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The Allocation of Governmental Regulatory Authority: Federalism and the Case of Insurance Regulation

Martin F. Grace
Richard D. Phillips

Abstract

We investigate the incentives states have to provide insurance regulatory services in an efficient manner. Regulation of the insurance industry in the United States is unique, as it is conducted primarily at the state level whereas the majority of insurance sales are interstate. Consistent with predictions from the federalism literature, we find evidence of trans-state externalities, as states with small domestic insurance markets are less efficient producers of insurance regulation and appear to allow states that choose to expend the greatest resources to regulate for them. In addition, states with more profitable domestic insurers are shown to export greater levels of regulation, suggesting extraterritorial regulation may erect modest barriers to entry. We find evidence of increasing economies of scale in the production of insurance regulation after controlling for these regulatory externalities.

Introduction

Regulation of the U.S. insurance industry, conducted almost exclusively at the state level, is unique in the U.S. federal system of financial services regulation. In contrast, banks are regulated primarily at the federal level. Although states can charter banks, these banks are now under the joint supervisory and regulatory jurisdiction of the state and the Federal Reserve or the Federal Deposit Insurance Corporation (FDIC). Securities are regulated at both the state and federal level but, as with other joint regulatory

Martin F. Grace is the James S. Kemper Professor of Risk Management and Insurance, and Richard D. Phillips is the Bruce A. Palmer Professor of Risk Management and Insurance, Georgia State University, Atlanta, GA, USA. The authors can be contacted via e-mail: mgrace@gsu.edu and rphillips@gsu.edu. Financial support provided by the Research Program Committee at Georgia State University's J. Mack Robinson College of Business is gratefully acknowledged. We would like to thank Stephen Coate, J. David Cummins, Steven D'Arcy, Scott Harrington, Robert W. Klein, Harold D. Skipper, Jr., Clifford W. Smith, and Stephen D. Smith for their valuable input on the numerous previous drafts of this article. We also thank the Insurance Project seminar participants at the NBER, seminar participants at Louisiana State University, the University of Minnesota, and the Risk Theory Seminar for their suggestions.

activities, the states and the federal government tend to separate regulatory authority (when they can) based on notions of interstate versus intrastate commerce. The SEC oversees those securities (and their exchanges) with a national interest as defined in the Securities Acts, and it leaves the remainder to the states to supervise. Thus there is a tradition of sharing authority between the state and federal governments for regulation of other financial services, no sharing of regulatory authority exists for the insurance industry.

Although the states have maintained their authority, the system is under increasing pressure. Following a number of insolvencies in the late 1980s and early 1990s, the U.S. Congress (1990) found the state system of insurance regulation to be inadequate and inefficient. In response, the states and the National Association of Insurance Commissioners (NAIC), moved to increase both the quantity and quality of regulation. The most important new initiatives were the Risk-Based Capital requirements introduced in the mid 1990s and the NAIC's state regulatory accreditation program, which was designed to ensure each state's regulation met certain minimum standards.[1]

The Gramm-Leach-Bliley (GLB) Act in 1999 further weakened boundaries separating various components of the financial services industry and sparked debate over which regulator should oversee the activities of newly formed financial service conglomerates. Further, industry demands for either federal intervention or an optional federal charter have attracted increasing amounts of attention.

In 2004 the House of Representatives' Committee on Financial Services renewed the call to the states and the NAIC to increase the quality and efficiency of state regulation. Their intent was that the federal government will intervene if the states do not act. The NAIC and the states responded in two ways. First, they proposed an interstate compact for the regulation of life insurance market conduct. Further, they have put together a proposal that attempts to address the perceived shortfalls in state regulation (NAIC, 2004). As of the fall of 2006 neither has had a substantive effect, but Congress is seriously considering a proposal to remove excess and surplus lines from state regulation.

With these concerns in mind, we investigate the production of regulation with a goal of providing evidence for whether insurance regulation is efficiently produced by the states. Theory suggests the pareto optimal provision of a public good will be achieved when it is produced by the most decentralized layer of government capable of internalizing all the economic costs and benefits associated with the good. The advantage of having local governments produce public goods in smaller jurisdictions is that the regulator is more likely to be responsive to the tastes and preferences of the local citizenry and therefore can tailor the quality and level of output to maximize welfare. In addition, competition between jurisdictions to attract tax revenue provides incentives for local governments to innovate and find more efficient ways to produce

[1] To become accredited a state must adopt model legislation, increase its regulatory budget to a preset target, and perform a new minimal level of regulatory oversight. As of 2006, 49 states are accredited (http://www.naic.org/frs/accreditation/map.htm). Interestingly, New York, a state with one of the largest insurance departments, has not sought accreditation because it felt the NAIC's requirements interfered with the state's sovereignty.

public goods. These advantages must be weighed against the inefficiencies of decentralization which could include possible spillover effects between jurisdictions and the possibility the jurisdiction may be too small to capture any economies of scale that may be associated with the production of the good.

We investigate the sources of inefficiency in the production of insurance regulation. The theoretical foundations for our hypotheses are drawn from two areas of the literature. First, from the literature on fiscal federalism, we develop a set of regulatory externality hypotheses to see who benefits from state regulation. Second, from the literature on the sources of public sector inefficiency, we develop a set of regulatory environment hypotheses to see whether differences in efficiency can be explained by variation in the environment in which insurance regulators operate.

The article is organized as follows: The next section offers statistics on the structure of the insurance market, discusses attempts by insurance regulators to coordinate their activities across state boundaries, and highlights some of the possible sources of conflict across the states. In section Estimating Cost and Efficiency of the Regulatory Function of the State, we estimate a cost function based on the unique characteristics of state regulation to investigate the costs of producing insurance regulation at the state level. In section Determinants of Efficiency we develop hypotheses regarding the sources of inefficiency in the production of regulation, set up the empirical framework, and present the results. We conclude in section Conclusions and Implications and discuss the policy implications of our work.

INTERSTATE STRUCTURE OF THE INSURANCE MARKETPLACE

Although regulated by the states, insurance is largely an interstate business. Consider Table 1, which shows descriptive statistics for the percentage of premiums written and the percentage of firms that would be considered "local" at various levels of aggregation. For example, Panel A shows that in 2000, the average state had only 12.74 percent of the premiums written in the state by a domestic company. Further, domestic companies accounted for only 3.45 percent of the total number of companies writing business in the average state. Even Illinois, the state with the greatest percentage of premiums written by domestics, still had almost 50 percent of the premiums written in the state by foreign insurers. Panel B shows similar statistics after we aggregate the business that would be considered "local" to the level of U.S. Census regions. At the Census region level, on average only 26.16 percent of premium volume written in the region would come from "local" insurers, whereas the average of domestic companies conducting business in the region would only be 16.83 percent. Finally, when we use the NAIC's four regional definitions (a higher level of aggregation) we see an increase to approximately 40 percent for the percentage of premiums written by domestics of the region and approximately 35 percent for the number of companies domesticated in the average region doing business in the region. Clearly there is a national market for insurance, as states with the largest domestic operations receive substantial amounts of writings from outside the state. In addition, aggregating to only four regulatory jurisdictions does not greatly internalize the costs and benefits of insurance regulation.

The mismatch between the interstate nature of the insurance marketplace and the regulatory structure may create problems. For example, to avoid duplication of

TABLE 1
Proportion of Premiums Written and Proportion of Companies Considered Local by Geographical Area: 2000

	Percent of Premiums Written by Local Companies	Percent of Companies Conducting Business in the State or Region Considered Local
Panel A. Individual States		
State average	12.74%	3.45%
State min	0.00%	0.00%
State max	54.71%	21.98%
Panel B. U.S. Census Regions		
New England	42.87%	9.03%
Mid-Atlantic	45.09%	21.25%
East North Central	33.32%	30.60%
West North Central	35.29%	17.83%
South Atlantic	21.27%	15.04%
East South Central	10.99%	8.50%
West South Central	18.42%	31.01%
Mountain	18.64%	10.37%
Pacific	9.56%	7.87%
Census region average	26.16%	16.83%
Panel C. NAIC Regional Averages		
Atlantic	71.68%	34.53%
South	16.99%	23.75%
Midwest	47.88%	46.93%
Pacific	24.52%	35.17%
NAIC region average	40.27%	35.09%

Table shows statistics for the percentage of premiums written by insurers and the percentage of companies that would be considered local, i.e., within the legal jurisdiction of the local regulator, at various levels of geographical aggregation: (1) at the state level (Panel A); (2) aggregating to U.S. Census Regions (Panel B); and (3) aggregating to regulatory regions as defined by the National Association of Insurance Commissioners (Panel C). U.S. Census and NAIC regional definitions are presented in Appendix A. Data source: 2000 NAIC data tapes.

regulatory activities across states, the common practice is to concentrate regulatory efforts on the locally domiciled companies and rely upon the other states to monitor the foreign insurers that do business in the state (Klein, 1996). Although this delegation of responsibility is potentially efficient, it also creates the potential for significant free-rider problems—a topic we explore further below.

