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"Beggar thy neighbor:" Testing for free riding in state-level endangered species expenditures *

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Abstract. An important public policy question that remains unresolved is whether devolution will enhance sensible policy making by exploiting informational asymmetries or, instead, trigger a "beggar thy neighbor" response and stimulate free riding amongst localities. We analyze this question within the framework of U.S. environmental policymaking by scrutinizing a unique panel data set on state-level endangered species expenditure patterns. Our empirical estimates are consistent with the notion that states free ride, which may lead to an expenditure equilibrium that is not Pareto efficient.

1. Introduction

Analyzing the appropriate division of functions among levels of government remains an important public policy issue, And, as budgetary difficulties of federal and state governments in the United States and of decentralized governments in a number of countries increases, understanding intergovernmental fiscal relations becomes invaluable (Oates, 1991). Within the broad scope of the public sector, one area that is gaining attention is the allocation branch, or the optimal institutional arrangements for the provision of public goods and services. An important question that remains unresolved in the literature is whether responsibility for setting environmental regulations and enforcement levels should rest with the federal government or the states. Wilson (1996) presents an extensive theoretical analysis of a number of situations where initial distortions are present in the economy and shows that

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local environmental regulations either may "race to the top" or "race to the bottom."

To provide initial empirical insights into the issues associated with regulatory federalism, List and Gerking (2000) use three data sets associated with state-level air pollutants and find evidence that states did not "race to the bottom" when President Reagan's policy of new federalism returned responsibility for many environmental regulations to the states in the early 1980s. Given that their examination was primarily focused on the provision of local public goods (local pollutants), it may not be surprising that little evidence of free riding was found, In this study, we broaden the scope of analysis by examining a much different piece of legislation – the Endangered Species Act (ESA). Through work to conserve and restore endangered and threatened species and the ecosystems upon which they depend, the ESA provides public goods much more global by nature than the goods examined in List and Gerking (2000).

Without a doubt, few pieces of law have created as much controversy as the federal ESA, The ESA, which was passed by large majorities in both the House of Representatives and the Senate, offered sweeping protection to such charismatic wildlife as bald eagles and grizzly bears. The ESA was notably different from previous attempts to centralize authority of conservation efforts, as it essentially placed full responsibility of endangered species conservation on the federal government (Petersen, 1999). The act gave the federal government the authority to constrain *any* activity that may harm a species that is in danger of becoming extinct; in effect once a species is labeled endangered, cost-benefit analysis is essentially precluded (Metrick and Weitzman, 1996; hereafter MW). Since millions of U.S. dollars are allocated annually to preserve biodiversity, policymakers and academic researchers have scrutinized the efficacy of federal expenditure patterns.[1]

One such academic study, due to MW, uses aggregate governmental expenditure data covering the 1989–1991 period to examine the pattern of spending and preservation decisions.[2] Their aggregate expenditure data are comprised of $248 million in federal expenditures and $74 million in state expenditures. Amongst other interesting findings, MW provide evidence that suggests visceral characteristics influence the spending decision more than scientific characteristics. Coupling these sorts of behavioral patterns with the fact that of the over 1400 species placed on the endangered list, only 27 have been subsequently removed (Smith, 1999), critics of the ESA have argued "if one deliberately set out to create a law that would have harmed wildlife, destroyed habitat and discouraged private landowners from protecting wildlife on their lands, it would have been difficult to surpass the Endangered Species Act" (Smith, 1999: 12).

The perceived failure of the ESA has prompted calls for a major overhaul of the bill. Similar arguments were forwarded two decades ago about other environmental bills and President Reagan responded by implementing a policy of new federalism, which returned responsibility for many environmental regulations to the states (Nathan and Doolittle, 1983). The notion of devolution has also gained widespread attention as a possible reform of the ESA.[3] Two particularly strong promoters of decentralization are The National Endangered Species Act Reform Coalition and The States' Rights Movement; both groups contend that states should be responsible for their own endangered species protection since they are at the heartbeat of the problem and better understand the local trade-offs between species, land development, and economic cycles.[4] Devolution, as the argument goes, would result in more efficient and effective policies, which would serve to reduce private landowners' perverse incentives to view endangered species as a liability best disposed of – the incentive to "shoot, shovel and shut up" has undermined efforts to protect endangered species in the past (Shogren and Brown, 1998).

