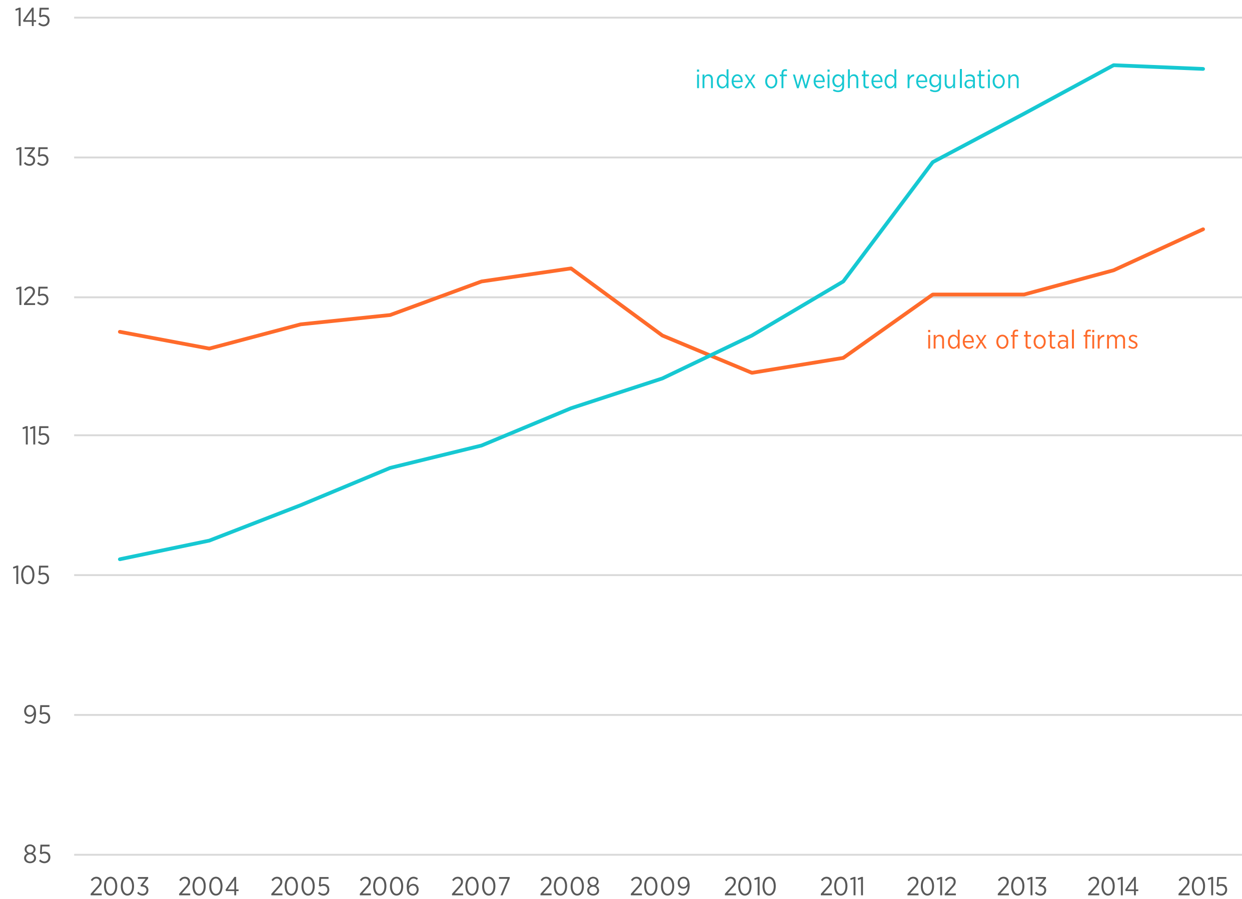
Note: For each firm size category (e.g., 10–19 employees), the corresponding weighted regulations (see table 4) are divided by the weighted regulations for small firms in 1998 (25,633 weighted regulatory restrictions), and the resulting ratio is multiplied by 100. Thus, the indexes are relative measures equal to 100 when the regulatory burden equals that faced by small firms in 1998.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Figure 2. Total Small Firms vs. Small Firm Index of Weighted Regulation



Note: The index of small firms equals the total number of small firms each year divided by the number of small firms in 1998, and this ratio is multiplied by 100. The regulation index is the firm-size-weighted measure of regulations faced by small firms divided by the weighted regulations for small firms in 1998 (25,633 weighted regulatory restrictions); again, the resulting ratio is multiplied by 100.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Figure 3. Total Large Firms vs. Large Firm Index of Weighted Regulation