In addition to the inefficiencies due to free-riders, the activity by a given state's regulator can have an effect on consumers in other states. For example, suppose the regulator has inadequate resources to monitor the solvency of the local industry and one of its domestic firms becomes insolvent. In this case, the guaranty fund of the state

is responsible only for a portion of the insolvent company's shortfall representing the amount of business sold within the state. Thus, the other states where this insurer wrote business would retain responsibility for the remaining shortfall through their own guaranty funds.

The NAIC is also part of the regulatory environment for the insurance industry as it assists and coordinates state insurance regulators to overcome these trans-state problems. However, the NAIC has to rely upon moral suasion and the threat of federal intervention to achieve its objectives. Unfortunately, this ability to persuade states to enact new laws and regulate in a different manner appears to vary in its effectiveness (see e.g., Klein, 1995). In addition, the NAIC cannot force the industry to pay any taxes or fees to finance its operations. Thus, the NAIC relies heavily upon "voluntary" assessments. In 2004 for example, 44 percent of the NAIC's revenues were generated from voluntary fees paid by insurers when they filed their annual and quarterly financial statements. Klein (1996) reported that this system of voluntary payments leaves the NAIC particularly vulnerable to the industry's willingness to pay—a willingness that can change depending on whether the industry believes the NAIC is regulating wisely.

As an alternative to the NAIC, a number of parties have called for a multistate or federal approach to insurance regulation.[2] These proposals rely upon a long understood notion: only when all the costs and benefits of a service are internalized will that service be produced in the optimal quantity. Since insurance transactions are largely interstate in nature, even at high levels of geographical aggregation, the optimal scale of the regulator should be inclusive of large amounts of the interstate trade to internalize the net benefits of regulation. Thus, it may be more efficient, for example, for the New England states to form a regional compact to regulate the business of insurance in New England if the interstate spillover effects are substantially reduced.[3] However, before a conclusion can be made about the benefits of aggregation, the sources of inefficiency in the current system should be examined. We conduct that analysis in the next section.

ESTIMATING COST AND EFFICIENCY OF THE REGULATORY FUNCTION OF THE STATE

We now investigate the cost and efficiency of regulating the insurance industry at the state level. Table 2 shows the direct costs of insurance regulation to the state taxpayers. In 2000 the average budget for insurance regulation was just over $17 million. States receive substantially more money in taxes, licenses, and other fees from the industry, averaging just over $204 million in 2000. Thus, the average state used only 8.78 percent of the revenues collected from the insurance industry to finance the operations of the regulator in the state. The size of the insurance department budget relative to

[2] See ACIR (1992), Otis (1994), Mulcahy (1995), or papers contained in Wallison (2000).

[3] There has been some discussion of the use of interstate compacts (see Schact and Gallanis, 1993) and at least 27 states have also entered into a life insurance product regulation compact to assist in the formation of common market conduct standards (see NAIC, 2006).

TABLE 2
1995 Direct Costs of Insurance Regulation to the States

Variable	Mean	Standard Deviation	Minimum	Maximum
Total budget of state insurance department*	$12.7	$18.7	$1.2	$93.6
Insurance-related revenues to the states*	$182.4	$210.6	$13.9	$1,298.0
Total state direct premiums written*	$14,166.0	$15,566.7	$952.8	$68,725.4
Total budget of state insurance department relative to the insurance-related revenues	6.68%	3.16%	1.80%	14.52%
Total budget of state insurance department relative to the state's direct premiums written	0.10%	0.05%	0.03%	0.25%
Total insurance-related revenues relative to the state's direct premium written	1.54%	0.55%	0.56%	2.92%

Source: 1995 NAIC Insurance Department Resources Report.
*Amounts reported in $ millions

premiums collected by the industry is relatively small, averaging only 0.10 percent and ranging from 0.02 to 0.33 percent.[4]

This study differs from earlier studies in two important ways. First, we examine the regulators rather than the industry. This is important to the extent that we find significant economies of scale or scope in the production of insurance regulatory services. Second, we estimate a cost function which does not assume cost-minimization. Because government officials, such as insurance regulators, are not necessarily profit maximizing agents,[5] estimating the cost function may lead to biased results especially

[4] Table 2 shows only the direct taxpayer cost; it does not include the industry's compliance costs. Grace and Klein (2000) find significant compliance costs ($4.5 billion in 1995). This represents about 1 percent of 1995 premium volume. The costs imposed by the NAIC are also not considered. In 1995 the NAIC's budget was approximately $39.9 million (Klein, 1996) and it was almost $50 million in 2001 (per National Conference of Insurance Legislators, Press Release at http://www.ncoil.org/). However, this amount, as a percent of the total expenditure by the states, was only 6.2 percent and 5.7 percent, respectively, in 1996 and 2001. Thus, the predominant regulatory expenditures on insurance regulation are at the state level.

[5] For example, one assumption about the public sector objective function common in the public finance literature is the Niskenen (1971) assumption that government officials will behave as if they are budget maximizers and not cost minimizers. Ideally a regulator should maximize social welfare, but some of the earliest work on the economics of regulation by Stigler (1971) and Peltzman (1976) suggests this is not necessarily the case. Others have suggested economic policy choices can be affected by the possibility of reelection (Besley and Case, 1995), by the

in terms of inputs. Thus, we explicitly model the cost function of a noncost-minimizing agency using a method similar to one proposed by Eakin and Kneisner (1988).[6,7] This approach allows us to test whether the agency is cost-minimizing rather than making it a maintained assumption.

Noncost-Minimizing Cost Function Analysis

To allow that the possibility for regulators may not minimize costs, we employ a model where the regulator makes decisions based upon shadow prices, which are a function of the market price of the inputs and of a shadow divergence parameter for each input. Thus, our formulation allows the ratio of shadow prices for any two inputs to deviate from the market price ratio of the inputs. The estimated shadow divergence term is specific to the input and is interpreted as the regulator's desire to over (under) employ a particular input. We argue it is important to adopt this framework since theory suggests governmental officials may deviate from cost-minimization. For example, one could hypothesize that a politician would prefer to have more clerical employees relative to professional employees because of the additional political benefits the state receives from a larger number of potential voters.[8]

One can think of the noncost-minimizing cost function (NCMCF) analysis as a general model with the traditional cost-minimizing neoclassical cost function as a special case. First, we define C^{sh} to be the shadow cost of the regulatory agency such that

$$C^{sh} = (\boldsymbol{Y}, \boldsymbol{w^{sh}}) \tag{1}$$

where $\mathbf{Y}$ is the vector of outputs and $\boldsymbol{w}^{sh}$ is a vector of the shadow price of inputs. Using Shephard's lemma we can obtain the conditional input demands. In logarithmic form, these can be expressed as the shadow share equations

$$S_i^{sh}(\boldsymbol{Y}, \boldsymbol{w^{sh}}) = \frac{w_i^{sh} X_i}{C^{sh}} = \frac{\partial \ln C^{sh}}{\partial \ln w_i^{sh}}, \qquad i = 1, \ldots, n. \tag{2}$$

Rearranging (2) gives the observed input usage as a function of the shadow input prices, shadow cost, and shadow cost share:

$$X_i(\boldsymbol{Y}, \boldsymbol{w^{sh}}) = \frac{C^{sh} S_i^{sh}}{w_i^{sh}}. \tag{3}$$

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politics of the state (Poterba, 1994), or by pressure from special interest groups (Peltzman, 1976; Coate and Morris, 1995).

[6] To undertake the analysis one needs also to see a comment by Atkinson and Halvorsen (1992) and the reply by Eakin and Kneisner (1992).

[7] We follow Berger, Hancock, and Humphrey (1993) in our estimation of allocative efficiency.

[8] We do not test this specific conjecture but instead employ it as a maintained hypothesis as a means of motivating why a state may treat inputs differently. Others, such as Shleifer and Vishny (1994), provide evidence governments are willing to subsidize public enterprises only to the extent they hire workers beyond the profit-maximizing level.

Using the conditional factor demands from (3) and the observed wage rates, w_i, it is then possible to calculate the observed total costs as

$$C^{obs}(\boldsymbol{Y}, \boldsymbol{w^{sh}}, w) = \sum_{i=1}^{n} w_i X_i(Y, w^{sh}) = C^{sh} \sum_{i=1}^{n} \frac{S_i^{sh} w_i}{w_i^{sh}} \tag{4}$$

By letting $T_i = S^{sh}\ w_i / {w_i}^{sh}$ and $T = \Sigma_i\ T_i$, the natural logarithm of the observed cost function system of equations can be expressed as

$$\ln C^{\text{obs}} = \ln\ C^{sh} + \ln T \tag{5}$$

and

$$S_i^{\text{sh}} = \frac{T_i}{T}, \qquad i = 1, \ldots, n. \tag{6}$$

One further decision to be made is the form of the shadow price's deviation from the actual price. We define θ_i as the shadow price divergence parameter and employ an additive form such that

$$w_i^{\text{sh}} = w_i + \theta_i. \tag{7}$$

If θ_i is positive, all other things held constant, then ${w_i}^{sh} > w_i$ implies that the input is under employed. If $\theta_i < 0$, the reverse is true, and the input is over employed.