Alternatively, endangered species preservation constitutes provision of a global public good, primarily involving nonuse values. And, at least since the seminal work of Samuelson (1954), it is well understood that local provision of global public goods is inefficient due to the tendency for localities to free ride. Therefore, states may prefer to free ride on other states' preservation efforts- species preservation typically involves considerable opportunity costs and lax policies in this regard potentially releases land for other endeavors, such as industrial development.[5] On balance, it is therefore not clear whether delegating authority to state and local authorities will be in the interest of efficiency.[6]

In this study, we shed light on the tendencies of local free riding by considering the underlying behavioral spending decisions on endangered species at the state-level.[7] We use federal expenses as a "spending benchmark," and investigate the degree to which state expenditure patterns differ from federal spending patterns. The federal government would prefer states to focus their preservation efforts on the same set of species, but also expects states to exploit local knowledge and therefore invest funds more effectively. States, on the other hand, have an incentive to focus their efforts on species that are least in conflict with local industry, *ceteris paribus*.

The paper's contribution is in the spirit of MW, but uses state rather than aggregate expenditures and examines a much different issue. Our unique panel data set, which includes state-level data from the 1993–1995 period, allows us to address questions that were heretofore unanswerable. Overall, certain empirical results presented suggest free riding occurs at the state level. This result may be interpreted as an argument against devolution in this

particular policy domain, and cautions that if responsibility for setting ESA regulations and enforcement levels enforcement is decentralized, this sort of behavior may preclude an expenditure equilibrium that is Pareto efficient.

2. The theory, the data, and the empirical techniques

2.1. *Theory and hypotheses*

Until recently, decisions regarding the preservation of biodiversity were hindered by lack of a workable theoretic construct. An early contributor to the field was Weitzman (1992, 1993), who provided insights into fundamentals of species conservation, including maintenance and enhancement of biodiversity preservation. More recently, Weitzman (1998) constructed an intuitively appealing model to examine the diversity issue-the Noah's Ark Problem. Weitzman's (1998) Noah's Ark framework formalized the general problem of preserving diversity under a budget constraint, and derived four factors that should be considered when determining the optimal mix of species that gain admittance on Noah's Ark. The four factors include species uniqueness, direct utility of the species to humans, increases in the species' survivability rate by allowing the species to board the Ark, and the dollar cost of achieving this increase in survivability.

MW (1996, 1998) extended the Noah's Ark Problem to an empirical dimension by using a regression framework to identify the factors that actually matter in Noah's boarding decision at the federal level. At the state level, however, different incentives may be at work. As aforementioned, states may compete with one another to attract investment, and stringent endangered species legislation (or restrictions on allowable land use) could hinder the ability to attract mobile factors as it might reduce the expected return on capital investments. Assuming that free riding considerations play a role in shaping expenditures, how may these considerations manifest themselves? We suspect that states are acutely aware of species whose preservation entails considerable restrictions on private landowners and firms, leading to the following hypotheses:

H_1: States prefer not to preserve species whose preservation involves protecting extensive areas (habitat), *ceteris paribus*.

H_2: States prefer not to preserve species whose preservation conflicts with current development plans, *ceteris paribus*.

The latter hypothesis relates to current conflicts between preservation and development, whereas the former allows for the potential of future conflicts and competition for land amongst potential uses.

2.2. *The data*

In our attempt to uncover whether free riding is evident in the nonfederal endangered species spending decision, we analyze 1993–95 species-by-species expenditure data from the International Association of Fish and Wildlife Agencies (IAFWA). IAFWA consists of fishery and wildlife administers and land managers from states throughout the U.S. (as well as from foreign countries). State fish and wildlife agencies are responsible for monitoring fish and wildlife species abundance within each state. In 1989, IAFWA was charged with gathering data on state-level expenditures for each species for each year. IAFWA's data gathering process entails a detailed mail survey sent out to each state environmental agency. The survey asks the state agencies to break down all expenditure figures by species type from all state agencies. Our expenditure figures therefore include spending by parks, heritage programs, forests, highways, and any other state agency that supported the conservation effort.