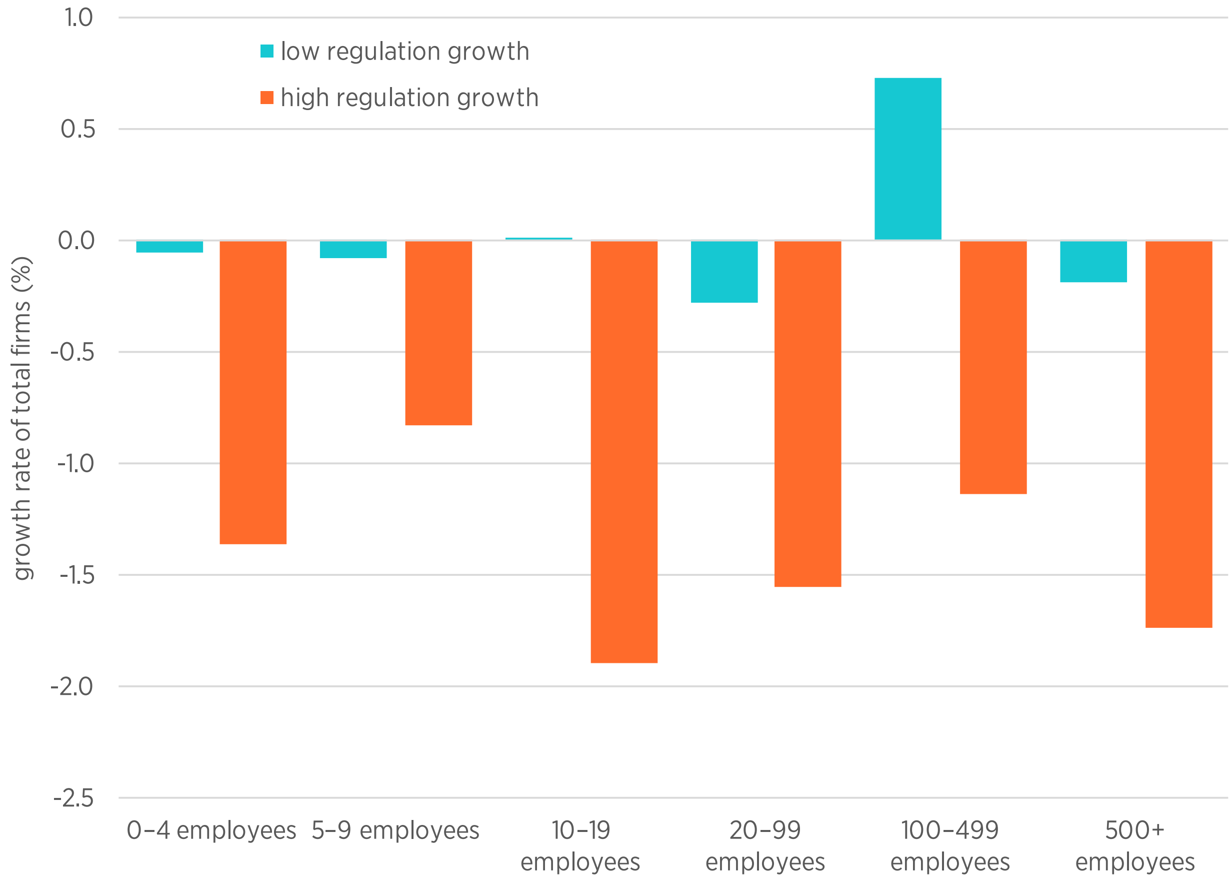
Note: The index of large firms equals the total number of large firms each year divided by the number of large firms in 1998, and this ratio is multiplied by 100. The regulation index is the firm-size-weighted measure of regulations faced by large firms divided by the weighted regulations for large firms in 1998 (14,026 weighted regulatory restrictions); again, the resulting ratio is multiplied by 100.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Table 5. Correlation between Total Firms of Varying Sizes and Weighted Regulation

	Firm size category (by number of employees)					
Period	0–4	5–9	10–19	20–99	100–499	500+
2003–2015	−0.323	−0.825	−0.908	−0.810	0.178	0.533
2009–2015	−0.283	−0.391	−0.837	−0.228	0.713	0.884

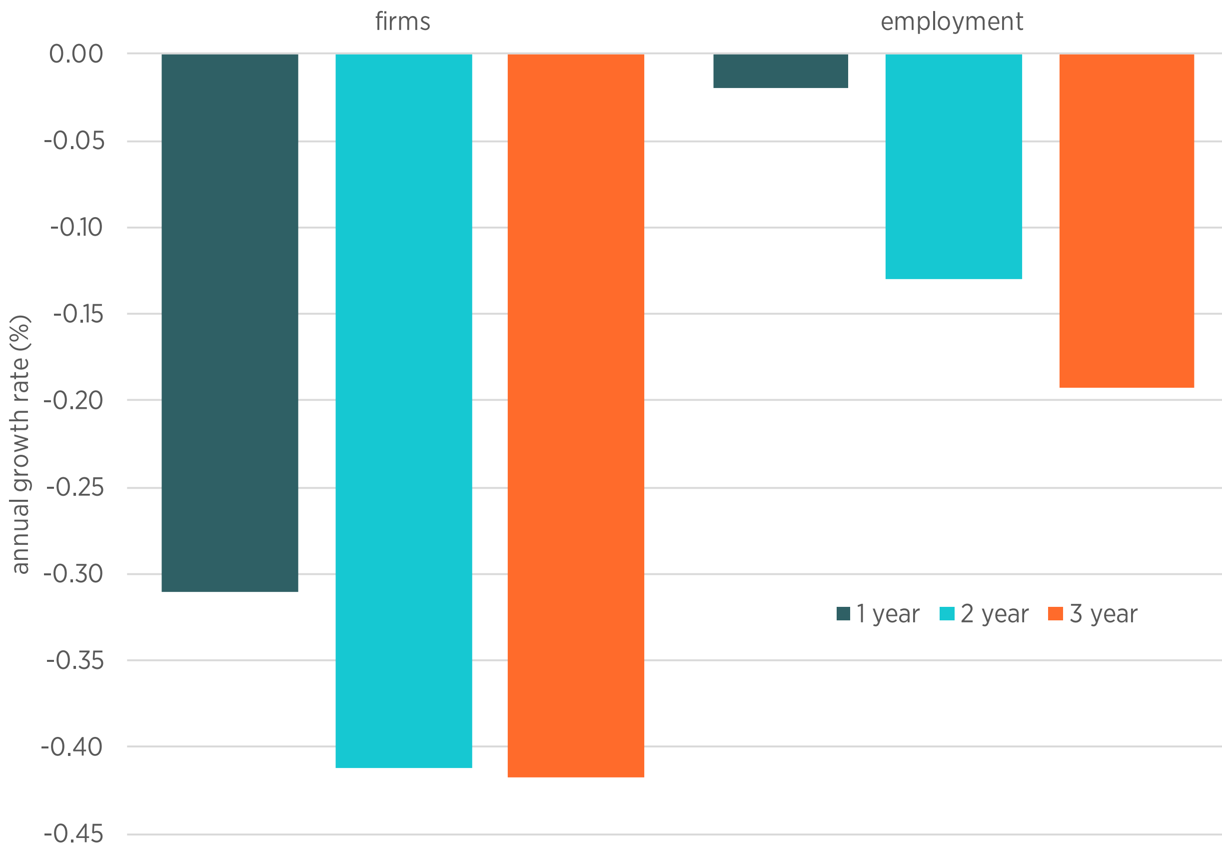
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; Authors' calculations.