The cost function to be estimated is a translog cost function written as

$$\begin{aligned} \ln\ C^{\text{obs}} &= \alpha_0 + \sum_k \alpha_k Y_k + .5 \sum_k \sum_m \alpha_{km} Y_k Y_m + \sum_i \gamma_i \ln(w_i + \theta_i) \\ &+ .5 \sum_i \sum_j \delta_{ij} \ln(w_i + \theta_i) \ln(w_j + \theta_j) + \sum_i \sum_k \phi_{ik} \ln(w_i + \theta_i) Y_k + \ \ln T + \varepsilon \end{aligned} \tag{8}$$

where the dependent variable, C^{obs}, is the total real budget expenditure of insurance regulation in the state. In addition, the regression is estimated with the following share equations for each input *i*:

$$S_i^{\text{obs}} = \frac{1}{T} \left[\gamma_i + \sum_j \delta_{ij} \ln(w_i + \theta_j) + \sum_k \phi_{ik} Y_k \right] \left[\frac{w_i}{w_i + \theta_i} \right]. \tag{9}$$

Note that if $w_i = {w_i}^{sh}$ then $T = 1$, and $\ln T = 0$. This is the case where the shadow price is equal to the observed price.

Finally, the general restrictions on symmetry are imposed as follows: $\sum \alpha_k = \sum \gamma_i = 1$, $\delta_{ij} = \delta_{ji}$, $\phi_{ik} = \phi_{ki}$, and $\sum_i \delta_{ij} = \sum_i \phi_{ik} = 0$. In the empirical estimation of this model, the outputs and input prices are normalized by their means to increase the efficiency of the nonlinear estimation and to allow for unbiased hypothesis testing (Spitzer, 1984). We estimate the cost function, Equation (8), and the two share equations, shown in

Equation (9), as a system of equations using full information maximum likelihood estimation techniques.

We investigate a number of issues in the production of insurance regulation using the estimated NCMCF. First, we investigate whether there are economies of scope in the production of regulation by estimating pair-wise cost complementaries between each output. Economies of scope are said to exist when the cost associated with joint production of two outputs is lower then the production of the same two outputs by separate units. Cost complementaries between two outputs are defined as $C_{km} = {}^{\partial^2 C}/_{\partial Y_k \partial Y_m}$. Cost complementaries suggest economies of scope exist when $C_{km} < 0$. Finding $C_{km} > 0$ suggests diseconomies of scope and C_{km} not significantly different from zero implies costs are additive.

We next investigate overall economies of scale which are a measure of the marginal cost of the state expanding its level of outputs holding the output-mix fixed. To test whether there are overall economies of scale in the production of regulation, we define $E_s = \sum_k {}^{\partial \ln C}/_{\partial \ln Y_k}$. When E_s is greater than, equal to, or less than one, there are decreasing, constant, and increasing returns to scale, respectively.

Additional insights into the existence of scale economies for the specific outputs of insurance regulation are examined by estimating product-specific scale economies. Product-specific scale economies for each output k are defined as $PSE_k = {}^{\partial^2 C}/_{\partial Y_k^2}$. Marginal costs are decreasing when $PSE_k < 0$, suggesting product-specific increasing returns to scale. Finding $PSE_k > 0$ suggests marginal costs are increasing and therefore product-specific decreasing returns to scale. PSE_k is not significantly different from zero, implying constant returns to scale.

Finally, we examine the distribution of the error term to garner some information about the relative efficiency of the regulators. Similar to Schmidt and Sickles (1984) and Berger (1993), we assume the error term for state s in year t, ε_{st}, has two components, i.e., $\varepsilon_{st} = \ln u_{st} + \ln v_{st}$ where $\ln u_{st}$ is state s's persistent error term in time t, while $\ln v_{st}$ is a random disturbance term with mean zero for state s over the time period used in this study. Further, by assuming that the minimum cost state represents the frontier (or best practice state), we can calculate how far each state is from this frontier. This estimate of inefficiency, usually referred to in the efficiency literature as x-efficiency, is defined as

$$XEFF_i = \exp(\ln\hat{\mu}_{\min} - \ln\hat{\mu}_i) \tag{10}$$

where $\hat{\mu}_{\min}$ is the average (across time) minimum residual from the estimation of the cost function and μ_i is the average residual for state i.[9] We will investigate the sources of inefficiency in the next section of the article.

We also determine the allocative inefficiency (AI) resulting from the divergence between the observed and shadow prices. Following Eakin (1993), we estimate C^{obs} with

[9] We compute truncated x-efficiency measures by setting the top and bottom 5 percent of the averaged state residuals to the 5th and 95th percentile, respectively. The truncation is employed because the average state residual may still contain some error from the ln v_{st} term not fully canceled out over the six-year time period used in this study (see Berger, 1993).

all the divergence terms (θ_i) set equal to 0. This provides an estimate of the long-run average cost. Thus,

$$\hat{C}^{\min} = \hat{C}^{\text{obs}}(\boldsymbol{Y}, \boldsymbol{w}; \boldsymbol{\theta} = \mathbf{0}) \tag{11}$$

and AI is measured as

$$\text{AI} = \frac{\hat{C}^{\text{obs}} - \hat{C}^{\min}}{\hat{C}^{\min}}. \tag{12}$$

AI is thus the percentage by which actual costs exceed minimum costs due to the regulator's misperception of prices for the inputs. It can be thought of as the opportunity cost of misallocated resources whose next best use might or might not be the production of regulation.

Data and Data Sources

The primary data come from the NAIC's *Annual Insurance Department Resource Report* for the period 1990–1995.[10] These reports provide detailed data on the quantity and costs of the various regulatory services produced by the individual state insurance departments. We also obtained wage data from the Bureau of Labor Statistics (1990–1995).

Outputs Definitions

Estimation of the cost function requires data on the quantity of the outputs produced by regulators and the prices of the regulatory inputs. Determining the proper outputs for an agency is difficult and may depend upon the regulator's objective function. Thus, before we discuss the specific outputs we employ, it is instructive to describe the state regulatory mandate, as this can provide guidance to understand how our proxies measure the activities of the state insurance departments.[11]

Regulators focus their efforts in three main areas: (1) solvency regulation, (2) market regulation, and (3) price regulation. Solvency attempts to monitor the health of firms operating in the state to minimize the social costs of failures. In turn, market regulation focuses on the insurers' products and on the trade practices of agents and brokers. Market regulation attempts to protect consumers by reviewing the insurer's marketing materials, by verifying that insurers do not engage in unfair trade practices, and by ensuring agents and brokers are properly trained so they can accurately describe the

[10] Our data set contains 277 observations over the six years. Twenty-nine observations were deleted due to missing data or because inconsistent variable definitions were used by some of the states. The data end in 1995 because the NAIC substantially changed the way it accounted for regulatory actions starting in 1996. However, the funding of the regulatory agencies by the states has not changed appreciably since 1995. For example, in Table 2 we show the average ratio of a state's insurance regulatory budget as a percentage of total premiums being 0.10 percent. In 1995 it was at the exact same level.

[11] This is a summary of regulatory activities. See Skipper (1998) and Klein (1999) for a more detailed description of the activities states undertake in the regulation of the insurance industry.

contracts being sold. Finally, price regulation, while not practiced in every state, is designed to ensure prices reflect insurers' costs.

In addition to these definitions of regulatory activity, we also attempt to control for additional regulatory goods and services provided by numerous states. For example, some states specifically target insurance fraud, while others allocate resources for the development of model legislation for regulatory use in all states. Our output proxies were developed based upon both written descriptions of the regulatory mandate as described in the NAIC's *Resources Report* (various years) as well as with numerous conversations with regulators, officials with the NAIC, and with industry professionals. Thus, we are confident the outputs we employ explain much of the variation in costs across the states.

The specific outputs we considered in this analysis were:

Number of Licensed Agents

The regulator monitors the conduct of the agents operating in the state. Accordingly, this output is measured by the number of agents and brokers licensed to conduct business in the state.

Market Conduct and Solvency Oversight

Market conduct examinations are used to ensure that company advertising, and sales materials and practices are accurate. The states perform solvency oversight by conducting periodic solvency examinations or audits, primarily on locally based insurers.[12] Because many of these market conduct and solvency examinations are performed concurrently, we measure this output as the sum of market conduct and financial examinations conducted each year. We also weight the number of examinations conducted by the average assets of the insurers domiciled in the state. This weighting is employed in an attempt to recognize the difference between a state with small, relatively simple local insurers and a state with larger insurers and therefore potentially more complicated examinations.