Expenditure data have been collected since 1989, but IAFWA was only able to track down the disaggregated state spending figures from 1993–95. Indeed, IAFWA does not have these state-level disaggregated figures computerized-we were actually mailed the raw data and proceeded to enter the observations manually. Our final sample included expenditure figures for 189 species totaling more than $30 million.[8] We should note that our total expenditure figures are significantly less than estimated aggregate figures that IAFWA submits to the Fish and Wildlife Service.[9] This discrepancy arises for at least four reasons. First, only direct costs attributable to designated species are included in the IAFWA report. Expenditures that cannot be matched with an individual single species are therefore excluded.[10] These expenditure types include, but are not limited to, state-level operating expenditures and salaries and benefits to employees. Second, most states do not include law enforcement costs broken down by species. Hence, these expenditures, and any indirect costs associated with preservation, are not included in the state reports. Third, any federally mandated expenditures are not included in our state-level figures: the states had full discretion over the expenditure figures in our data set.[11] Finally, following MW we focus only on expenditures to conserve and protect vertebrates since a large portion of typical state-level budgets is comprised of these expenditure types.

We provide Table 1 to indicate how the spending decision varies across government types.[12] Table 1 breaks down the expenditure levels for the top 10 species, where MW's figures in the top panel include all governmental expenditures during the 1989–91 period, and our figures in the bottom panel only include nonfederal 1993–1995 expenditures. Similar to MW's findings, nonfederal spending decisions appear to be concentrated heavily on relatively

Table 1. Expenditures on top 10 species

Species		Spending	Cumulative spending (%)
Metrick and Weitzman			
1.	Bald Eagle	31.3	9.9
2.	Northern Spotted Owl	26.4	18.3
3.	Florida Scrub Jay	19.9	24.5
4.	West Indian Manatee	17.3	30.0
5.	Red Cockaded Woodpecker	15.1	34.8
6.	Florida Panther	13.6	39.1
7.	Grizzly (or Brown) Bear	12.6	43.1
8.	Least Bell's Vireo	12.5	47.1
9.	American Peregrine Falcon	11.6	50.7
10.	Whooping Crane	10.8	54.2
State-level			
1.	Chinook Salmon	4.7	16.4
2.	Northern Spotted Owl	3.0	26.6
3.	Bald Eagle	2.7	35.8
4.	Grizzly (or Brown) Bear	2.1	43.1
5.	Marbled Murrelet	2.0	50.0
6.	American Peregrine Falcon	1.1	53.7
7.	Black-Footed Feret	1.0	57.1
8.	Florida Panther	1.0	60.4
9.	Piping Plover	0.8	63.1
10.	Loggerhead Sea Turtle	0.7	65.5

Notes. Figures in the top panel are from Metrick and Weitzman's (1996) total government expenditure data, covering 1989–1991. Bottom panel data are state-level expenditure figures from 1993–1995.

few species. Our data suggest that nonfederal expenditures are more concentrated than MW's overall governmental expenditures. This finding may imply that through time expenditures have become more concentrated. Alternatively, it may suggest that state agencies tend to concentrate on fewer species since they have a much smaller budget compared to the federal government.

2.3. *Empirical methodology*

To provide a baseline for comparison, we follow MW and estimate versions of their regression model #2 (described below) using data for all verteb-

rate species. By including scientific and visceral proxies in the regression model, we can examine the roles that these variables play in the nonfederal (state) spending patterns. Our regression models make the natural logarithm of expenditures a function of a set of regressors:

$$E_i = \alpha + \beta X + \varepsilon_i, \tag{1}$$

where E_i is the natural logarithm of total nonfederal expenditures from 1993–1995 to preserve and protect species i; X is a vector of species-specific characteristics that presumably affect expenditures; α and β are parameters to be estimated, and ε_i is the well-behaved random error component.[13] When constructing vector X we follow MW and include dummy variables for taxonomic class (*Mammal, Bird, Reptile, Amphibian, and Fish*), a dummy variable for monotypic genus (*Monotypic* = 1; 0 otherwise), a dummy variable indicating whether the species is a subspecies (*Subspecies* = 1; 0 otherwise), the natural log of physical length (*Lnlength*), and a measure of endangerment (*NCrank*). The measure of endangerment is from the Nature Conservancy database. Low levels of *NCrank* represent highly endangered species, while a high *NCrank* suggests the opposite.