Figure 4. Growth of Total Firms in Industries with High vs. Low Regulatory Growth



Note: For each firm size category, the average year-over-year growth rate of total firms within each industry was calculated. Industry-year observations for which the corresponding rate of regulatory growth was low (in the bottom quartile for the entire sample) were grouped and the overall average growth rate of total firms for the group was calculated. This procedure was repeated for the high regulatory growth group (in the top quartile).
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Figure 5. Impact of Consecutive Years of Regulatory Growth on Very Small Firms



Note: Small firms with 0–4 employees were grouped on the basis of whether they experienced regulatory growth for one year, two consecutive years, or three consecutive years. The overall average growth rate of (1) total number of firms and (2) total employment was then calculated for each group.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Figure 6. Impact of Consecutive Years of Above-Average Regulatory Growth on Very Small Firms

Note: Small firms with 0–4 employees were grouped on the basis of whether they experienced above-average regulatory growth for one year, two consecutive years, or three consecutive years. The overall average growth rate of (1) total number of firms and (2) total employment was then calculated for each group.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Table 6. Baseline Regression Estimates of Models (4) and (5) for Small and Large Firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Growth in total firms (dependent variable)			Growth in total employment (dependent variable)		
Variables	0–4 employees	0–499 employees	500+ employees	0–4 employees	0–499 employees	500+ employees
Regulatory growth	−0.0565***	−0.0423**	−0.0372	−0.0410**	−0.0547*	−0.0470
	(0.0203)	(0.0206)	(0.0317)	(0.0211)	(0.0295)	(0.0409)
Unemployment	−0.3270	−0.3930*	−0.1412	−0.3694	−0.6023**	−0.2705
	(0.2343)	(0.2049)	(0.4470)	(0.2758)	(0.3098)	(0.5416)
GDP gap	0.0407	0.1439	0.7270	0.1257	0.5756	1.6215**
	(0.3903)	(0.3928)	(0.7451)	(0.4969)	(0.6859)	(0.8045)
Observations	10,226	10,226	10,226	10,226	10,226	10,226
Goodness of fit	0.149	0.194	0.103	0.135	0.166	0.166

Notes: Dependent variable is the year-over-year growth rate of the total number of firms or total employment. Intercept included but not reported. Industry-specific fixed effects included but not reported. White robust cross-section standard errors in parentheses. ***, **, and * denote 1 percent, 5 percent, and 10 percent statistical significance, respectively.

Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Table 7. Marginal Impact of Regulations (Pre- and Post-2008) in Models (6) and (7) for Small and Large Firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Growth in total firms			Growth in total employment		
Variables	0–4 employees	0–499 employees	500+ employees	0–4 employees	0–499 employees	500+ employees
Pre-2008 dummy	1.0042	0.6089	−0.6058	0.9626	−0.2748	−3.1814*
	(0.8678)	(0.5696)	(0.8308)	(1.0116)	(1.0224)	(1.678)
Regulatory growth	−0.0854***	−0.0811***	−0.0616	−0.0770**	−0.1065**	−0.0861
	(0.0331)	(0.0289)	(0.0517)	(0.0319)	(0.0435)	(0.0712)
Regulatory growth × pre-2008 dummy	0.0700*	0.0915***	0.0545	0.0863**	0.1186**	0.0799
	(0.0412)	(0.0323)	(0.0608)	(0.0432)	(0.0474)	(0.0798)
Unemployment	0.0348	−0.1124	−0.2388	0.0015	−0.5294	−1.0407
	(0.3127)	(0.2296)	(0.4692)	(0.4015)	(0.4176)	(0.7265)
GDP gap	0.2908	0.3528	0.6890	0.3879	0.6681	1.1812
	(0.3971)	(0.3863)	(0.7415)	(0.5553)	(0.7389)	(0.8609)
Observations	10,226	10,226	10,226	10,226	10,226	10,226
Goodness of fit	0.151	0.197	0.104	0.137	0.169	0.169

Notes: Dependent variable is the year-over-year growth rate of the total number of firms or total employment. Intercept included but not reported. Industry-specific fixed effects included but not reported. White robust cross-section standard errors in parentheses. ***, **, and * denote 1 percent, 5 percent, and 10 percent statistical significance, respectively.
Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Table 8. Impact of Consecutive Years of Above-Average Regulations on Small and Large Firms in Models (8) and (9)

	(1)	(2)	(3)	(4)	(5)	(6)
	Growth in total firms			Growth in total employment		
Variables	0–4 employees	0–499 employees	500+ employees	0–4 employees	0–499 employees	500+ employees
High growth dummy	−0.0943	−0.1697	0.6965	−0.4712	0.0940	0.7867
	(0.6396)	(0.4889)	(0.7594)	(0.6562)	(0.4600)	(1.0215)
Regulatory growth	−0.0448**	−0.0355*	−0.0320	−0.0309	−0.0499*	−0.0320
	(0.0208)	(0.0211)	(0.0342)	(0.0220)	(0.0271)	(0.0379)
Regulatory growth × high growth dummy	−0.1092**	−0.0645*	−0.0454	−0.0959**	−0.0448	−0.1362**
	(0.0471)	(0.0349)	(0.0627)	(0.0484)	(0.0425)	(0.0614)
Unemployment	−0.3290	−0.3933*	−0.1471	−0.3684	−0.6040*	−0.2793
	(0.2334)	(0.2039)	(0.4417)	(0.2770)	(0.3087)	(0.5450)
GDP gap	0.0338	0.1410	0.7166	0.1236	0.5715	1.6036**
	(0.3932)	(0.3952)	(0.7371)	(0.4994)	(0.6857)	(0.8104)
Observations	10,226	10,226	10,226	10,226	10,226	10,226
Goodness of fit	0.150	0.194	0.104	0.136	0.166	0.167

Note: Dependent variable is the year-over-year growth rate of the total number of small firms or total employment. Intercept included but not reported. Industry specific fixed effects included but not reported. White robust cross-section standard errors in parentheses. The high growth dummy equals one if the industry experienced two consecutive prior years of above-average regulatory growth. ***, **, and * denote 1 percent, 5 percent, and 10 percent statistical significance, respectively.

Source: US Census Bureau, "Statistics of US Businesses: Annual Data Tables by Establishment Industry," accessed February 13, 2018, https://www.census.gov/programs-surveys/susb/data/tables.html; RegData 3.0; authors' calculations.

Regulation and Poverty

An Empirical Examination of the Relationship between the Incidence of Federal Regulation and the Occurrence of Poverty across the States

Dustin Chambers, Patrick A. McLaughlin, and Laura Stanley

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Abstract

We estimate the impact of federal regulations on poverty rates in the 50 US states using the recently created Federal Regulation and State Enterprise (FRASE) index, which is an industry-weighted measure of the burden of federal regulations at the state level. Controlling for many other factors known to influence poverty rates, we find a robust, positive, and statistically significant relationship between the FRASE index and poverty rates across states. Specifically, we find that a 10 percent increase in the effective federal regulatory burden on a state is associated with an approximate 2.5 percent increase in the poverty rate. This paper fills an important gap in both the poverty and the regulation literature because it is the first paper to estimate the relationship between these variables. Moreover, our results have practical implications for federal policymakers and regulators, because the increased poverty that results from additional regulations should be considered when weighing the costs and benefits of additional regulations.