Model Law Development and the Investigation of Common Problems

The insurance commissioners and their staff serve on committees to develop new regulations and to examine problems common to many or all of the states. To measure the extent that a state commits time and resources to this function, we determined the number of committee positions that are filled by a representative from each state using the *1996 Committee List* obtained from the NAIC.[13]

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[12] Our measure of oversight also includes examinations conducted on out-of-state insurers. This is important to the extent that some states feel compelled, for a variety reasons, to conduct their own examinations in addition to the examinations conducted by the insurer's local regulator.

[13] There is no time series variation in this variable because we were able to obtain this information for one year only. However, conversations with officials from the NAIC suggest that the composition of the majority of these committees was relatively stable over the time period considered.

Consumer Services

Individual departments also provide services to the state's residents. These include telephone "hotlines" to provide consumers a mechanism to contact the insurance commissioners' office to lodge complaints against their insurer and the development of brochures and price guides to help educate consumers about the insurance market. We measured the states' quantity of services as the number of consumer complaints received and acted upon by the state insurance department each year.

Regulation of Prices

Approximately 50 percent of the states regulated the price of private passenger automobile (PPA) and/or workers' compensation insurance over this time period. To control for the production costs associated with regulating the price of insurance, we employ three rate regulation dummy variables. First, since the majority of states which regulate the price of insurance do so for both lines of business, we employ a variable equal to one if the state used either prior approval or state-made rates for both PPA and worker's compensation. Otherwise, the variable equals zero. We expect a positive sign on this variable. We employ two other dummy variables to control for differences in production costs when the state regulates prices in only one of the two lines of insurance: one dummy variable set equal to one if the state regulated rates for PPA insurance only and a second dummy variable equal to one if the state regulated rates for only workers' compensation. The expected signs on these two dummy variables are negative, reflecting the reduced production costs the state should incur when they do not regulate prices in both lines of insurance.[14]

Fraud

We use a dummy variable for those states that have separately funded insurance fraud prevention and detection departments. We have no method of comparing the intensity of the effort across states, so we use a dummy variable that is one if the state has a unit or bureau devoted to detecting and/or prosecuting insurance fraud within the state, zero otherwise.

Input Definitions

Empirical estimation of the cost function requires estimates for the input prices. Inputs used in this study were wages for professionals (lawyers and actuaries), clerks (which includes all other labor staff of the insurance department), and the cost of materials (such as paper, pencils, and photocopying).

To estimate the input prices of labor, we obtained average wage data from the Bureau of Labor Statistic's publication *Annual Employment and Wages.* For lawyers we used the wage data from the series entitled "Lawyers" (SIC code 8111), for actuaries we used data for "Management Consultants" (SIC code 8742), and for clerical staff we used the series entitled "Total State Government." To save degrees of freedom, we took the weighted average of lawyers and management consultant wages to calculate the wage for professionals in each state. To estimate the price of materials, we assumed

[14] Data Sources: Alliance of American Insurers (1993), American Insurance Association (1995), and National Association of Insurance Commissioners (1995a).

that the states faced the same price for materials in a given year equal to the producer price index.

Control Variables

Cost-efficiency studies are often criticized because no attempt is made to control for product quality differences (Braeutigam and Pauly, 1986). Failure to adequately control for these differences will show up as cost-inefficiencies if states incur additional costs in providing higher quality regulatory services. Fortunately, beginning in 1990, the NAIC began a review of each state's insurance department to determine if the state met a comprehensive set of standards designed to ensure the state could effectively regulate the insurers domiciled in its jurisdiction. The standards for accreditation went beyond requiring the adoption of laws and regulations to include other areas such as the operational and administrative functions of the departments (NAIC, 1995b). To control for cost differences associated with states certified as high-quality producers of insurance regulatory services, we include a dummy variable equal to one if the state was accredited by the NAIC during the year, zero otherwise.

The second control we include is a dummy variable set equal to one for the state of New York and zero otherwise. New York is the only state to require all life insurers licensed in New York to substantially comply with its rules and regulations in all states that insurer operates in regardless of its state of domicile.[15] This effectively requires the New York insurance department to oversee the national operations of both the domestic and foreign life insurers operating in New York. Thus, we include a New York dummy variable to control for cost differences associated with this extraterritorial regulation.

Our third and final control variable is the percentage of premiums written in the state purchased by commercial enterprises (rather than individuals). We employ this variable as a measure of intensity of oversight. Our hypothesis is that regulators will scrutinize personal coverages more closely for a number of reasons. First, consumers are allegedly not as well as informed as the purchasers of commercial insurance and therefore personal products need closer supervision.[16] Second, the price of personal automobile or homeowners insurance is often politically contentious and these prices receive consumer notice, comment, and analysis. Thus, the percentage of commercial business written in a state is a control variable that will reflect the costs of dealing with personal lines versus commercial lines of business within the state.

Table 3 presents the summary statistics for the inputs and the outputs. The budget of the average insurance department was $11.6 million over the period 1990–1995, as measured in real 1995 dollars. Note, however, that the smallest insurance department (South Dakota) had a real budget of less than $1,000,000 on average during this time period, whereas California reported the largest budget of over $90 million. Correspondingly, there is a wide variation in the quantity of regulatory outputs produced.

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[15] See N.Y. Insurance Law § 4205 (consol. 1998).

[16] In fact, a number of states have proposed to deregulate commercial insurance for this reason (Whitney, 1999).

TABLE 3
Summary Statistics for Data Used to Estimate Cost Functions

Description	Mean	Standard Deviation	Minimum	Maximum
Total budget of state insurance department	$11,571,610	$18,133,137	$843,544	$99,167,751
Input prices				
State government employees' wage	$29,146.9	$4,986.0	$20,061.7	$43,686.9
State wage of lawyers	$40,085.6	$8,558.6	$23,145.1	$65,637.0
State wage of actuaries	$43,074.5	$11,533.6	$21,301.3	$85,837.2
Input quantities				
Full-time equivalent clerks	203.0	298.4	23.0	1541.3
Full-time equivalent actuaries	5.2	9.4	0.0	71.5
Full-time equivalent lawyers	8.8	12.4	0.0	73.0
Outputs				
Licensed producers	49,064.5	49,222.6	1,718.0	321,266.0
Consumer complaints	9,190.7	12,451.1	320.0	100,679.0
Market conduct + financial examinations conducted	81.6	94.2	1.0	606.0
Average domestic assets	$436,955,742	$505,351,403	$2,772,546	$3,406,023,219
NAIC committees	25.6	19.6	3.0	89.0
PPA and workers' compensation rate regulation dummy	0.623	0.485	0	1
PPA only rate regulation dummy	0.094	0.293	0	1
Workers' compensation rate regulation dummy	0.123	0.330	0	1
Fraud detection unit dummy variable	0.460	0.499	0	1
Control variables				
New York state dummy variable	0.022	0.119	0	1
NAIC accredited state dummy variable	0.412	0.471	0	1
Proportion of state premiums written in commercial lines	0.481	0.062	0.348	0.735

Note: All dollar amounts are reported in 1995 dollars.
Source: 1990–1995 NAIC's Insurance Department Resources Report
Number of observations is 277.

The quantity of inputs employed also varies dramatically. For example, the number of full-time equivalent actuaries employed by the average state was 5.2 and ranged from none to 71.5 actuaries (New York in 1993).[17] The number of clerical workers also varies dramatically across the states. The average state insurance department employed 203 clerical workers. The state with the largest number of clerical employees was Texas, which employed 1,541.3 workers. To estimate the quantity of materials employed by each state, we determined the amount of the insurance department's budget not allocated to wages for professionals (actuaries and lawyers) and clerks and divided that amount by the materials input price, the producer price index.

Estimation Results

Table 4 shows the results of the estimation of Equations (8) and (9). We estimated two share equations: one for professionals and one for clerical workers. The materials equation was dropped to prevent singularity. Further we estimate two cost functions. The first is a cost function assuming cost-minimization. This is essentially the NCMCF as described in Equations (8) and (9) except we set $\theta_i = 0$ for all θ_i.[18] The second is the NCMCF as described in Equations (8) and (9).

It is possible to test the assumption of cost-minimization by conducting a likelihood ratio test between the two estimated cost functions. The log likelihood function is greater for the NCMCF and the difference is significant at the 0.005 level with 2 degrees of freedom. Thus, the assumption of cost-minimization is rejected. In addition, we tested the joint hypothesis that $\theta_i \neq 0$ for all i from the estimated NCMCF. With 2 degrees of freedom, the joint hypothesis is rejected at all reasonable levels of significance. This second test further supports the conclusion that state insurance regulators are not cost-minimizers and therefore the conjecture of allocative inefficiency in state insurance regulatory departments is warranted.

Examining the parameter values from Table 4 for the NCMCF, we see that the shadow divergence parameter for professionals, θ_1, is negative but not significantly different from zero. For clerks, $\theta_2 < 0$ implies that ${w_2}^{sh} < w_2$ and the states, on average, over employ clerical assistance. These results are at least consistent with the anecdotal evidence regarding the heavy work load of professionals who tend to have competitive market salaries in insurance departments and the lack of investment in computers and technology (see GAO (1989)). Table 4 also shows that accredited states incur significantly higher production costs consistent with the hypothesis that the quality of regulatory services produced by these states is higher.