Besides estimating the baseline model, which is identical to MW's regression model #2, we also estimate an empirical model that includes a conflict variable in X, which is similar to MW's regression model #3. The conflict variable was originally introduced in Mann and Plummer (1993), and serves to proxy for the formal priority system created by the Fish and Wildlife Service in 1983. The priority system places importance on recovery potential and whether the species is in conflict with construction or other anthropogenic activities. Although species labeled as "in conflict" are not supposed to receive higher priority, *ceteris paribus*, we suspect that a species in conflict will receive greater attention than a species not in conflict. The conflict variable is dichotomous: *conflict* = 1 if the species is in conflict, 0 otherwise.

Before proceeding to the empirical results, a brief explanation of our two hypotheses within the regression framework is worthwhile. First, *ceteris paribus*, states will spend less money on preservation of large species than the federal government. Given that preserving a large species typically requires more land (Primack, 1998),[14] and thus involves a larger cost on the constituency and potential capital investors, states should spend less on larger species than the federal government, *ceteris paribus*. Evidence to test this conjecture can be found via examination of the coefficient of "physical length": if the coefficient takes a *lower* value for states than for the federal government, implications are that states spend less preservation dollars on larger species than the federal government. Second, states will be less inclined to support species whose preservation conflicts with current development plans, *ceteris*

paribus. Evidence in favor of our second hypothesis would come by means of examining the coefficient of the variable "conflict". If the coefficient of "conflict" is significantly smaller for the state subsample than for the federal government, implications are that states are less inclined to support species in direct competition with current development plans.

3. Empirical results

Columns 1 and 3 of Table 2 present our empirical results for both models, and columns 2 and 4 provide summary estimates from MW's (1996) regression models #2 and #3. Overall, our coefficient estimates are generally consistent with MW's main findings. For example, we find that states consider taxonomic class in the spending decision.[15] However, whereas MW find that mammals received the greatest level of overall support from 1989–1991, our results suggest birds had that distinction between 1993–1995. Other interesting results include coefficient estimates of the extent of endangerment (*NCrank*). MW found a positive and significant coefficient estimate of degree of endangerment in both regression models #2 and #3. Their result implies that endangerment and expenditure levels are inversely related-more endangered species receive fewer preservation dollars, *ceteris paribus*. Although their coefficient estimate is probably due to omitted variable bias (MW refer to the omitted variable as "species charisma"), one cannot be assured that this perverse behavior fails to exist at the federal level, Our results are different as they suggest that degree of endangerment does *not* have a statistically significant effect on the state-level spending decision. Nevertheless, it is quite plausible that omitted "charisma" bias plagues our model as well, and if the bias is strong enough to change our insignificant coefficient estimate to a significant negative effect, one could conclude that endangerment matters in an intuitive manner.

Turning to the theme of free riding, we find support for both research hypotheses. First, consider the coefficient estimate of the species length variable. In both state level regression specifications, the coefficient estimate of species length is positive and significant at the $p < .05$ level; hence in accordance with MW we find that larger species attract more preservation dollars than smaller species, *ceteris paribus*. Taken literally, empirical estimates suggest that for each 10% increase in species length, expenditures increase 3.2% and 4.0%, depending on model type. Although each parameter is significantly different from zero at conventional levels, both point estimates are significantly lower than the length elasticities reported in MW-about unity (such that a 10% increase in species length is matched by a 10% increase in preservation funds). Recall that state expenditures are included in the MW