JEL codes: D31, I32, J38, K20, R10

Keywords: regulation, poverty, states, FRASE

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Regulation and Poverty:

An Empirical Examination of the Relationship between the

Incidence of Federal Regulation and the Occurrence of Poverty across the States

Dustin Chambers, Patrick A. McLaughlin, and Laura Stanley

1. Introduction

Poverty is one of the most pressing challenges that public policymakers face. Unfortunately, little consensus exists on how to remedy this stubbornly persistent problem. We argue in this paper that federal regulatory reform may offer a way forward.

The link between poverty and regulatory policy has been widely neglected by economists. As such, this paper is the first to examine the relationship between poverty and federal regulations across the states. Although both regulation and poverty are interesting in their own right, we argue that there is an underappreciated connection between them that policymakers should consider when drafting new rules. Empirically estimating this relationship was impossible until recently because of the unavailability of state-level regulatory data. However, in this paper, we use the recently created Federal Regulation and State Enterprise (FRASE) index, which ranks the 50 states and the District of Columbia according to how federal regulations affect each state or district. Specifically, we characterize the association between poverty and regulation by exploiting variation across space and time in poverty rates and in the FRASE index among the states. Although variation in poverty rates is observational and remains to be explained, variation in the FRASE index arises by construction from two sources: (1) differences over time in the quantity of federal regulation targeting each industry in a state's economy and (2) year-to-year changes in the mix and relative importance of industries in each state (as measured by value added to the state's GDP).[1]

Before the release of the FRASE dataset, anyone seeking to research the impact of federal regulations at the state level faced a daunting task. The 2016 *Code of Federal Regulations* (CFR), which annually compiles all current federal regulations, spans 236 volumes and is more than 175,000 pages long (McLaughlin and Sherouse 2016). Manually reading the CFR, classifying each regulatory restriction by industry, and repeating this process for each prior year to construct a panel dataset would take decades.[2] Fortunately, RegData, a suite of data-mining and machine-learning algorithms developed by Al-Ubaydli and McLaughlin (2015) and McLaughlin and Sherouse (2016), has made it possible for computers to mine the CFR, identify regulatory restrictions, and probabilistically match these restrictions to the four-digit North American Industry Classification System industry codes to which they apply.[3]

Although federal regulation applies to all states, each state's economy comprises a different mix of industries. As a result, regulations that affect a specific industry will affect states in different ways. To address this problem, McLaughlin and Sherouse, the makers of the FRASE index, matched and weighted national-level regulations (from RegData) by the relative importance of each industry to each state using input-output data available from the Bureau of Economic Analysis (BEA).

We focus on regulations because economists have long recognized that they have both real and distributive effects on the economy. Friedman (1962) emphasizes that the relative

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[1] For complete details on how the FRASE index is calculated, see the appendix to McLaughlin and Sherouse (2016, 29–31).
[2] The Mercatus Center estimates that the average reader (reading at a rate of 300 words per minute) would take nearly three years to read the current CFR if it were a full-time job: https://quantgov.org/regdata/the-code-of-federal-regulations-the-ultimate-longread/.
[3] For more information on RegData, see https://quantgov.org/regdata/.

distribution of income is a reflection of the operation of the market economy, given the initial endowments and preferences of participants and the success or failure of their individual economic decisions. Government policies, such as federal regulations, influence economic winners and thus the resulting income distribution. Higgs (1987) stresses that regulations reduce the sphere of private economic decision-making, because through regulations and restrictions, the government effectively makes choices for the private sector. Given that these predetermined choices are likely to be dynamically inefficient, the result is both reduced freedom and poorer long-run economic performance.

Consistent with these theories, a growing number of recent papers empirically estimate the negative impact of federal regulations on the US economy. Using an older and less reliable measure of federal regulations (i.e., the number of pages in the CFR), Dawson and Seater (2013) find that since 1949, the growth of federal regulations has significantly decreased the rate of US economic growth. Specifically, they estimate that the cumulative loss of output between 1949 and 2011 totals $38.8 trillion.[4] Crain and Crain (2014) estimate that the annual cost of federal regulations equals $2 trillion. Coffey, McLaughlin, and Peretto (2016) find that if federal regulations had been frozen in 1980 and subsequently never increased, the US economy would have been approximately 25 percent larger in 2015 than it actually was. Collectively, those results demonstrate that federal regulations represent a significant economic headwind that slows economic growth and reduces real incomes. Even in a best-case scenario whereby these impacts affect all income groups proportionately (i.e., there is no change in income inequality), the absolute income levels of low-income individuals would be reduced and there would be more

[4] To put that number into perspective, note that the nominal GDP in 2011 equaled $15.8 trillion (see http://www.bea.gov). Therefore, the cumulative impact of regulations from 1949 to 2011 was roughly 2.5 times the size of the US economy in 2011.

people living below any absolute poverty threshold. Unfortunately, recent research finds ample evidence that regulations have regressive effects—that is, that regulations have a disproportionately negative impact on poorer households.

There is a growing body of literature on the regressive effects of regulations. Such effects include costly risk mitigation, higher consumer prices, barriers to entry (such as those created by occupational licensure and startup regulations), and compliance costs and mandates. These strands of the literature both individually and collectively demonstrate that regulations disproportionately hurt the most vulnerable in society, including would-be entrepreneurs; those with less education, fewer skills, and less job experience; and those with less income and political clout. Therefore, it is not unreasonable to hypothesize that greater regulation, all else being equal, diminishes economic mobility and reduces the economic opportunities of low-income individuals, thereby making it harder to escape poverty. We next briefly summarize each of these facets of the literature on the regressive effects of regulation.

Thomas (2012) argues that regulations aimed at reducing health and safety risks tend to be regressive. High-income earners, relative to low-income earners, have a higher willingness to pay to mitigate low-probability risks. When federal regulations target low-probability risks—especially those that are expensive to mitigate—all households pay for them in the form of lower wages and higher prices. These costs are disproportionately borne by low-income earners. Chambers, Collins, and Krause (2018) find empirical evidence that the poorest households spend a larger proportion of their income on goods and services that are heavily regulated, suggesting that the regulations have a regressive effect.