Table 5 shows that the average state's efficiency score was 0.6611 for the NCMCF result.[19] Thus, the average state could produce the same level of outputs at 66.11

[17] Insurance departments often hire outside consultants and temporary workers to staff positions. Our measure of the number of employees includes both salaried staff as well as contract staff.

[18] To provide some indication of the explanatory power of our models, the R^2 from the cost function regression estimated assuming cost-minimization is 0.9080. We are unable to report a similar goodness-of-fit statistic from the NCMCF as it is a non-linear function estimated via full information maximum likelihood.

[19] Berger and Humphrey (1997) assess a number of efficiency studies in the financial services area and find that the mean efficiency level for studies using similar methodologies ranges

TABLE 4
FIML Estimated Cost Functions of State Insurance Departments, 1990–1995

Variable	Cost-Minimizing	Non-Cost-Minimizing
Intercept	15.9860***	16.1100***
	(0.2088)	(0.2241)
Licensed agents and brokers	0.3328***	0.3143***
	(0.0500)	(0.0502)
Consumer complaints	0.3188***	0.3313***
	(0.0434)	(0.0436)
(Mkt. + Fnc. exams) × Ave. domestic assets	0.0832***	0.0884***
	(0.0260)	(0.0253)
NAIC committees	0.3359***	0.3550***
	(0.0470)	(0.0479)
Licensed agents and brokers^2	0.1202	0.1213
	(0.0868)	(0.0867)
Licensed agents and brokers × consumer complaints	−0.0190	−0.0085
	(0.0516)	(0.0519)
Licensed agents and brokers × [(Mkt. + Fnc. exams) × Ave. domestic assets]	−0.0317	−0.0320
	(0.0310)	(0.0310)
Licensed agents and brokers × NAIC committees	0.2363***	0.2173***
	(0.0634)	(0.0634)
Consumer complaints^2	−0.0486	−0.0503
	(0.0482)	(0.0481)
Consumer complaints × [(Mkt. + Fnc. exams) × Ave. domestic assets.]	0.0866***	0.0821***
	(0.0216)	(0.0221)
Consumer complaints × NAIC committees	−0.0603	−0.0483
	(0.0485)	(0.0483)
[(Mkt. + Fnc. exams) × Ave. domestic assets]^2	−0.0201	−0.0173
	(0.0142)	(0.0140)
[(Mkt. + Fnc. exams) × Ave. domestic assets] × NAIC committees	−0.0570**	−0.0580**
	(0.0264)	(0.0268)
NAIC committees^2	0.3028***	0.3201***
	(0.1146)	(0.1165)
Professional's wage	0.0864***	0.1243***
	(0.0045)	(0.0148)
Professional's allocative inefficiency term, θ_1	−−	−0.2167
		(0.1700)
Clerk's wage	0.9136***	0.8757***
	(0.0045)	(0.0148)
Clerk's allocative inefficiency term, θ_2	−−	−0.5846***
		(0.0651)
Professional's wage^2	−0.0047	0.0400**
	(0.0105)	(0.0184)
Professional's wage × clerk's wage	0.0047	−0.0400**
	(0.0105)	(0.0184)
Clerk's wage^2	−0.0047	0.0400**
	0.0105	0.0184
Professional's wage × licensed agents and brokers	0.0102***	0.0157***

(*continued*)

TABLE 4
(Continued)

Variable	Cost-Minimizing	Non-Cost-Minimizing
	(0.0037)	(0.0058)
Professional's wage × consumer complaints	−0.0067***	−0.0090**
	(0.0028)	(0.0043)
Professional's wage × [(Mkt. + Fnc. exams) × Ave. domestic assets]	−0.0015	−0.0048**
	(0.0013)	(0.0023)
Professional's wage × NAIC committees	−0.0031	−0.0117***
	(0.0029)	(0.0050)
Clerk's wage × licensed agents and brokers	−0.0102***	−0.0157***
	(0.0037)	(0.0058)
Clerk's wage × consumer complaints	0.0067***	0.0090**
	(0.0028)	(0.0043)
Clerk's wage × [(Mkt. + Fnc. exams) × Ave. domestic assets]	0.0015	0.0048**
	(0.0013)	(0.0023)
Clerk's wage × NAIC committees	0.0031	0.0117***
	(0.0029)	(0.0050)
PPA and WC rate regulation dummy	0.1633***	0.1656***
	(0.0511)	(0.0508)
PPA rate regulation only dummy	−0.0871	−0.1364
	(0.0834)	(0.0839)
WC rate regulation only dummy	−0.2032***	−0.1778***
	(0.0660)	(0.0649)
Fraud detection unit dummy	0.3285***	0.3296***
	(0.0397)	(0.0394)
New York dummy	0.1468	0.0839
	(0.1516)	(0.1520)
NAIC accredited state dummy	0.1701***	0.0767
	(0.0420)	(0.0592)
Proportion of state premiums written in commercial lines	−1.6673***	−1.7132***
	(0.4094)	(0.4108)
Log likelihood function	376.326	393.415

Note: ***significant at the 1 percent level; **significant at the 5 percent level
Standard errors are reported in parentheses.

percent of the cost if they adopted the optimal technology. Table 5 also provides evidence regarding the degree of allocative efficiency. Using Eakin's (1993) AI measure described in Equation (12), we see that costs are on average about 1.54 percent higher for the noncost-minimizing models than they would be if the state employed the

from 0.42–0.74 depending on the industry. Although we must exercise some caution making comparisons between the industry and the regulators which oversee its actions, it is interesting to note that efficiency estimates of the insurance industry reported by various researchers are consistent with the estimate we report here. See, for example, Gardner and Grace (1993), Cummins, Weiss, and Zi (1999), and Yuengert (1993).

TABLE 5
Estimated Total Inefficiency, Allocative Inefficiency, and Input Elasticities

	Cost-Minimizing	Non-Cost-Minimizing
Total inefficiency score	0.6739	0.6611
	(0.1942)	(0.1981)
Allocative inefficiency	–	0.0153
		(0.0086)
Elasticity of factor substitution between professionals and clerks		
Shadow	–	0.7005
		(0.1395)
Observed	1.0579	
	(0.1290)	
Price elasticities of demand: Professional workers		
Shadow	–	−0.5893
		(0.1161)
Observed	−0.9633	−0.7521
	(0.1180)	(0.1117)
Price elasticities of demand: Clerks		
Shadow	–	0.1161
		(0.0267)
Observed	−0.0190	−0.2677
	(0.0516)	(0.0439)

Note: All estimates are at the mean input prices and mean output quantities. Standard errors are reported in parentheses.

market input prices and employed the correct input amounts. Thus, the majority of the estimated inefficiencies in state regulation are attributable to technical inefficiencies and not to allocative inefficiencies.

Although the overall allocative efficiency difference is small, the price elasticity of input demand differs between the cost-minimizing and noncost-minimizing models for the two observed elasticities. Further the shadow own price elasticities are more inelastic than the observed elasticities. There is also a difference between the input cross elasticity of demand estimates. The noncost-minimizing model shadow elasticity is lower than the observed, implying less substitutability between clerks and professionals. Thus, the perceived production function is quite different from the cost-minimizing version. A likelihood ratio test of these differences is significant at all relevant ranges.

Table 6 shows the pair-wise cost complementary estimates using the NCMCF for three levels of output.[20] We examine the cost function at the first quartile of outputs, at the mean level of outputs, and at the third quartile. The results are largely consistent across each output level. We find that costs are additive across most outputs pairs with the only exceptions being diseconomies of scope (positive cost complementaries) between licensing agents and brokers and regulatory examinations at all three quartiles

[20] The estimates using the cost-minimizing cost function are similar to those reported in Table 6.

TABLE 6
Estimated Pair-Wise Cost Complementaries

	Consumer Services	Model Law Development	Regulatory Examinations
Outputs at first quartile (smallest states)			
Licensed agents and brokers	0.0016	1.5476***	−1.6895
	(0.8065)	(0.4318)	(1.5812)
Consumer services		−0.5640	7.5691***
		(0.5368)	(1.8404)
Model law development (NAIC committees)			−1.6549*
			(0.9299)
Outputs at means			
Licensed agents and brokers	0.0001	0.2366***	−0.0337
	(0.0516)	(0.0660)	(0.0315)
Consumer services		−0.0519	0.0908***
		(0.0494)	(0.0221)
Model law development (NAIC committees)			−0.0474*
			(0.0266)
Outputs at third quartile (largest states)			
Licensed agents and brokers			
	0.0001	0.1193***	−0.0207
Consumer services	(0.0375)	(0.0333)	(0.0193)
		−0.0358	0.0762***
Model law development (NAIC committees)		(0.0341)	(0.0185)
			−0.0276*
			(0.0155)

Note: ***significant at the 1 percent level; **significant at the 5 percent level; *significant at the 1 percent level
Standard errors are reported in parentheses.

of analysis. Thus, no matter the scale of state regulation, we see highly significant diseconomies of scope. Table 6 also shows us that there are weakly significant economies of scope (negative cost complementaries) between model law development and regulatory examinations. These two results may suggest something about the possible cost benefits of state versus national regulation. Specifically, splitting authority among a national and state regulator along certain regulatory product lines would not necessarily increase total governmental expenditures on regulation holding outputs constant. Secondly, where we do see the weak cost complementarity (model law development and regulatory examinations) an argument can be made to keep these functions together. Thus, solely from a cost-efficiency viewpoint, a weak argument can be made suggesting each output of insurance regulation need not be produced in every state.