Table 2. Determinants of the state-level spending decision

Variable	Regression #1	MW #2	Regression #2	MW #3
Constant	8.3**	7.69**	8.2**	7.99**
	(18.7)	(16.9)	(18.7)	(17.1)
Mammal	0.55	0.75*	0.58	0.54
	(1.2)	(1.7)	(1.3)	(1.4)
Bird	0.86**	0.27	0.93**	0.46
	(2.2)	(0.7)	(2.4)	(1.3)
Reptile	–0.50	–1.72**	–0.49	–1.62**
	(–0.9)	(–3.4)	(–0.9)	(–3.5)
Amphibian	–1.16*	–0.94	–1.12*	–1.19*
	(–1.7)	(–1.4)	(–1.6)	(–1.9)
NCrank	0.07	0.65**	0.11	0.80**
	(0.7)	(3.4)	(1.0)	(4.4)
Lnlength	0.40**	1.03	0.32**	0.85**
	(2.6)	(6.7)	(2.0)	(5.9)
Monotypic	0.34	–0.37	0.21	
	(0.7)	(–0.7)	(0.4)	
Subspecies	–0.42	–0.35	–0.41	
	(–1.4)	(–1.2)	(–1.3)	
Conflict	–	–	0.61**	1.20**
			(2.1)	(4.2)
n	189	237	189	237

Notes. [a]Dependent variable is the natural logarithm of state-level endangered species expenditures on vertebrates from 1993–1995.
[b]t-ratios are beneath coefficient estimates.
[c]MW (1996) estimates are from Tobit models; MW #3 also includes a priority regressor. In our regression specifications, Tobit models yield similar estimates to those presented.
[d]"Fish" and "full" species dummies are excluded; and are therefore baseline categories.
**Significant at the .05 level.
*Significant at the .10 level

sample, and therefore if state expenditure patterns are roughly equivalent across data sets, differences between state and federal expenditures are actually underestimated in Table 2. Clearly, state agencies are less sensitive to species length than federal planners, which is consistent with our hypothesis on the opportunity cost of preservation.

Concerning our second hypothesis, we find that the coefficient estimate of *Conflict* in column 3 of Table 2 is positive and statistically significant at the

$p < .05$ level. While conflict is not supposed to be an important determinant in the expenditure equation, it appears that states, like the federal government in MW's model #3, are considering whether the species is in conflict with human activities when making the expenditure decision. Many factors may be at play here, but MW provide one intuitively appealing explanation-species in conflict may be attracting special media attention, leading special interest groups and others to generate extra support for the species. Nevertheless, consistent with our free riding hypothesis, we find that the coefficient estimate of conflict for the state level regression is significantly lower than the respective coefficient in the federal spending regression. This finding may suggest that states are more concerned about the local development benefits against which species survival is compared.

Before concluding, we should mention two potential shortcomings inherent in our results: (i) the degree of substitutability between federal and state preservation funds, and (ii) exclusion of certain expenditure components. In terms of the former caveat, it is possible that state spending is concentrated on those species that are underfunded by the federal government, filling the "gaps" that have emerged for some reason. The raw data suggest that this is not the case, however, as expenditure patterns across federal and nonfederal agencies concentrate on similar species. Concerning the latter caveat, we again stress that we followed MW in the data construction. As such, we excluded expenditure types that could not be matched to individual species (e.g., state-level operating expenditures and salaries and benefits to employees). This exclusion will admit bias in our regression results if these sorts of expenditures are disproportionately protecting species that need extensive habitats *and* the proportion (general expenditures that cannot be attributable to individual species/total expenditures) is larger for state agencies than the federal government. Through interviews with IAFWA representatives (Mark Reeff and Robert Miles) and an informal examination of the state and federal data, we believe that neither of these concerns compromises our general findings.

4. Concluding comments and discussion

Shifting responsibility of federal policies to the states has been an important agenda item in the U.S. for the last two decades. Indeed, during the 1993–1998 period, there was nearly a 75% increase in delegated programs from the Environmental Protection Agency to the states. Within this devolutionary trend remains many unanswered questions. One such question is how protection of the environment and biodiversity will proceed. We fill this gap by examining endangered species expenditure patterns across nonfederal agen-

cies from 1993–1995. Use of these unique panel data allows us to explore whether a "beggar thy neighbor" attitude is present in state spending on endangered species preservation.