Small business owners and would-be entrepreneurs are also disproportionately affected. Crain and Crain (2010) find that small businesses bear most of the costs of regulation. Chambers, McLaughlin, and Stanley (2018) find that countries with more barriers to business entry tend to experience higher levels of income inequality. Chambers and Munemo (2017) find that nations with more startup regulations also have lower rates of entrepreneurship. Bailey, Thomas, and Anderson (2018) find that regulations lead to an increase in the relative demand for compliance-oriented professionals (e.g., lawyers and accountants), which means lower wage growth and fewer job prospects for less educated, noncompliance workers. McLaughlin, Ellig, and Shamoun (2014) find that occupational licensing has a disparate impact on the economically vulnerable, including ethnic minorities. Kleiner and Krueger (2013) estimate that nearly one-third of workers were affected by occupational licensure regulations as of 2008. Taken together, these findings suggest that regulations diminish opportunities for social mobility and economic advancement, thus stranding many in a life of poverty.

Although the previous literature on regulation has focused on its regressive impact on prices, entrepreneurship, or inequality, all of which are determinants of poverty, no study has provided a comprehensive analysis of the impact of regulation on poverty itself. This paper fills that gap in the literature by examining the regressive relationship between regulation and the poverty rate across US states. We find a significant and positive relationship between the FRASE index and poverty levels across states. Specifically, we find that a 10 percent increase in the effective federal regulatory burden on a state is associated with an approximate 2.5 percent increase in that state's poverty rate.

In the remainder of the paper, we describe the benchmark empirical poverty rate model commonly used in the development literature, from which we build our model of interest. We discuss the data used in our analysis and present the regression results and associated robustness tests before concluding.

2. The Benchmark Empirical Model

If a poverty line can be expressed as a threshold monetary value, Dhongde (2006) shows that the poverty rate (*P*) can be expressed as function of mean income (*Y*) and the Lorenz curve (ℓ) by way of the following identity:

$$P \equiv f\big(Y, \ell(Y)\big). \tag{1}$$

In practice, data on the precise distribution of income are unavailable, so a summary measure of the relative income distribution, typically the Gini coefficient, is used as a proxy for the Lorenz curve. This yields the model below, wherein ε captures variation in the poverty rate explained by the Lorenz curve but not the Gini coefficient:

$$P = g(Y, Gini) + \varepsilon. \tag{2}$$

Equation (2) represents the core functional relationship from which we derive the linear benchmark regression model. Following the development literature, this equation can easily be adapted to fit a panel framework. For example, Meng, Gregory, and Wang (2005) and Chambers, Wu, and Yao (2008) use a similar double-log benchmark model to study poverty rates in Chinese provinces:

$$p_{it} = \alpha_i + \beta_1\eta_t + \beta_2 y_{it} + \beta_3 gini_{it} + \varepsilon_{it}, \tag{3}$$

where p_{it} is the natural log of the poverty rate; α_i is a cross-sectional fixed effect that captures idiosyncratic differences in the mean poverty rate for a province, state, or nation not otherwise explained by the other independent variables; η_t is an exogenous time trend (i.e., $\eta_t = t$); y_{it} is the natural log of mean income; $gini_{it}$ is the natural log of the Gini coefficient; and ε_{it} is a mean zero error term. Many papers in the development literature have sought to estimate the coefficient on log mean income (i.e., β_2), also known as the growth elasticity of poverty. In this strand of the literature (see, for example, Adams 2004, Ram 2007, and Chambers and Dhongde

2011), common practice is to take model (3) and transform it by way of a first difference. This exercise has the advantage of removing both the cross-sectional fixed effects (α_i) and the exogenous trend, yielding a simpler regression model:

$$\Delta p_{it} = \beta_1 + \beta_2 \Delta y_{it} + \beta_3 \Delta gini_{it} + u_{it}, \tag{4}$$

where deltas denote first differences—that is, $\Delta p_{it} = p_{it} - p_{it-1}$, $\Delta y_{it} = y_{it} - y_{it-1}$, and $\Delta gini_{it} = gini_{it} - gini_{it-1}$. In the analysis to follow, we extend both benchmark specifications to estimate the relationship between regulatory burden and poverty across the US states.[5]

3. The Regulation-Poverty Empirical Model

To estimate the impact of federal regulations on poverty across the 50 US states and the District of Columbia, we add the FRASE index to the benchmark models in section 2. Given the poverty decomposition formulated by Dhongde (2006), adding the FRASE index to the benchmark models implicitly assumes that when federal regulations are more burdensome in a given state, the result is a change in the underlying distribution of income. This assumption is consistent with the arguments of Friedman (1962) mentioned earlier. By influencing and affecting market outcomes, federal regulations likely affect the resulting income distribution (i.e., government policies help to influence the economic winners and losers). The literature also finds empirical evidence that regulations affect the overall level of output of an economy (see Dawson and Seater 2013, Crain and Crain 2014, and Coffey, McLaughlin, and Peretto 2016, among others), which suggests that including both the FRASE index and mean income in a linear regression model will likely introduce some multicollinearity. Although this effect does not bias the

[5] The decomposition of changes in poverty into changes in income distribution (inequality) and changes in mean income (growth) has a long history in development economics. It was first pioneered by Datt and Ravallion (1992) and was later used by many subsequent scholars (see, for example, Bourguignon 2003).

coefficient point estimates, it will inflate standard errors and reduce statistical significance. Adding the FRASE index to equation (3) yields the following:

$$p_{it} = \alpha_i + \beta_1\eta_t + \beta_2 y_{it} + \beta_3 gini_{it} + \beta_4 frase_{it} + \varepsilon_{it}, \tag{5}$$

where $frase_{it}$ is the natural log of the FRASE index; the remaining variables retain their original specifications and interpretations. Adding the FRASE index to equation (4) yields the following:

$$\Delta p_{it} = \beta_0 + \beta_1\eta_t + \beta_2\Delta y_{it} + \beta_3\Delta gini_{it} + \beta_4\Delta frase_{it} + u_{it} \tag{6}$$

where $\Delta frase_{it}$ is the first difference of the natural log of the FRASE index; as before, the remaining variables retain their original specifications and interpretations.[6] Thus, equations (5) and (6) will serve as the benchmark regression models to test the empirical impact of federal regulatory burden upon the poverty rates of states.