Table 7 reports the economy of scale and the product-specific scale estimates for each regulatory output. Recall that an estimate smaller (greater) than one implies increasing (decreasing) returns to scale whereas an estimate of one implies constant returns to scale. The first column reports scale economies using the estimated cost function

TABLE 7
Estimated Overall and Product-Specific Economies of Scale

Overall Economies of Scale	Cost-Minimizing	Noncost-Minimizing
Outputs at first quartile (smallest states)	0.5381***	0.5490***
	(0.0460)	(0.0470)
Outputs at means	0.8774***	0.8884***
	(0.0332)	(0.0341)
Outputs at third quartile (largest states)	1.3187***	1.3278***
	(0.0561)	(0.0562)
Product-specific economies of scale	**Cost-minimizing**	**Noncost-minimizing**
Outputs at first quartile (smallest states)		
Licensed agents and brokers	−0.1746	−0.0120
	(0.9230)	(0.9308)
Consumer services	−7.0517***	−7.2924***
	(1.9035)	(1.9161)
Regulatory examinations × Ave. domestic assets	−26.0770***	−25.9050***
	(4.8643)	(4.8818)
Model law development (NAIC committees)	0.9267	0.9247
	(0.5938)	(0.5908)
Outputs at means		
Licensed agents and brokers	−0.1494	−0.1267
	(0.0921)	(0.0926)
Consumer services	−0.3069***	−0.3220***
	(0.0556)	(0.0557)
Regulatory examinations × Ave. domestic assets	−0.1035***	−0.1047***
	(0.0173)	(0.0172)
Model law development (NAIC committees)	0.0365	0.0370
	(0.1099)	(0.1111)
Outputs at third quartile (largest states)		
Licensed agents and brokers	−0.1766***	−0.1611***
	(0.0498)	(0.0499)
Consumer services	−0.3523***	−0.3742***
	(0.0702)	(0.0704)
Regulatory examinations × Ave. domestic assets	−0.0489**	−0.0510***
	(0.0195)	(0.0194)
Model law development (NAIC committees)	−0.1002***	−0.1023***
	(0.0385)	(0.0389)

Note: ***significant at the 1 percent level; **significant at the 5 percent level
Standard errors are reported in parentheses.

assuming cost-minimization. The second column reports those same estimates using the noncost-minimization cost function. As before, we report these estimates at the first quartile, mean level, and third quartile of outputs.

The top portion of Table 7 shows that at the mean level of outputs, the overall observed elasticity of scale is 0.8774, suggesting that at the mean level of outputs, there are increasing returns to scale in insurance regulation. A one-tail test is significantly less than one at the 0.01 level. With the relaxation of the cost-minimization assumption, the overall scale economies estimate is slightly lower at 0.8618, which is also significantly less than one at the 0.01 level. Examining the results for the outputs at the first quartile, we see that the elasticities of scale are even lower than that of the mean state. This makes intuitive sense as the states are to the left of the mean state on the estimated average cost curve. However, when we examine the results at the levels of the third quartile, we see that the noncost-minimizing state experiences decreasing returns to scale as the estimate is statistically greater than one at the 0.01 level.

If we compare the overall scale efficiency estimates in the top half of Table 7 with the product-specific scale economies in the bottom half, a divergence exists between what is expected and what we estimate for the states in the third quartile. In particular, overall and product-specific scale estimates suggest that for the lower quartile and the mean sized states, there are both increasing returns to scale (overall) and increasing product returns to scale for some outputs. However, for the upper quartile we find overall diseconomies of scale and yet we still observe product-specific economies of scale. Obviously these results would not be a sustainable equilibrium with firms subject to competitive forces, as profit-maximization provides managers with strong incentives to reallocate resources to those areas where the firm has a comparative advantage. Thus, what we see in the regulatory arena is not an equilibrium based upon competitive forces, but instead a structure arguably based upon both political and economic considerations.

At this stage our estimates of economies of scale need to be interpreted with care because we do not yet know the reason we see the average cost of production increasing for the large regulatory budget states. Identification of the source of inefficiency is important to understand the incentives of state regulators and before it is possible to make a policy recommendation regarding the proper placement of regulatory authority. For example, the results could suggest that the state level is the most cost-efficient scale to produce insurance regulation and aggregating the production of one or more of the regulatory functions to a multistate or federal regulator would lead to increases in the average cost of production. Alternatively, the result may also be consistent with the hypothesis that larger states are regulating for a national audience and are providing regulatory benefits not fully captured by the state, even though the cost of doing so is fully borne by the state. This latter interpretation of our scale economy result suggests that we need to control for the perverse incentive for states to free-ride on the regulatory outputs of other states before we can make any conclusions regarding the optimal scale of insurance regulation. We investigate this and other hypotheses designed to explain the relative cost-efficiency of the states next.

DETERMINANTS OF EFFICIENCY

We are interested in three principal questions: (1) is there evidence of states free riding on the regulatory outputs and services of other states; (2) if the answer to the first question is yes, does controlling for the regulatory externality give us additional information regarding the optimal scale for the production of insurance regulation; and (3)

does the fiscal environment of the state impact the level of regulatory efficiency? We investigate our hypotheses by estimating additional regressions using the measure of inefficiency (x-efficiency) as the dependent variable.

Regulatory Externatilities

The literature suggests jurisdictions have strong incentives to utilize their resources efficiently when the benefits of the public goods they produce are fully internalized (Oates, 1972; Inman and Rubinfeld, 1997 and Zhuravskaya, 2000). Thus, our first hypothesis is that states with a greater percentage of premiums written in the state by local companies will have a greater incentive to utilize resources in a more cost-efficient manner. Stated differently, states with small domestic industries have a lesser incentive to use their resources efficiently and will instead rely upon other states to regulate for them. To test this hypothesis, we include the percent of premiums written in the state by foreign insurance companies. We expect a positive sign as states with a greater proportion of premiums being written by foreign insurers will be less cost-efficient.

As a more refined test of the externality hypothesis, we estimate an additional regression where we decompose the foreign insurer market share variable discussed above into two parts: one equal to the proportion of the state's insurance premiums written by foreign insurers headquartered in the top ten states in terms of regulatory expenditures; and two, a variable equal to the proportion of the state's insurance premiums written by foreign insurers from all other states excluding the large regulatory states. We expect both variables will be positive. However, the coefficient on the variable measuring the proportion of the foreign insurer market share from the large regulatory states should be larger in magnitude than the foreign insurer variable from the smaller regulatory budget states if states have a greater ability to free-ride on those states which choose to expend the greatest regulatory resources. We test this hypothesis by conducting a Wald test on the restriction that the estimated coefficients on the two foreign insurer market share variables will be equal.

The regulatory externality hypothesis suggests small states have an incentive to conduct minimal oversight of their own insurers because they believe large regulatory budget states will pick up the slack. However, the local insurance industry in these large regulatory budget states may have incentive to encourage their home state regulator to scrutinize foreign insurers more carefully if doing so creates a barrier to entry for insurers coming from lax regulatory jurisdictions. Most studies of the industrial organization of the insurance industry suggest that there are relatively low barriers to entry (see e.g., Joskow and McLaughlin, 1991). However, if the local industry is successful in influencing the regulator to erect modest barriers which discourage the marginal low-cost (and/or low-quality) insurers, then we would expect the profitability of the domestic insurance industry to be positively correlated with degree to which the state appears to be regulating beyond its jurisdiction.[21] To test this hypothesis we include a variable equal to the total net income generated by the domestic insurers

[21] Some states allegedly use tax policy to overtly keep out foreign low quality companies. For example, Illinois stated in a public hearing before the Supreme Court of Illinois (In *Milwaukee Safeguard Insurance Co. v. Selcke*, 179 Ill. 2d 94, 688 N.E.2d 68 (1997 Sup. Ct. Ill.)) that one reason

in the state divided by their total capital and surplus.[22] The sign on the estimated coefficient should be positive, suggesting states which regulate beyond their borders, and thus appear more cost-inefficient, have a more profitable insurance industry.