A major finding from our analysis is that state agencies appear to be influenced by free riding considerations. Specifically, states are less inclined to spend money on the preservation of species that are large (i.e., demanding extensive habitat with restrictions on land use for survival) or directly in conflict with development. These findings are consistent with our free riding hypothesis, but not consonant with previous work on devolution of environmental policies. For example, List and Gerking (2000) analyzed whether states adopt lax pollution policies in an effort to attract investment after the federal government allowed greater state control. They found little support for the race to the bottom hypothesis. However, the regulations and pollutants considered in their analysis primarily are related to local problems, suggesting that the potential for free riding is limited, Species preservation, in contrast, involves mainly nonuse values that readily spill over to other constituencies and offer more opportunity for free riding. While our results should not be misconstrued as an argument in favor of a command-and-control approach to endangered species preservation, we believe it should be realized that devolution of authority is not a panacea; it is advisable for some problems and the case is less clear-cut for others.

Notes

1. For a critical assessment of the behavior and motives of *non*-governmental environmental organizations such as the Nature Conservancy and Sierra Club, see Hewitt and Brown (2000).
2. Metrick and Weitzman (1999) extend the MW (1996) study by using aggregate expenditure data from 1989–1993. Since their new results are similar in spirit to the 1996 findings, we will focus attention on the estimates from the 1996 study.
3. Another novel policy change is decreasing the scope of government and introducing the market mechanism to preserve endangered species (see, e.g., Merrifield, 1996). This has been dubbed the "conservation banking" approach (Shogren and Brown, 1998) and, while interesting, is not considered further herein.
4. Devolution of endangered species is not germane to the U.S. Fraserinstitute (1999), amongst other organizations, presents a strong plea for devolution in Canada.
5. The incentive to free ride also crosses international borders. The Fraserinstitute (1999), for example, argues that species in the northernmost part of their range (that is, species more plentiful in the USA) should not receive special preservation funds in Canada. Supposedly, the neighbor may be able to take care of preservation at lower cost. This may illustrate both an incentive to free ride as well as an incentive to enhance efficiency in preservation.
6. Of course there are other considerations. For example, de-linking the financing and provision of public goods may trigger monitoring and information problems so that it is not

obvious that the (state) government will expend the optimal level of preservation effort (see Boadway et al., 1999).

7. Admittedly, this is an imperfect measure since current expenditures (i.e., with federal preservation efforts in place) may prove to be a poor proxy of behavior after devolution (depending on substitution effects); nevertheless, the data available allow us to learn about states' preferences from observing current behavior.
8. Seven observations were unreadable and therefore deleted. Note that our expenditure figures are actual rather than hypothetical. Some studies in the literature use hypothetical data from non-incentive compatible surveys, which could present important methodological issues (see, e.g., List, 2001).
9. These are the overall state expenditure figures that the US FWS reports in its annual publication *Federal and State Endangered Species Expenditures*.
10. We should note that we closely adhered to MW's data entering procedure. For example, when expenditures were for a group of species, we split the spending evenly between the species. Hence, if $100,000 was spent on land preservation to restore bald eagles and grizzly bears, each of the species received $50,000. This method of consistent data entry should preclude any systematic biases due to error.
11. Thanks to Mark Reeff at IAFWA for pointing this out.
12. We would like to provide the state-by-state data, but an IAFWA confidentiality restriction prohibits us from publishing the actual dollar figures spent by each state.
13. Note that we could examine the data in a manner consistent with Merrifield (2000). This sort of analysis would use the state, rather then the species, as the unit of observation and test whether institutional and political variables affect expenditures. Although this exercise would shed light on some important issues, it would answer a fundamentally different question about regulatory federalism.
14. Primack (1998, p.281) writes that it may take 100 to 1,000 km^2 to maintain many small mammal populations, and about 50,000 km^2 to support as few as 50 grizzlies.
15. Since the fish dummy is excluded, it represents the base category.

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