4. The Data

The data we use on poverty come from the US Census Bureau and measure the proportion of households with incomes that fall below the poverty line, i.e., a threshold dollar amount, for a family of their size and composition. For example, in 2016, the poverty line for a four-person family consisting of two adults and two children equaled $24,339.[7] The poverty line does not vary by state, and it is adjusted annually for inflation. The data on mean income are from the BEA and equal the real per capita GDP for each state in chained 2009 dollars.[8] The Gini coefficient panel is an update of the one constructed by Frank (2009), which is derived from individual income tax filings from the Internal Revenue Service.[9]

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[6] Following common practice, we retain the period fixed effect in equation (6) despite its first-difference derivation.
[7] Poverty rates and threshold values can be obtained from the Census Bureau website: http://www.census.gov/topics /income-poverty/poverty.html.
[8] Data on real per capita GDP can be accessed at the BEA website: https://www.bea.gov/regional/.
[9] The Gini panel can be downloaded from Frank's website: http://www.shsu.edu/eco_mwf/inequality.html.

Finally, we use the FRASE index, which measures the burden of federal regulations in a given state using state-specific industry weights, to determine the regulatory exposure.[10] The FRASE index relies on a combination of regulatory data from RegData and economic data from the BEA. To calculate the FRASE index score for each state, McLaughlin and Sherouse (2016) start with the number of regulatory restrictions targeting each industry, as estimated in the RegData 2.2 dataset. Those levels of industry-specific regulatory restrictions are then weighted according to each industry's importance to a particular state's private-sector economy relative to that industry's importance to the nation as a whole. Thus, if an industry contributes twice as much to a state's private sector as it does to the nation's, the restrictions count twice as much for that state. In this paper, we sum the result across all industries and scale the resulting score to that of the nation overall.

The result shows the impact of federal regulation on states relative both to the nation and to other states. A FRASE index score of 1 means that federal regulations affect a state to precisely the same degree that they affect the nation as a whole. A score greater than 1 means that federal regulations have a higher impact on the state than on the nation, whereas a score less than 1 means that they have a lower impact on the state.

The combined, balanced panel spans the period from 1997 to 2013 and includes all 50 US states plus the District of Columbia (867 observations).[11] Table 1 contains summary statistics for the benchmark dataset by state. The simple average poverty rate across the states between 1997 and 2013 equals 12.56 percent, with the highest average rate equaling 19.22 percent (Mississippi) and the lowest average rate equaling 6.91 percent (New Hampshire). The simple average real per

[10] The FRASE index can be downloaded from the Mercatus Center's RegData website: https://quantgov.org/50states/.

[11] Going forward, we will treat the District of Columbia as a state: instead of referring to the "50 US States plus the District of Columbia," we will simply refer to the group as "the states."

capita GDP across the states between 1997 and 2013 equals $46,939, with the highest average hailing from the District of Columbia ($156,401) and the lowest average coming from Mississippi ($30,641). Frank's Gini coefficients are quite large, with the average value across all the states and time periods equaling 0.59. The lowest average Gini equals 0.55 (Iowa), and the highest average equals 0.66 (both Florida and New York). Finally, the simple average value of the FRASE index across the states and time periods equals 1.22, which implies that the states, on average, experienced a relative regulatory burden between 1997 and 2013 that was 22 percent higher than the US average in 1997. The state with the highest average FRASE index is Louisiana (2.03), whereas the state with the lowest average FRASE index is New Hampshire (0.82).

Table 1. Mean Panel Values, 1997–2013

State	Poverty rate (%)	Real GDP per capita (2009)	Gini coefficient	FRASE index
Alabama	15.47	35,585	0.59	1.27
Alaska	9.46	64,084	0.58	1.99
Arizona	16.00	39,710	0.59	1.03
Arkansas	16.87	34,342	0.60	1.24
California	14.28	50,360	0.64	1.11
Colorado	10.36	49,877	0.59	1.04
Connecticut	8.81	62,613	0.64	1.19
Delaware	10.23	63,123	0.56	1.04
District of Columbia	18.48	156,401	0.62	0.91
Florida	13.19	39,544	0.66	1.01
Georgia	14.59	44,029	0.61	1.15
Hawaii	10.72	47,303	0.56	1.02
Idaho	12.31	34,372	0.61	1.23
Illinois	11.85	50,152	0.61	1.12
Indiana	11.57	42,015	0.57	1.60
Iowa	9.60	43,478	0.55	1.31
Kansas	11.85	42,317	0.58	1.42
Kentucky	15.64	37,254	0.58	1.53
Louisiana	18.01	44,826	0.62	2.03
Maine	11.54	37,335	0.56	0.95
Maryland	8.77	50,047	0.56	0.95
Massachusetts	10.66	56,986	0.61	0.93
Michigan	12.27	40,985	0.58	1.30
Minnesota	8.86	49,495	0.57	1.04
Mississippi	19.22	30,641	0.61	1.34
Missouri	12.29	41,910	0.59	1.17

Montana	14.34	34,908	0.62	1.36
Nebraska	10.28	45,982	0.59	1.35
Nevada	11.67	48,002	0.63	0.87
New Hampshire	6.91	45,391	0.57	0.82
New Jersey	8.90	54,893	0.60	1.16
New Mexico	18.85	39,232	0.60	1.23
New York	15.03	56,932	0.66	1.07
North Carolina	14.74	43,294	0.58	1.37
North Dakota	11.49	43,967	0.58	1.41
Ohio	12.40	42,964	0.56	1.20
Oklahoma	14.19	37,013	0.60	1.37
Oregon	12.65	43,080	0.58	1.00
Pennsylvania	11.03	43,997	0.59	1.14
Rhode Island	11.79	44,282	0.57	0.84
South Carolina	14.30	36,335	0.59	1.13
South Dakota	11.89	41,410	0.61	1.28
Tennessee	15.16	40,331	0.60	1.19
Texas	16.38	46,741	0.63	1.49
Utah	9.20	40,785	0.58	1.09
Vermont	9.45	39,484	0.58	0.96
Virginia	9.74	49,809	0.57	1.09
Washington	10.73	51,363	0.58	1.31
West Virginia	16.09	33,219	0.56	1.61
Wisconsin	10.06	43,523	0.56	1.04
Wyoming	10.38	58,184	0.63	1.99

Source: Author calculations based on the FRASE index.

As a preliminary step, we calculate the correlation matrix for poverty, real per capita income, the Gini coefficient, and the FRASE index, all expressed as natural logarithms. The results (see table 2), though only anecdotal, are consistent with our prior expectations. Specifically, poverty is negatively correlated with log per capita income (−0.146), implying that states with higher mean incomes exhibit less poverty. Likewise, log poverty is positively correlated with the log of the Gini coefficient (0.340), consistent with the notion that as income inequality rises, absolute living standards for the poorest households decline, thus increasing the poverty rate. Finally, log poverty is also positively correlated with the log of the FRASE index (0.335), implying that states that are effectively more federally regulated also possess higher poverty rates.