Regulatory Environment

Our first environmental hypothesis is related to the funding mechanism employed by the state. The operations of insurance departments are financed in two ways. Dedicated funding is a system where the department is allowed buildup cash reserves which can be carried over from year to year whenever the revenue of the department exceeds its expenses. In doing so, the department has access to funds which allow it to continue spending even when its anticipated expenditures for the year are greater than its legislative appropriation (NAIC, 1997). The alternative mechanism, known as general revenue funding, requires the regulator to request funds each year through the annual budgetary appropriation process which, according to the NAIC, gives the state government substantial control over how the department spends this money.

There are two competing hypotheses about how the system of dedicated funding will impact a regulator's incentive to employ resources efficiently. First, dedicated funding may provide regulators an incentive to husband their resources to ensure they have adequate funding in times when the workload of the department exceeds its short-term resources. Alternatively, dedicated funding may be synonymous with the concept of a soft budget constraint. Budget constraints are said to be soft, i.e., not fixed, whenever an enterprise can be infused with additional capital when it is on the verge of failure (Maskin, 1999). Using this idea, Bartel and Harrison (1999) empirically demonstrate public sector enterprises, which face softer budget constraints than their private sector competitors, are more cost-inefficient and argue the primary reason is because they are able to hire and retain unnecessary workers given their access to subsidized government loans. Thus, the alternative to the "husband your resource hypothesis" is that regulators with a dedicated funding system have access to funds, outside of direct oversight by the legislature, which allows them to continue spending even in times of shortfalls. Thus, we include an indicator variable equal to one when the state insurance department has access to reserve funds through dedicated funding, and zero otherwise. The expected sign on the estimated coefficient is ambiguous.

Our second fiscal environmental hypothesis is related to source of the regulators' funds. There are two primary sources of funds states use to finance the operations of the insurance department: general appropriations from the overall state budget; and fines, fees, and assessments imposed on the industry. We expect departments with a greater percentage of funds from state appropriations will be more cost-efficient since the legislative and executive branches of state government have strong incentives to monitor how the department uses its resources as any savings could be reallocated to other uses within the state. Insurance companies domiciled in states which rely more heavily upon fines, fees, and assessments also have an incentive to monitor

it taxed foreign companies differentially higher than local insurers was to discourage foreign companies from entering the state. At 179 Ill. 2d 97, 688 N.E. 2d 71-72.

[22] This ratio can be thought of as the total return on equity for companies headquartered in a given state.

how efficiently the department utilizes its resources. However, it is unlikely that the industry's ability to monitor the actions of the regulator is superior to the state's, and its ability to enforce more fiscal discipline upon the department is likely to be weaker than the state's. Thus, we expect insurance departments which finance their operations through fines, fees, and assessments will be more cost-inefficient. To test this hypothesis we include a variable equal to the percent of the insurance department's annual budget which comes from fines, fees, and assessments. We expect the sign on the estimated coefficient to be positive.

One of the results we found in conducting our analysis is that the estimated shadow input price for clerical assistance was significantly below the market input price, suggesting the average insurance department over employs clerks. The literature predicts the level of wages in unionized state government labor markets is higher than in nonunionized states (see e.g., Poterba and Rueben, 1998). Assuming these results hold in the market for insurance department clerks, the presence of an employee union, through its ability to collectively bargain with the state, may correct the divergence between actual market prices and the estimated shadow prices and therefore lead the department to employ the efficient level of clerical assistants.[23] To test this hypothesis, we include a variable equal to the percent of state government employees (excluding teachers) who are either members of a union or a covered under a union contract. The data to estimate this variable are available in the March Supplement of the Current Population Survey. We expect a negative sign on this variable, suggesting that states with a greater percentage of their workers in unions will be less cost-inefficient.

Our final environmental hypothesis investigates whether the regulatory selection method explains the levels of efficiency across the states. In most states, the insurance commissioner is appointed. However, in fourteen states, the commissioner is an elected position. To generate our hypothesis, we draw intuition from a literature which suggests officials who desire to advance their political careers must act in the principal's interest sufficiently often to merit consideration for the same or a higher office (Besley and Case, 1995). Since effort is not directly observable, the principal will use some output measure correlated with the agent's performance to gauge the agent's quality. In the case of the appointed commissioner, the principal primarily judging the performance of the insurance commissioner will be the governor. Given the institutional memory contained by the staff of the executive branch, governors should have reasonable expectations regarding the efficient production of regulatory outputs given departmental budgetary constraints and thus should judge the quality of the commissioner, in part, by how efficiently resources are utilized. For the elected commissioner, however, the primary principal monitoring the performance of the commissioner will be the voters. We hypothesize voters are unlikely to use efficiency

[23] Unions may increase productivity for other reasons besides correcting the shadow/market price differences estimated in this article. For example, Cavalluzzo and Baldwin (1993) argue unions can force management to adopt more efficient job practices. Freeman and Medoff (1984) suggest unionized workers are likely to have longer job tenures, which may lead to increases in productivity due to their greater training and experience with the firm. Finally, Mohanty (1997) finds empirical evidence that the higher wages promised by unions attract more productive workers to unionized government jobs, which leads to higher levels of estimated productivity.

TABLE 8
Summary Statistics: Independent Variables Used in State Insurance Department Efficiency Regressions

Variable	Mean	Standard Deviation	Minimum	Maximum
Foreign insurer market share	0.8355	0.1005	0.5847	0.9960
Foreign insurer market share from large regulatory budget states	0.3618	0.0858	0.1583	0.6153
Foreign insurer market share from all other states	0.4737	0.0771	0.2824	0.7146
Domestic industry return on equity (net income divided by total capital and surplus)	9.9164%	3.7637%	1.1600%	19.7200%
Appointed commissioner indicator variable	0.2202	0.4151	0.0000	1.0000
Percent state government employees represented by a union	44.77%	30.88%	0.00%	100.00%
Percent funding from fees and fines	0.6605	0.4148	0.0000	1.0000
Reserve funds indicator variable	0.3827	0.4869	0.0000	1.0000
Statewide DPW/Nat'l DPW	0.0191	0.0230	0.0013	0.1290

as the primary performance measure by which they gauge the quality of their regulator given the complexity of the variable and the small size of departmental financing relative to the overall state budget. The electorate is more likely to use measures which can be easily communicated, such as the number of complaints reviewed by the insurance department. Thus, we predict appointed commissioners have a greater incentive to use their resources in a cost-efficient manner. To test this we include a dummy variable equal to one if the insurance commissioner is appointed and zero otherwise. We expect a negative sign, suggesting appointed commissioners operate closer to the estimated frontier and therefore appear more cost-efficient.

In Table 8 we present the descriptive statistics of our sample. Note that this is the same sample of states and the same time period we use to estimate the NCMCF. We include these statistics here to summarize the variables employed in the determinants of efficiency regressions.

As suggested earlier, the regression conducted here is cross-sectional where the dependent variable is the x-efficiency score for each state, XEFF. The explanatory variables are the averages, across time, of the control variables for each state.

The results reported in the first two columns of Table 9 are largely consistent with our hypotheses. In Model 1, the foreign insurer market share variable is positive and significant, suggesting states with a greater percentage of the premiums written by insurers domiciled in other states are less efficient. In Model 2, both the large regulatory states' foreign insurer market share and the all other states' foreign insurer market share variables are positive although only the large regulatory variable is significant. A Wald test rejects the null hypothesis that the coefficient on the large

TABLE 9
Determinants of State Insurance Department Efficiency

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	−1.1322***	−0.9839***	−1.1924***	−1.2864***	−0.9101**	−0.9670**	−0.8703*
	(0.269)	(0.239)	(0.315)	(0.350)	(0.392)	(0.385)	(0.472)
Foreign insurer market share	0.5147**		0.5741*	0.6510*	–	–	0.1461
	(0.252)		(0.323)	(0.359)			(0.530)
Foreign insurer market share from large regulatory budget states	–	0.9781***	–	–	1.1905***	1.2708***	–
		(0.264)			(0.381)	(0.401)	
Foreign insurer market share from all other states	–	−0.2615	–	–	−0.4171	−0.4968	–
		(0.400)			(0.739)	(0.716)	
Domestic industry return on equity	0.0039	0.0055	0.0038	0.0035	0.0017	0.0018	−0.0004
	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)	(0.011)
Appointed commissioner indicator variable	−0.0230	−0.0099	−0.0116	−0.0220	−0.0319	−0.0517	−0.0062
	(0.048)	(0.048)	(0.052)	(0.050)	(0.051)	(0.052)	(0.061)
Percent state government employees represented by a union	−0.2012***	−0.2005***	−0.2088***	−0.1889**	−0.2030**	−0.1675*	−0.2325**
	(0.065)	(0.063)	(0.073)	(0.080)	(0.094)	(0.098)	(0.096)
Percent funding from fees and fines	0.0012**	0.0016***	0.0012*	0.0012*	0.0021***	0.0021***	0.0022**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Reserve funds indicator variable	0.1390***	0.1098**	0.1391***	0.1407***	0.1070**	0.1151**	0.1082**
	(0.046)	(0.049)	(0.047)	(0.050)	(0.046)	(0.045)	(0.042)
Statewide DPW/Nat'l DPW			0.3121	2.0551	−0.8796	1.6191	−15.5793*
			(0.840)	(2.431)	(1.049)	(1.871)	(8.881)
(Statewide DPW/Nat'l DPW)^2	–		–	−14.6964	–	−19.9658	–
				(18.697)		(12.707)	
Interaction term: (Foreign insurer market share) × (Statewide DPW/Nat'l DPW)	–	–	–	–	–	–	21.6374*
							(12.025)
Adjusted R^2	84.4%	85.8%	84.1%	83.9%	97.4%	97.4%	97.1%