Table 2. Panel Correlation Table

	Log poverty rate	Log output	Log Gini	Log FRASE
Log poverty rate	1.000	−0.146	0.340	0.335
Log output	−0.146	1.000	0.199	−0.055
Log Gini	0.340	0.199	1.000	0.227
Log FRASE	0.335	−0.055	0.227	1.000

Source: Author calculations.

5. Benchmark Estimation Results

5.1. Estimation Results for Equation (5)

Table 3 reports the estimation results for five variants of equation (5). In column (1), the log poverty rate is regressed on a pooled constant (not reported), the log of the FRASE index, the log GDP per capita, and the log Gini coefficient. In line with prior expectations, the coefficient on the log FRASE index (0.2879) is positive and statistically significant at the 1 percent level. This finding implies that a 1 percent increase in binding federal regulations is associated with a 0.2879 percent increase in the poverty rate. The coefficient on the log output has the appropriate sign (−0.2113) and is statistically significant at the 1 percent level, implying that a 1 percent increase in output reduces the poverty rate by just over 0.2 percent. Finally, the coefficient on the log Gini coefficient is positive and statistically significant at the 1 percent level (1.4849), implying that a 1 percent increase in income inequality increases the poverty rate by 1.4849 percent.

Column (2) is the same as column (1) but includes a time trend, as is common practice in the literature. The estimation results change very little: the coefficient on the log FRASE index equals 0.2596 and is significant at the 1 percent level. The coefficients on the log output and the log Gini coefficient are nearly unchanged, and both remain statistically significant at the 1 percent level. The added time trend is statistically insignificant.

Table 3. Equation (5) Estimation Results

Variables	(1)	(2)	(3)	(4)	(5)
Log FRASE	0.2879***	0.2596***	0.2504***	0.2125**	0.2373***
	(0.0390)	(0.0170)	(0.0205)	(0.0929)	(0.0903)
Log output	−0.2113***	−0.2224***	−0.2075***	−1.0313***	−0.8060***
	(0.0237)	(0.0241)	(0.0277)	(0.1164)	(0.0684)
Log Gini	1.4849***	1.4057***	1.6036***	−0.0543	−0.0087
	(0.1014)	(0.1368)	(0.1865)	(0.1223)	(0.1037)
Time trend	—	0.0034	—	0.0200***	—
	—	(0.0037)	—	(0.0037)	—
Fixed state effects	No	No	No	Yes	Yes
Fixed period effects	No	No	Yes	No	Yes
Observations	867	867	867	867	867
Goodness of fit	0.222	0.224	0.277	0.837	0.860

Notes: (1) Dependent variable is the log of the poverty rate; (2) intercept included but not reported; (3) White robust cross-section standard errors in parentheses; (4) ***, **, and * denote 1 percent, 5 percent, and 10 percent statistical significance, respectively.

Column (3) is similar to column (2), but fixed period effects replace the time trend. The coefficient on the log FRASE index is virtually unchanged and remains statistically significant at the 1 percent level. The coefficient on the log output also changes very little and remains statistically significant. The coefficient on the log Gini coefficient remains significant at the 1 percent level but increases in magnitude to 1.6036.

Columns (4) and (5) include state fixed effects. The overall goodness of fit of these models ranges from 0.837 to 0.860, much larger than the R^2 values reported in the first three columns (0.222 to 0.277), which ignore state-specific heterogeneity in the poverty rate. Column (4) includes a time trend, whereas column (5) uses fixed time period effects. In column (4), the coefficient on the log FRASE index equals 0.2125 and is significant at the 5 percent level. This finding is similar to that in column (5), in which the coefficient on the log FRASE index equals 0.2373 and is statistically significant at the 1 percent level. In both columns (4) and (5), the coefficient estimate on the log output is negative and statistically significant at the 1 percent level, ranging in estimated value from −0.8060 to −1.0313. This finding implies that a 1 percent increase in the log per capita output reduces poverty by 0.8060 percent to 1.0313 percent. Finally, the coefficient on the log Gini coefficient is statistically insignificant in both columns (4) and (5). The coefficient on the time trend in column (4) is positive and statistically significant (0.02), implying that poverty rates are drifting 2 percent higher each year, all else being equal.

5.2. Estimation Results for Equation (6)

Column (1) of table 4 reports the estimation results for the baseline version of equation (6). Because taking the first difference of the model's variables eliminates state heterogeneity, only fixed *period* effects are considered.[12] The coefficient on the first difference of the log FRASE index (0.2944) is statistically significant at the 5 percent level and in line with the previous results from equation (5), suggesting that a 1 percent increase in binding regulations is associated with an approximate 0.3 percent increase in the poverty rate. The coefficient on the first difference of the log output is negative but statistically insignificant. Likewise, the coefficient on the first difference of the log Gini coefficient has the correct sign but is also statistically insignificant.

[12] Any exogenous trend variables become constants.

Table 4. Estimation Results for Equations (6)–(9)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ (log FRASE)	0.2944**	0.2752**	0.3169**	0.2332*	0.3195**	0.2338*	0.2822**	0.2845**
	(0.136)	(0.1339)	(0.1315)	(0.1251)	(0.1336)	(0.1267)	(0.1222)	(0.1235)
Δ (log output)	−0.1102	−0.0701	−0.1035	−0.0837	−0.0614	−0.0693	−0.1065	−0.0609
	(0.1752)	(0.2329)	(0.1871)	(0.1702)	(0.2533)	(0.2322)	(0.1866)	(0.2527)
Δ (log Gini)	0.1825	0.0071	0.0347	−0.0063	0.0348	−0.0062	0.0242	0.0242
	(0.288)	(0.2840)	(0.2942)	(0.2875)	(0.2937)	(0.2877)	(0.2976)	(0.2971)
Δ (log government)	—	0.0120	—	—	0.0522	0.0180	—	0.0566
	—	(0.1385)	—	—	(0.1397)	(0.1395)	—	(0.141)
Δ (log high school)	—	—	0.5025	—	0.5064	—	0.4933	0.4974
	—		(0.5814)	—	(0.5757)	—	(0.5813)	(0.5757)
Δ (log agriculture)	—	—	—	0.0332	—	0.0334	0.0279	0.0284
	—	—	—	(0.0257)	—	(0.0262)	(0.0263)	(0.0269)
Observations	816	800	750	800	750	800	750	750
Goodness of fit	0.114	0.111	0.118	0.112	0.118	0.112	0.119	0.119

Notes: (1) Dependent variable is the first difference of the log poverty rate; (2) period fixed effects and intercept included but not reported; (3) White robust cross-section standard errors in parentheses; (4) ***, **, and * denote 1 percent, 5 percent, and 10 percent statistical significance, respectively.

6. Robustness Results

To ensure that our results are robust to the inclusion of other independent variables, we add three additional explanatory variables common to the poverty literature. Regardless of how these additional explanatory variables are added (individually, in pairs, or as a group), the regulation coefficient is consistent in sign and magnitude, averaging 0.2779, and statistically significant in all cases. In other words, a 1 percent increase in binding federal regulations is associated with increases in state-level poverty rates of just under 0.28 percent, which is consistent with our findings from the baseline model.

6.1. Government Expenditures

Following Chambers, Wu, and Yao (2008), we include the size of public expenditures relative to the size of the state economy as a proxy for the relative provision of public services and public goods and the overall size and scope of government within each state economy.[13] The resulting model, which builds on equation (6), is specified as follows:

$$\Delta p_{it} = \beta_1 + \beta_2 \Delta y_{it} + \beta_3 \Delta gini_{it} + \beta_4 \Delta frase_{it} + \beta_5 \Delta gov_{it} + \eta_t + u_{it}, \tag{7}$$

where Δgov_{it} is the first difference of the log of state government expenditures as a fraction of state GDP and η_t is a fixed-effect time period dummy. Estimation results are provided in column (2) of table 4. Focusing on the variable of interest, the coefficient estimate on the first difference of the log of the FRASE index equals 0.2752 and is statistically significant at the 5 percent level. This is very consistent with the previous estimation results and suggests that a 1 percent increase in binding federal regulations is associated with increases in the state poverty rate of just under 0.28 percent.

[13] Government expenditures and state GDP data are obtained from the US BEA.

6.2. Human Capital

Following Chambers, Wu, and Yao (2008); Apergis, Dincer, and Payne (2011); and Johnson, Formby, and Kim (2011), we include a measure of educational attainment as a proxy for human capital levels within each state. In principle, states with more human capital should have less structural unemployment, higher labor force participation rates, and higher real earnings.[14] The resulting model, which builds on equation (6), is specified as follows:

$$\Delta p_{it} = \beta_1 + \beta_2 \Delta y_{it} + \beta_3 \Delta gini_{it} + \beta_4 \Delta frase_{it} + \beta_5 \Delta education_{it} + \eta_t + u_{it}, \qquad (8)$$

where $\Delta education_{it}$ is the first difference of the log of the high school completion rate (given as a percentage) and η_t is a fixed effect time period dummy. Estimation results are provided in column (3) of table 4. Focusing on the variable of interest, we find that the coefficient estimate on the first difference of the log of the FRASE index equals 0.3169 and is statistically significant at the 5 percent level. This finding is very consistent with the previous estimation results and suggests that a 1 percent increase in binding federal regulations is associated with increases in the state poverty rate of just under 0.32 percent.

6.3. Agriculture

Following Chambers, Wu, and Yao (2008), we include a measure of the relative size of the agricultural sector within each state. Given that highly agrarian and rural economies have lower wages and greater seasonality in employment patterns, we anticipate a positive relationship between the relative size of the agricultural sector and the poverty rate.[15] The resulting model, which builds on equation (6), is specified as follows:

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[14] High school completion rate data are from the US Census Bureau and can be accessed at https://www.census.gov /topics/education/educational-attainment/data.html.

[15] Agricultural output (North American Industry Classification System sector 11) and state GDP data are obtained from the US BEA.

$$\Delta p_{it} = \beta_1 + \beta_2 \Delta y_{it} + \beta_3 \Delta gini_{it} + \beta_4 \Delta frase_{it} + \beta_5 \Delta agriculture_{it} + \eta_t + u_{it}, \quad (9)$$

where $\Delta agriculture_{it}$ is the first difference of the log of the output of the agricultural sector as a percentage of state GDP and η_t is a fixed effect time period dummy. Estimation results are provided in column (4) of table 4. Focusing on the variable of interest, we note that the coefficient estimate on the first difference of the log of the FRASE index equals 0.2332 and is statistically significant at the 10 percent level. This finding is very consistent with the previous estimation results and suggests that a 1 percent increase in binding federal regulations is associated with increases in the state poverty rate of just over 0.23 percent.

6.4. Combined Effects

As a final robustness exercise, we include every pairing of the above explanatory variables (i.e., government expenditures, high school completion rates, and the relative size of the agricultural sector) in columns (5) to (7). The resulting coefficient estimates on the FRASE index range in value from 0.2338 to 0.3195 and are universally statistically significant. Finally, we include all three of these robustness variables in the augmented model (see column (8)). The resulting coefficient on the FRASE index equals 0.2845 and is statistically significant at the 5 percent level.

7. Conclusion

Consistent with economic theory, previous empirical research has documented that regulations reduce real incomes and regressively affect consumer prices, entrepreneurship, and income inequality. Given these demonstrable effects, it is not unreasonable to suspect that regulations also increase poverty rates. However, no study has provided a comprehensive analysis of the impact of regulation on poverty.

This paper fills this gap in the literature by being the first to examine the impact of federal regulations on poverty within the United States. Until recently, however, empirically estimating this relationship was impossible because of the unavailability of state-level regulatory data. But we use the FRASE index, which ranks the 50 states and the District of Columbia according to how federal regulations affect each state. Controlling for a large number of other factors known to influence poverty rates, we find a robust, positive, and statistically significant relationship between the FRASE index and the poverty rates across states. Specifically, we find that a 10 percent increase in the effective federal regulatory burden on a state is linearly correlated with an approximate 2.5 percent increase in that state's poverty rate. Although our analysis does not necessarily demonstrate a causal relationship, we find the relationship between federal regulation and state poverty rates to be robust to the inclusion of other explanatory variables common to the poverty literature, including government expenditures, human capital, and the relative size of the agricultural sector in each state. Consequently, we argue that there is a neglected and unappreciated connection between regulatory policy and poverty rates that policymakers and regulators should consider when drafting new rules.

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