All models estimated using the average value for the independent variables for each state across years. The dependent variable is Berger's distribution free estimate of inefficiency (XEFF) defined in Equation (10). Number of observations = 51.
*Weighted least squares. Weight is squares root of total premiums written in the state.
Standard errors are reported in parentheses.

regulatory states' foreign insurer market share variable is equal to the all other states' foreign insurer market share variable ($\chi^2 = 6.038$, one-sided p-value is 0.014 with 1 degree of freedom).[24] Thus, we find strong evidence that states have a greater ability to free-ride on those states which choose to expend the greatest resources on regulation. In addition, the coefficient on the profitability of the domestic industry variable is positive and significant consistent with the hypothesis that extraterritorial regulation is correlated with the profitability of the domestic insurance industry. Viewed broadly, our results are consistent with the conclusion reached by Case, Rosen, and Hines (1993) that states are influenced by the choices made by other states when deciding what their own state government should do.

Many of the environmental variables are also consistent with our expectations. The percent of state government employees covered by a union contract is negative and significant, consistent with the hypothesis that unions provide an incentive for bureaucrats to raise the wages of workers to market prices, thereby giving them incentives to employ the allocatively efficient number of clerks. The percent of funding from fees, fines, and assessments variable is positive and significant, suggesting state agencies funded by directly taxing the industry are more cost-inefficient, consistent with a heightened principal-agent problem. The reserve funding indicator variable is also positive and significant, lending support for the soft budget constraint hypothesis. Finally, in Models 1 and 2, the appointed commissioner dummy variable is negative although not significantly, suggesting elected and appointed insurance commissioners have equal incentives to use their resources in a cost-efficient manner.

Robustness Check

The results above suggest smaller budget states free-ride on large budget states. An unanswered question, however, is whether there is direct evidence that states appear to reduce their output, recognizing other states may pick up the slack. Considering the outputs of regulation, is seems likely the output that could most easily be exported to other states is solvency regulation, since the remaining outputs (price regulation, agent licensing, etc.) are mostly local in nature.[25] To examine the reduced output hypothesis, we conducted a simple test to examine whether the incentives state regulators have to initiate solvency examinations (output) are negatively related to the amount of business domestic firms wrote outside the state of domicile by running the following regression:

$$\text{Exams}_i = \alpha + \beta_1 \%\text{Dom Prem Exported}_i + \beta_2 \text{Size Ave. Dom Ins}_i + e_i,$$

where the dependent variable, Exams_i, equals the number of solvency examinations initiated by the insurance department in a year relative to the number of domestic

[24] This result is robust changing the decomposition of the foreign insurer market variable defining the large regulatory states as being either the top five or the top fifteen states. We report the result making the delineation using the top ten states as it yields the best overall fitting model in terms of F-statistic.

[25] The authors appreciate the comment from an anonymous reviewer suggesting this additional test.

insurers in the state. The primary explanatory variable of interest, % Dom Prem Exported$_i$, equals the percentage of the domestic industry's premiums written in foreign states. To control for any relationship between the complexity of solvency examinations and the average size of the insurers headquartered in the state, we also include the variable Size Ave. Dom Ins$_i$, which equals the average total real assets of the domestic insurers in the state.

The estimated regression

$$\underset{}{\text{Exams}_i} = \underset{(0.447)}{2.848} - \underset{(0.767)}{2.457}\%\text{Dom Prem Exported}_i - \underset{(0.00029)}{0.000024}\text{Size Ave. Dom. Ins}_i$$

is consistent with the reduced output hypothesis, as the coefficient on the % Dom Prem Exported variable equals −2.46 and is highly significant (the t-statistic is 3.199).[26] To give economic significance to the result, consider that during the time period of this study, the average state initiated 1.2 examinations per domestic company each year, had 85 companies under its watch, and 63 percent of the domestic industry's premiums were exported to another state. Using those same numbers except setting the percent of the domestic industry's premiums exported to other states equal to its value at the 90th percentile, 89 percent, implies a reduction of 0.067 examinations per domestic company or, for the average state, 5.6 examinations per year. This represents a reduction in the examination output of approximately 5 percent.

The reduced output test, when viewed in light of the determinants of inefficiency in the production of regulation, suggests the following. The results imply that regulators of states which export large percentages of their domestic premiums free-ride on other states by reducing the amount they produce and, assuming we have fully captured all the outputs of insurance regulation in our production model, they appear to divert savings to nonsocially productive activities instead of returning the savings to the state governments. Thus, our results suggest the state-by-state nature of insurance regulation provides individual regulators with reduced incentives to regulate their domestic industry and increased incentives to divert the savings to activities that maximize the private benefits of the regulator.

Optimal Scale

Having found direct evidence of extraterritorial regulation by large regulatory states, we now return to the question of whether the optimal scale for insurance regulation is still less than the largest quartile of insurance departments. We conduct this investigation by including a proxy for the size of the state's insurance department in the regulatory efficiency regressions reported in Table 9. Our proxy for state size equals the percent of national premiums written in the state and we include both linear and quadratic specifications to test for the presence of a nonlinear relationship between cost-efficiency and state size. The estimated coefficients specifications, reported in Models 3–6 of Table 9, are not significant, suggesting no significant cost-efficiency

[26] We control for possible state fixed effects by running the regression cross-sectionally after first taking the temporal averages of all the variables for each state. The regression contains 51 observations and the regression R^2 is 21.4 percent. Standard errors are reported in parentheses.

differences between large and small states. However, in Model 7 where we interact the state size variable with the foreign insurer market variable, the estimated coefficient on the variable which proxies for state size is now negative and significant, suggesting larger states are more cost-efficient, and the interaction variable is positive and significant, suggesting, after controlling for size, that states with greater levels of foreign market share are more cost-inefficient. The results for the remaining tests are largely unchanged.

CONCLUSIONS AND IMPLICATIONS

We examine the sources of inefficiency in the production of state regulation of the insurance industry, paying particular attention to examining the unique nature of insurance regulation in the U.S. federal system. Using data on the annual resources of state regulators, we estimated a NCMCF of regulation and obtained measures of state regulatory efficiency. We then use the efficiency results to infer the source of the inefficiencies.

We conjecture two major sources of inefficiency. The first is from the existence of a regulatory externality where states will voluntarily produce regulation benefitting those outside of the state and other states have an incentive to shirk their regulatory responsibilities. We find evidence that states with small insurance regulatory budgets free-ride on larger budget states and large states may voluntarily export these regulatory goods and services so as to erect entry barriers into the state by insurers from lax regulatory jurisdictions. One of the seemingly anomalous results we obtained was that there appeared to be decreasing returns at the largest level of regulatory production. On the surface this implies that the optimal level of regulation is below the scale of the largest states. However, once we control for the transstate externality we see that states with larger budgets are actually more efficient, all other things held constant. Thus consistent with the theoretical literature on fiscal federalism, there may be benefits to internalizing regulatory costs by increasing the scale of regulatory jurisdiction.

We also examine the possibility that the state's own fiscal environment dictates the level of efficiency obtained by the regulator. We find that proxies for differences between the methods used to finance the activities of the agency and the degree the agency has access to resources external to the direct oversight of the state government are important indicators of how efficient the regulator might be.

An implication concerns the regulatory issues that were raised with the passage of the GLB Act and the proposed regulatory modernization act currently being discussed. Although GLB eliminated many barriers between the sectors of the financial services industry, it maintained the status quo with respect to regulation. In contrast, regulatory modernization may remove state power to regulate prices or undertake market conduct regulation.

An implication of GLB-style functional regulation is that newly formed financial service conglomerates are now able to sample from all the regulatory agencies and thus will be able to compare and contrast the costs of compliance associated with the various agencies. An interesting question is how much longer major financial service companies will tolerate having to deal with potentially 51 state regulatory jurisdictions for insurance and only two or three for their banking operations. In addition to

the direct costs of compliance, these firms will also be able to assess the quality of state insurance regulation versus federal bank and securities regulation. This will become more important in the near future to the extent state regulation appears duplicative, inefficient, or ineffective due to the trans-state externalities or the states' own regulatory environments. Pressure by the industry to form a new system will be proposed if these firms find the net benefits of regulation are different in their insurance operations than in the other areas of their businesses. To survive in an environment where the costs and benefits of regulation can be inferred from within the same company, state insurance regulators will need to provide new methods of regulation to reduce the cost of regulation. Our results regarding the sources of inefficiency in the current system should prove useful as the financial service industries evolve.

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